

# **Review of Assumptions and Methods of the Medicare Trustees' Financial Projections**

Technical Review Panel on the Medicare Trustees Reports

December 2000

## **About This Material**

This report presents the findings and recommendations of the 2000 Technical Review Panel on the Medicare Trustees Reports (hereafter referred to as the Panel). It is the culmination of work beginning in June 2000 and concluding in December 2000. The Panel met five times at the headquarter offices of the Health Care Financing Administration (HCFA) in Baltimore.

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## Preface

The Boards of Trustees of the Medicare Trust Funds (the Hospital Insurance (HI) and Supplementary Medical Insurance (SMI) Trust Funds) report annually on the funds' financial condition. The reports describe the current and projected financial status of the trust funds over a 75-year period. The Boards of Trustees directed the Secretary of Health and Human Services to establish a panel of technical experts to review the methods and assumptions underlying the Medicare reports. The 2000 Panel includes the following members:

Dale H. Yamamoto, F.S.A., M.A.A.A., Principal, Hewitt Associates, Lincolnshire, IL (Chair)

Michael E. Chernew, Ph.D., Associate Professor, Department of Health Management and Policy, Department of Economics, and Department of Internal Medicine, University of Michigan, Ann Arbor, MI

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James M. Robinson, F.S.A., M.A.A.A., Ph.D., Senior Scientist, Center for Health Systems Research and Analysis, University of Wisconsin, Madison, WI

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Sam Gutterman, F.S.A., M.A.A.A., Director and Consulting Actuary, PricewaterhouseCoopers, Chicago, IL (Consultant)

Ariel B. Winter of the Office of the Assistant Secretary for Planning and Evaluation (ASPE), Department of Health and Human Services (HHS), served as the Executive Director of the Panel.

The Panel was specifically asked to review the following four topics:

- Medicare assumptions (for example, utilization rates, medical price increases);
- Projection methodology;
- Long-range growth assumptions for HI and SMI; and
- Use of stochastic forecasting techniques.

Beginning in June 2000 and concluding in November 2000, the Panel met five times at the headquarter offices of the Health Care Financing Administration (HCFA) in Baltimore, MD. The Office of the Actuary (OACT) of HCFA was represented at all meetings and provided technical background and support for the Panel.

## *Preface*

The Panel consulted with many experts in developing its findings and recommendations. It heard detailed presentations from the Chief Actuary and the Director of the Medicare and Medicaid Cost Estimates Group, OACT, and their staffs. It also reviewed extensive background materials and heard presentations from invited experts in the field of health economics and actuarial science. Each Panel meeting generated extensive discussion. Special thanks to the following individuals who made formal presentations to the Panel:

- Bruce Schobel--American Academy of Actuaries
- Steven Lieberman, Noah Myerson, and John Sabelhaus--Congressional Budget Office
- Ralph Monaco--Interindustry Economic Research Fund, Inc. (University of Maryland)

This report presents the findings and recommendations of the Panel. The Panel generally concludes that the methods and assumptions used to project the status of the Medicare program are reasonable, with the exception of the long-range growth assumption. The Panel unanimously agreed that the projection work of OACT is of excellent quality and that OACT performs in a highly competent and completely professional manner.

The Panel strongly recommends that further research be done to fulfill many of the other recommendations made throughout this report. This research may be accomplished by additional staff resources and outside researchers in view of the limited resources currently available within OACT for such activities.

For their generous support, the Panel wants to thank ASPE; the HCFA Chief Actuary, Richard Foster; the Director of the Medicare and Medicaid Cost Estimates Group, Solomon Mussey; and their staffs. Throughout the Panel's deliberations, OACT had heavy demands on their time because of their ongoing work and their role with various legislative proposals affecting Medicare.

Dale H. Yamamoto, Chair

December 2000

## **Executive Summary: Findings and Recommendations**

Overall, the Panel found that the methods and assumptions used by the Trustees are reasonable, with the exception of the long-term health care cost growth assumption, which the Panel believes to be too low. The current growth assumption has been used for many years. The prior technical panel (1991) found the current assumption to be “not unreasonable” but recommended that it be closely monitored. Because of recent research and program experience, the Panel unanimously concluded that it is time to adopt an assumption of faster growth. The Panel also encourages future research to further refine this important assumption.

The staff of OACT is to be commended for its technical expertise and dedication to providing professional services to the Trustees.

Many of the recommendations made by the Panel require substantial research efforts to accomplish. Accordingly, the Panel recommends that staff and research budgets be significantly expanded as necessary to fulfill these recommendations.

The findings and recommendations of the Panel are detailed in chapters 1 through 5 of this report and are listed below. Unless otherwise noted, all recommendations apply to the intermediate set of assumptions. The general themes underlying these recommendations include (a) consistency of the methods and assumptions used in the HI and SMI projections; (b) ease of understanding of the projection models; (c) optimal use of available information; and (d) clear communication and qualification of the projection methods and assumptions. In keeping with its charter, the Panel focused its attention on that portion of the Medicare projections that is specific to health care. It did not address the demographic, economic, and other aspects of the projections that are not specific to health care and that are shared with the projections of the OASDI system.

### **Current Methodology**

**Finding I-1:** The Panel concurs with the Trustees’ use of a tripartite division of the 75-year projection period into short-term, intermediate-term, and long-term periods, with the intermediate term being a transition between the short term and the long term.

**Recommendation I-2:** The Panel recommends that cost growth rate assumptions in the intermediate term and long term be established for HI as a whole and for SMI as a whole, and then allocated to specific services as needed.

**Finding I-3:** The Panel finds that the differentiation of the forecasts into a price component and a quantity component is reasonable.

**Recommendation I-4:** The Panel recommends that for the short-term forecasts, the quantity and price components of spending for each service category be modeled explicitly, with total spending by category being computed as the product of a price component and the quantity component.

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**Recommendation I-5:** The Panel recommends viewing short-term forecasts in a two-part framework, with one part consisting of an underlying growth trend and a second part consisting of shifts in spending that alter the level of spending, but not the trend.

**Recommendation I-6:** The Panel recommends that assumptions regarding changes in site of care be explicit and consistent across models. This refinement is especially important for shifts between HI and SMI, such as movements from inpatient to ambulatory care settings.

**Recommendation I-7:** The Panel recommends that models of utilization be based on age and gender utilization patterns for each service category.

**Recommendation I-8:** The Panel recommends that distinctions among spending be made within each age/gender cell for decedents and survivors.

**Recommendation I-9:** The Panel recommends that explicit health status models be developed for eventual incorporation into the projection methodology.

**Finding I-10:** The Panel finds that the current method used to estimate future rates of change in managed care penetration is reasonable.

**Recommendation I-11:** The Panel recommends that the projection of managed care enrollment be based on a cohort analysis and that enrollment be disaggregated into age, gender, and geographic cells.

**Recommendation I-12:** The Panel recommends that an explicit assumption of selection effects be incorporated in the managed care shift effect.

**Recommendation I-13:** The Panel recommends that an explicit assumption of managed care spillover effects be incorporated in the managed care shift effect.

**Recommendations I-14:** The Panel recommends that the model documentation be made more explicit regarding key underlying assumptions and the reasons for various adjustments to historical trends.

## **Short-Term Assumptions**

**Finding II-1:** The Panel finds that the short-term forecast of price changes is reasonable.

**Recommendation II-2:** The Panel recommends setting the trend component of the growth rate in such a way that age- and gender-adjusted, per-beneficiary spending growth exceeds the growth of per-capita GDP by 1 percentage point per year.

**Recommendation II-3:** The Panel recommends a trend in the next decade toward lower inpatient hospital utilization, increased utilization of ambulatory care services, and no change in utilization of home health or skilled nursing facility services.

**Recommendation II-4:** The Panel recommends that, as a general principle, forecasts of trend growth rates and shift effects that are different from their long-term values be partially offset by changes in the opposite direction before the ultimate value is reached.

**Recommendation II-5:** In implementing recommendation II-2, the Panel recommends that the case-mix increase for inpatient hospital, skilled nursing facility, home health, and hospital outpatient services paid on a prospective payment basis be projected to have an underlying trend growth rate increasing at 1 percent per year.

**Recommendation II-6:** In implementing recommendation II-4, the Panel recommends that the case-mix index for inpatient hospital services be forecast to increase above the ultimate, steady-state growth rate before the steady state is reached.

**Finding II-7:** The Panel finds reasonable both the assumptions about increases in case mix for home health services and hospital outpatient services in the first year of prospective payment and the assumptions that case-mix index increases for these services and for skilled nursing facilities will decline to a steady-state growth rate over time.

**Finding II-8:** The Panel finds reasonable the short-term spending forecasts for physician and other SMI services not paid on a prospective payment basis.

**Finding II-9:** The Panel finds reasonable the current assumptions of behavioral offset due to specific payment systems.

## **Long-Term Cost Growth**

**Recommendation III-1:** The Panel recommends that, for the period extending from 25 to 75 years into the future, age- and gender-adjusted, per-beneficiary expenditures for both SMI and HI be assumed to grow at a rate 1 percentage point above per-capita GDP growth.

## **Stochastic Forecasting and Uncertainty**

**Recommendation IV-1:** The Panel recommends that the Trustees evaluate historical experience on a regular basis to better identify the sources and causes of changes in health care costs.

**Recommendation IV-2:** The Panel recommends that, to the extent possible, the Trustees regularly evaluate and report on the accuracy of past HI and SMI projections over various periods--for example, over 1, 5, and 10 years.

**Finding IV-3:** The Panel finds that the current 1-year decomposition of changes in actuarial balance included in the HI Trustees Report is reasonable and can be enhanced through further analysis of contributing causes.

**Recommendation IV-4:** The Panel recommends decomposition analysis of the change in SMI cost projections similar to the analysis of change in the HI actuarial balance.

**Finding IV-5:** The Panel finds that the stochastic model presented in the 2000 SMI Trustees Report is a reasonable and prudent initial application of stochastic modeling.

**Recommendation IV-6:** The Panel recommends that the stochastic model used for SMI be further enhanced and that a stochastic model be developed for HI.

## *Executive Summary*

**Recommendation IV-7:** The Panel recommends that the difference in health care cost trends between those of the low-cost and high-cost assumptions and those of the intermediate assumptions be greater than the difference currently assumed during the short term and that it decline for the remainder of the projection period to a level always different from zero percent.

**Recommendation IV-8:** The Panel recommends that a new set of indicators be developed that focuses on sources of uncertainty and sensitivity of health care projections for both HI and SMI with respect to underlying factors that can significantly affect future costs, including the effects of managed care, under alternative scenarios.

**Finding IV-9:** The Panel finds that the current measures of actuarial balance of the HI Trust Fund reasonably satisfy the objectives of actuarial soundness.

**Recommendation IV-10:** The Panel recommends that a broader set of indicators be developed to assess the implications of estimated SMI cost growth.

## **Research and Presentation**

**Recommendation V-1:** The Panel recommends that more resources be devoted to serving the analytic research priorities of OACT and the Trustees. This increased resource commitment should include additional staff inside OACT and additional funds for sponsored research directed by OACT, as well as adequate dedicated research funds from outside OACT that can address Trustees Report-related issues.

**Recommendation V-2:** The Panel recommends that more resources be devoted to insuring that quarterly cost and utilization data are available with a shorter time lag for analysis by OACT and the Trustees.

**Recommendation V-3:** The Panel recommends greater coordination of relevant research projects and agendas across executive branch agencies, congressional support agencies, private foundations, and public and private research organizations.

**Recommendation V-4:** The Panel recommends that the clarity of the Trustees Reports be enhanced with a number of specific changes and additions.

## **Chapter I: Current Methodology**

The findings and recommendations of this chapter are based on the Panel's understanding of the current projection modeling structure and process. Appendix A of this report provides a summary of the Panel's documentation of the current methodology.

The Panel has intentionally left some recommendations rather vague, in an effort to outline reasonable criteria for future model development without arbitrarily constraining the specific form that such model refinements might ultimately take.

With few exceptions, the Panel found the current methodology to be reasonable, and, consequently, almost all of the recommendations that follow should be considered proposed refinements rather than corrections. Since implementation of these refinements will depend upon the availability of reliable data and adequate OACT resources (both of which requirements may be substantial for several of the recommendations), the Panel has not included specific timeframes for completion of these recommendations. Despite the lack of such timeframes, the Panel considers these recommended changes in the modeling methodology to be important and ultimately feasible.

### **Short-Term, Intermediate-Term, and Long-Term Forecast Periods**

**Finding I-1: The Panel concurs with the Trustees' use of a tripartite division of the 75-year projection period into short-term, intermediate-term, and long-term periods, with the intermediate term being a transition between the short term and the long term.**

The current forecasting methodology divides the 75-year projection period into several intervals. For the first 25 years (HI) or 10 years (SMI), each category of spending is forecast separately. As shown in table 1, this approach involves four components of fee-for-service (FFS) spending for HI (inpatient hospitals, skilled nursing facilities, home health agencies, and hospices) and six components for SMI (outpatient hospital, durable medical equipment (DME) and labs, home health, other intermediary services such as dialysis and rehabilitation, physicians, and other carrier services such as ambulances and surgery centers). In addition, separate managed care projections are made for HI and SMI.

**Table 1**  
**Medicare Service Categories**

HI	Share of HI Costs <sup>1</sup>	SMI	Share of SMI Costs <sup>1</sup>
Inpatient hospitals .....	80%	Physicians .....	53%
Home health agencies .....	7	Outpatient hospitals .....	14
Skilled nursing facilities .....	11	DME/Labs.....	12
Hospices .....	2	Other carrier.....	10
		Other intermediary.....	9
		Home health agencies.....	2

<sup>1</sup> Based on calendar year 1999 cash fee-for-service expenditures.

Note: In 1999, HI and SMI represented 61 and 39 percent, respectively, of total Medicare expenditures.

The period after 25 years is deemed the long term, and forecasts for that period are made for all HI services combined and for all SMI services combined. The period between 10 and 25 years (the intermediate term) for SMI serves as a transition between the short term and the long term. While there is no explicit difference in the HI model structure between the first 10 forecast years and the next 15 years, this intermediate term currently serves as a transition period during which short-term, service-specific assumptions converge toward the global HI assumptions used in the long-term portion of the model. Despite the different forecasting periods employed for HI and SMI, therefore, both use similar short-term, intermediate-term and long-term periods for establishing the growth rate assumptions that are used to generate the forecasts. The Panel believes that this methodology is reasonable.

**Recommendation I-2: The Panel recommends that cost growth rate assumptions in the intermediate term and long term be established for HI as a whole and for SMI as a whole, and then allocated to specific services as needed.**

Under the current model structure, long-term cost growth rate assumptions for HI and SMI, and intermediate-term assumptions for SMI, are made for each program as a whole rather than for each service category. Consequently, the existing methods of establishing HI and SMI long-term and SMI intermediate-term growth rate assumptions already comply with the recommendation.

Intermediate-term projection assumptions for HI costs, in contrast, are made on a service-specific basis. Although current growth rate assumptions for the different services do not vary significantly, they are separately established, and there is no explicit process in place to ensure that, in future projections, service growth rates will be consistent and that the resulting aggregate HI growth rates will be reasonable. The Panel recommends, therefore, that explicit aggregate HI growth rates be established for the intermediate term. These assumptions could serve as the starting point for setting service-specific growth assumptions, or they could serve as a check on the aggregate growth rates resulting from separately established assumptions for each service category. In practice, this recommendation would not change current projections, but it could be important in the future if the short-term growth in costs for different components of HI is projected to vary significantly.

## Methodology for Short-Term Forecasts

**Finding I-3: The Panel finds that the differentiation of the forecasts into a price component and a quantity component is reasonable.**

Currently, service category forecasts generally are disaggregated into price and quantity components. Since, arithmetically, total spending is the product of prices and quantities added across all services, these forecasts will add up to a forecast of total cost growth. The Panel believes that this is a reasonable way to produce these forecasts.

**Recommendation I-4: The Panel recommends that for the short-term forecasts, the quantity and price components of spending for each service category be modeled explicitly, with total spending by category being computed as the product of a price component and the quantity component.**

Differing levels of information about quantity changes are available for different components of spending. Except for hospice care within the HI model, the trends in price and quantity are modeled separately and explicitly. For SMI segments of spending, with the exception of hospital outpatient care and home health care, quantity growth is treated as a residual (the difference between aggregate spending growth and projected price growth). No explicit unit of service is identified for these service categories. Utilization and case mix are separated for hospital outpatient services and home health care because these services are now paid under prospective payment systems that provide natural units of service and price structures.

HI components are disaggregated into utilization (hospital admissions, days of skilled nursing care, or home health visits), case mix, and population aging. For the fee-for-service program, there are also changes resulting from biased selection into managed care plans, although some of these changes are offset subsequently by lower payments to managed care plans. This structure allows for explicit treatment of changes to reimbursement rules and for explicit inclusion of analysis regarding utilization changes (for example, the impact of shifts in the site of care).

For SMI service categories other than hospital outpatient services and home health care, the use of a residual balancing item to represent quantity makes it difficult to model the implications of changes, such as shifting site of care, in a manner consistent with the explicit HI modeling of such changes. Consequently, the Panel recommends that explicit modeling of both price and quantity elements be adopted for all SMI service categories.

Currently, each component of quantity--utilization and case mix for HI services and total quantity changes for SMI services--is forecast separately for each service category. Although some components of spending are projected to grow at the same rate, these projections are based on perceived similarities among those categories, not on an explicit assessment of the overall trend in Medicare costs. The Panel reviewed this methodology for short-term forecasts and recommends that a common link among service categories be considered as noted below in recommendation I-6.

**Recommendation I-5: The Panel recommends viewing short-term forecasts in a two-part framework, with one part consisting of an underlying growth trend and a second part consisting of shifts in spending that alter the level of spending, but not the trend.**

The Panel views the underlying trend growth rate as driven predominantly by technological changes in medical treatments. As discussed in chapter III of this report, medical technology changes have been the dominant factor in explaining the growth of medical care costs over the past half century. The Panel views the underlying rate of medical technology change as an important driver of short-term cost growth.

Apart from overall growth trends, several factors may affect expenditure levels, including changes in the perceived efficacy of various types of care and changes in financial incentives to provide various services. These shift effects may be manifest permanently (such as the effect on physician costs of a new preventive screening benefit) or concentrated over a few years (such as the impact on nursing facility costs of new resident classification rules). Thus, the growth rate of any particular service category in the short term may differ from the technological-trend assumption. Over time, however, shift effects will frequently have a declining impact on cost growth. Shift effects are discussed in more detail in chapter II.

**Recommendation I-6: The Panel recommends that assumptions regarding changes in site of care be explicit and consistent across models. This refinement is especially important for shifts between HI and SMI, such as movements from inpatient to ambulatory care settings.**

The current models are based on the trends in spending for each service category. They implicitly recognize changes in site of care because the historical data reflect these trends. Yet future projections are not explicitly coordinated so that assumptions regarding future shifts in care settings may not be treated consistently.

Moreover, the impact of shifts in site of care depends on the initial distribution of spending across care settings. Extrapolation from past trends will not accurately capture the impact of future shifts in care settings.

Explicit treatment of shifts in care setting will provide more consistency among model components. Moreover, explicit treatment of shifting delivery settings will facilitate accurate and consistent treatment of case-mix changes across the different service categories.

**Recommendation I-7: The Panel recommends that models of utilization be based on age and gender utilization patterns for each service category.**

Currently, projections of HI services are based on utilization projections within age and gender cells. This method allows the analysis to account for the changing age and gender distribution within the Medicare population. However, SMI service projections are not analyzed within age and gender cells in the short-term models (intermediate and long-run projections include an age-adjustment factor).

Incorporating age and gender adjustment for all service categories will enhance the consistency among the various components of the models and facilitate a more explicit decomposition of spending growth between demographic factors and those factors related to changing prices and age/gender-adjusted utilization rates.

Such a modification will also allow for more consistent treatment of utilization shifts across service types. To some extent, this adjustment will also improve the extent to which the models can account for health status.

The Trustees should consider opportunities, beyond age and gender, to expand the set of characteristics used to categorize enrollees and their service utilization.

**Recommendation I-8: The Panel recommends that distinctions among spending be made within each age/gender cell for decedents and survivors.**

Spending for decedents is, on average, about 6 times higher than that for survivors (Lubitz and Riley, 1993). As age/gender-specific mortality rates change, more individuals in any given age/gender cell will survive. Thus, the age/gender-specific spending profile will change (Reese, 2000). Incorporating information on survivor/decedent spending will allow more consistent treatment of spending changes associated with improved mortality and will represent a first step toward incorporating health status into the models.

**Recommendation I-9: The Panel recommends that explicit health status models be developed for eventual incorporation into the projection methodology.**

Ultimately, models for projecting trust fund expenditure growth should incorporate, in a sophisticated manner, the impact of changing health status on spending patterns. More sophisticated modeling approaches, such as microsimulation, hold promise for developing a better set of tools for this purpose. Research organizations can help provide the expertise necessary to develop such models. A current effort in this regard is well under way at The Rand Corporation. The Panel recommends that the Trustees consider using such research efforts as resources to refine the trust fund projection methods and that they take advantage of, and encourage, work in this area, as the resulting models could enhance existing projection techniques.

## **Managed Care**

**Finding I-10: The Panel finds that the current method used to estimate future rates of change in managed care penetration is reasonable.**

Current forecasts of changes in aggregate Medicare managed care penetration are based on extrapolations from historical trends, adjusted by judgments based on assessments of how changes in payments to managed care plans will influence penetration. The adjustments recognize that changing payment rates will influence the availability of managed care plans and the benefit packages offered, which in turn will affect enrollment.

To date, no rigorous research has developed estimates of the relationship between payments and penetration. Such analysis is complicated because historical data reflect a period in which payments were correlated with area-specific costs. In addition, experience under the Medicare+Choice program is still evolving. Thus, until further research of this issue is conducted (see recommendation V-3), the current judgment-based approach is a reasonable one in a relatively understudied area.

**Recommendation I-11: The Panel recommends that the projection of managed care enrollment be based on a cohort analysis and that enrollment be disaggregated into age, gender, and geographic cells.**

Medicare managed care enrollment projections are used in two aspects of the current model. First, and most obviously, the enrollment projection is used in forecasting managed care expenditures. Secondly, projected managed care enrollment is subtracted from total Medicare enrollment projections for HI and SMI to determine FFS enrollment. Since HI FFS forecasting is performed on a gender-age cohort basis, managed care enrollment should also be split by age and gender.

The current method of allocating managed care enrollment holds the distribution of managed care enrollment among different age and gender categories constant over time. Because demographic trends result in fluctuating Medicare populations within demographic cells, the assumption of a constant age and gender distribution of managed care enrollees results in penetration rates that can fluctuate in arbitrary ways. In part to avoid this problem, the Panel recommends that the managed care projection methodology be refined to reflect reasonable age and gender penetration assumptions.

The Panel also recommends that geographic variation in managed care enrollment be modeled. Current managed care penetration varies significantly by region, and it is likely that the relative attractiveness of Medicare+Choice payment rates to providers will continue to vary by region. Geographic modeling will lead to more reliable aggregate enrollment forecasts and will facilitate analysis of the selection and spillover effects of recommendations I-12 and I-13.

One possible method of explicitly modeling managed care enrollment by age/gender/region cohort is outlined in Appendix B.

Until such a cohort-based model can be implemented, the current model should be adjusted to produce a less arbitrary projection of managed care penetration rates by age and gender.

## **Impact of Managed Care Assumptions on Fee-for-Service Expenditure Projections**

The impact on Medicare FFS expenditures of changing managed care enrollment reflects two factors:

- Selection effects, which reflect the tendencies toward the selection of healthier beneficiaries into managed care and the disenrollment of less healthy individuals from managed care; and
- Spillover effects, which reflect the impact of managed care enrollment on FFS spending through changes in practice patterns. Spillover effects reflect phenomena such as convergence of FFS and managed care practice patterns, cost shifting, and market-wide effects of managed care-induced changes in provider infrastructure.

### *Selection effects*

**Recommendation I-12: The Panel recommends that an explicit assumption of selection effects be incorporated in the managed care shift effect.**

Most evidence suggests that Medicare managed care plans tend to attract a healthier population than the average Medicare population, implying that the selection effect will increase FFS per-beneficiary HI and SMI spending. The impact of this selection depends on (a) the ratio of spending for the “switchers” relative to that for the beneficiaries who remain in FFS Medicare, and (b) the spending of disenrollees relative to that of continuing FFS beneficiaries. These ratios will vary at different levels of managed care penetration. Existing literature suggests that Medicare expenditures for beneficiaries in the year prior to their enrollment in managed care plans have been about 77 percent of the average for fee-for-service beneficiaries (Medicare Payment Advisory Commission (MedPAC), 2000). Earlier analysis suggested ratios as low as 63 percent (Physician Payment Review Commission (PPRC), 1996; Morgan et al., 1997).

Estimates of the cost bias in disenrollment (the costliness of managed care disenrollees relative to continuing FFS enrollees) have varied widely. The 1996 PPRC report suggests that in the first year disenrollees from managed care spend 160 percent of what continuing FFS beneficiaries spend. In contrast, the most recent evidence indicates that the figure has dropped to 102 percent (MedPAC, 2000). Because these data are based on voluntary disenrollments, the percentage would likely be even closer to one hundred, assuming involuntary disenrollments exhibit no biased selection. However, there are several technical reasons related to sample selection that would suggest the more recent figures might underestimate the impact of biased disenrollment.

The effect of biased selection of this magnitude can be computed based on estimates of the managed care enrollment rate (the probability that a FFS beneficiary will switch to a managed care plan) and rates of disenrollment. Estimates that are based on the following assumptions suggest that the impact of a 1-percent increase in managed care penetration (approximately the magnitude currently anticipated) would result in an increase in per-beneficiary FFS spending of about 1 percent. (See Appendix C.)

Assumptions:

- Base managed care enrollment is 18 percent.
- Surviving FFS enrollees have a 2.3-percent probability of enrolling in managed care in the subsequent year.
- Surviving managed care enrollees have a 5-percent probability of switching to FFS Medicare in the subsequent year.
- The ratio of expenditures in the first year for FFS beneficiaries who switch to managed care, relative to continuing FFS beneficiaries, is 0.77.
- The ratio of expenditures in the first year for FFS beneficiaries who have switched from managed care, relative to continuing FFS beneficiaries, is 1.3.

This estimate of the selection impact on fee-for-service spending is sensitive to the ratio of spending by enrollees to that by disenrollees, as well as to the extent of disenrollment. Specifically, the greater the disenrollment from managed care, the larger the outflow from FFS would need to be to generate a given change in managed care penetration. Thus, the selection effects associated with a 1-percent increase in net managed care penetration will depend on the gross flows that generate the net change.

*Spillover effects*

**Recommendation I-13: The Panel recommends that an explicit assumption of managed care spillover effects be incorporated in the managed care shift effect.**

Relatively little research has directly examined the impact of spillover effects. Yet some work has studied the aggregate impact of increased Medicare managed care enrollment on Medicare FFS costs. Several analytical issues arise that are related to the endogeneity of Medicare managed care penetration and to the correlation between Medicare managed care penetration and market-wide managed care penetration.

Baker (1997) estimates that a 10-percent increase in managed care penetration, in aggregate, results in a 0.5-percent decrease in FFS expenditures. This result might be attributable to spillover effects that dominate selection effects or to the correlation between Medicare managed care penetration and system-wide managed care penetration. This finding is similar for HI and SMI and is consistent with several other studies reported in Baker and Shankarkumar (1997).

Baker and Shankarkumar (1997) have updated this work, adding controls for system-wide managed care penetration. They report strikingly different results for HI and SMI. The results for SMI suggest virtually no aggregate effect, indicating that any selection effect would be completely offset by spillover savings.

For HI, Baker and Shankarkumar (1997) estimate that an increase of 10 percentage points in Medicare managed care market share would increase HI spending by about 9 percent. Due to the nature of the simulation, one cannot simply divide this figure by 10 to simulate the impact of a 1-percent increase in Medicare managed care market share. In addition, regional variation in managed care penetration will have nationwide effects. Simulations suggest that, even with parameters skewed to increase the selection effect, this estimate would imply a negative spillover effect, which the Panel views as implausible.

Since the available research into managed care penetration spillover effects is sparse and inconsistent, the Panel cannot recommend a specific value. Nevertheless, the Panel believes that the spillover effect may be a significant offset to the selection effect and that OACT should explicitly model its effect on FFS expenditures.

## **Model Documentation**

**Recommendations I-14: The Panel recommends that the model documentation be made more explicit regarding key underlying assumptions and the reasons for various adjustments to historical trends.**

The current models rely on a series of projections based on extrapolations of past data, modified by OACT as deemed appropriate. In general, these extrapolations and modifications seem reasonable, though it is difficult upon inspection to identify exactly which inputs are based on extrapolations and which modifications are based on specific requirements in current law as opposed to educated guesses about future trends. More explicit documentation would facilitate future, and ongoing, review and evaluation, as well as cooperation with other forecasters.

## Chapter II: Short-Term Assumptions

The Panel reviewed the actuarial assumptions for the short term (the first 10 years) at some length. Discussion of the overall forecasting methodology and the recommendations about that methodology are presented in chapter I. In this chapter, the Panel details its recommendations and findings about the specific assumptions used in the forecasts.

### Forecasts of Prices

#### **Finding II-1: The Panel finds that the short-term forecast of price changes is reasonable.**

The forecasts of price growth vary for the different services, as table 2 and figures 1, 2, and 3 show. Historical price changes that could be used as a consistent base from which forecasts can be developed are difficult to measure for some services, particularly in the SMI program. A data difficulty arises for service categories paid on a reasonable-cost basis, in which units of services are not always reported consistently. An ambulance ride, for instance, is sometimes coded as one service and at other times as the number of miles driven. Also, laboratory blood work is occasionally coded as one series of tests and sometimes as the total number of tests. As a result, some of the price changes (and corresponding quantity changes) for SMI services are only approximations. For example, the rapid growth rate of residual spending for outpatient hospital services prior to 1997 (figure 6) is likely a result of the misstatement of price increases in that time period.

Price forecasts reflect both economic assumptions and the projected effect of current legislation. The economic assumptions for HI services include growth of both labor and non-labor costs, as well as the differential between payments for home health and skilled nursing services and those for inpatient hospital care. In current forecasts, non-labor inputs are assumed to increase at an ultimate rate equal to the growth of the Consumer Price Index, and labor inputs are assumed to increase at an ultimate rate equal to the growth of average hourly earnings. Since they are more labor intensive, skilled nursing facility and home health agency prices are projected to increase slightly faster than the inpatient hospital market basket, but not by a substantial amount.

Hospital outpatient prices are now determined by a prospective payment system, similar to that for inpatient hospitals. For other SMI services, prices have a greater legislative component. For example, prices for physician services, the largest SMI category, are constrained by the Sustainable Growth Rate legislation, which adjusts prices when the volume of services differs from target levels.

In each case, the forecasting methodology assumes that price growth absent legislative effects will transition smoothly to long-term rates over a period of about 5 years (figures 1, 2, and 3). After considering these assumptions, the Panel finds that they are reasonable.

**Table 2: Methodology for Short-Term Price and Quantity Forecasts  
[Components Accounting for Changes in Variables]**

Service	First 25 Years (HI) or 10 Years (SMI)	
	Price (+legislative adjustments)	Quantity
<i>HI</i>		
Hospital	Market Basket = Labor (AHE) + Non-labor (CPI)	Admissions + case mix + aging + managed care shift
Skilled nursing	Hospital Market Basket + additional growth of post-acute services	Days + case mix + aging + managed care shift
Home health	Hospital Market Basket + additional growth of post-acute services	Visits + case mix + aging + managed care shift
<i>SMI</i>		
Hospital outpatient	Hospital Market Basket	Utilization + case mix
Lab (hospital)	CPI	Total residual + behavioral offset
Other intermediary <sup>1</sup>	Mostly 0 (by law)	Total residual + behavioral offset
Physician	MEI + MPA	Total residual + behavioral offset
DME	CPI	Total residual + behavioral offset
Lab (MD, independent)	CPI	Total residual + behavioral offset
Other carrier <sup>2</sup>	CPI	Total residual + behavioral offset
Home health	Hospital Market Basket + additional growth of post-acute services	Visits + case mix + aging + managed care shift

<sup>1</sup>Dialysis, rehabilitation/psychiatric hospitals, clinics

<sup>2</sup>Ambulatory surgery centers, ambulance, supplies

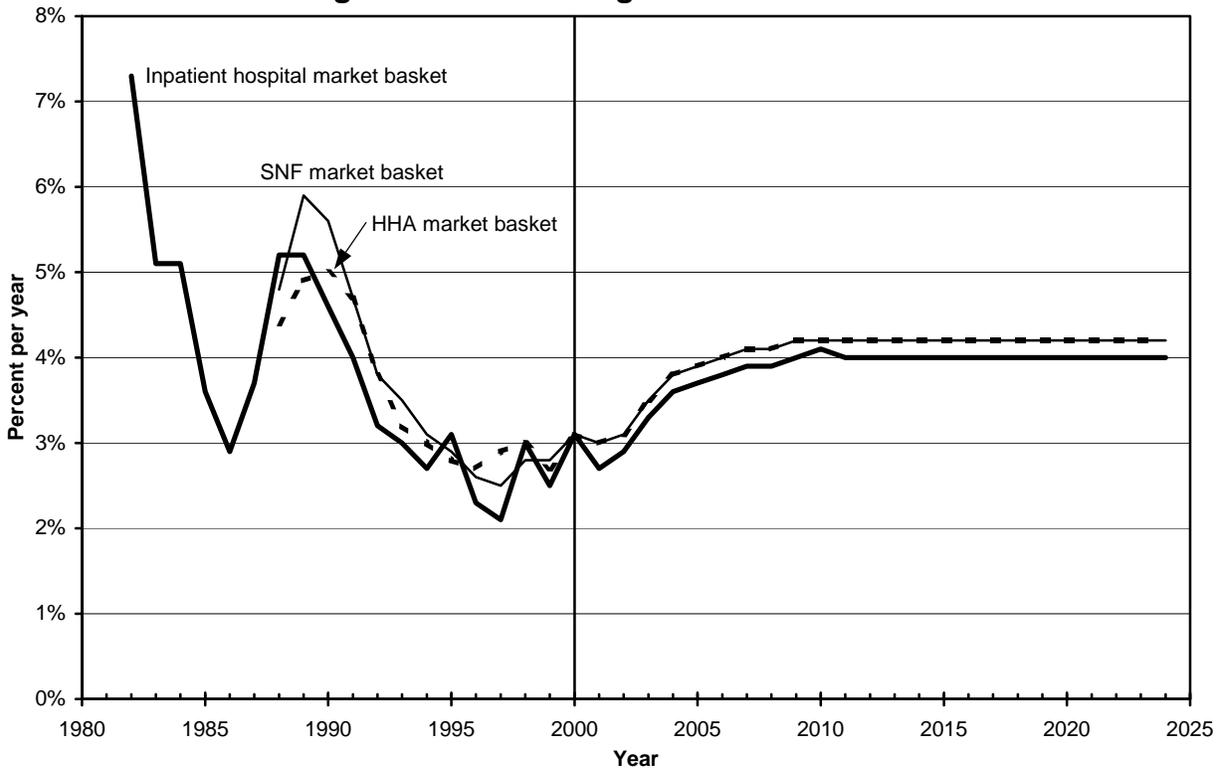
Note: AHE is Average Hourly Earnings; CPI is Consumer Price Index; MEI is Medicare Economic Index; and MPA is Medicare Performance Adjustment.

## Forecasts of Quantities

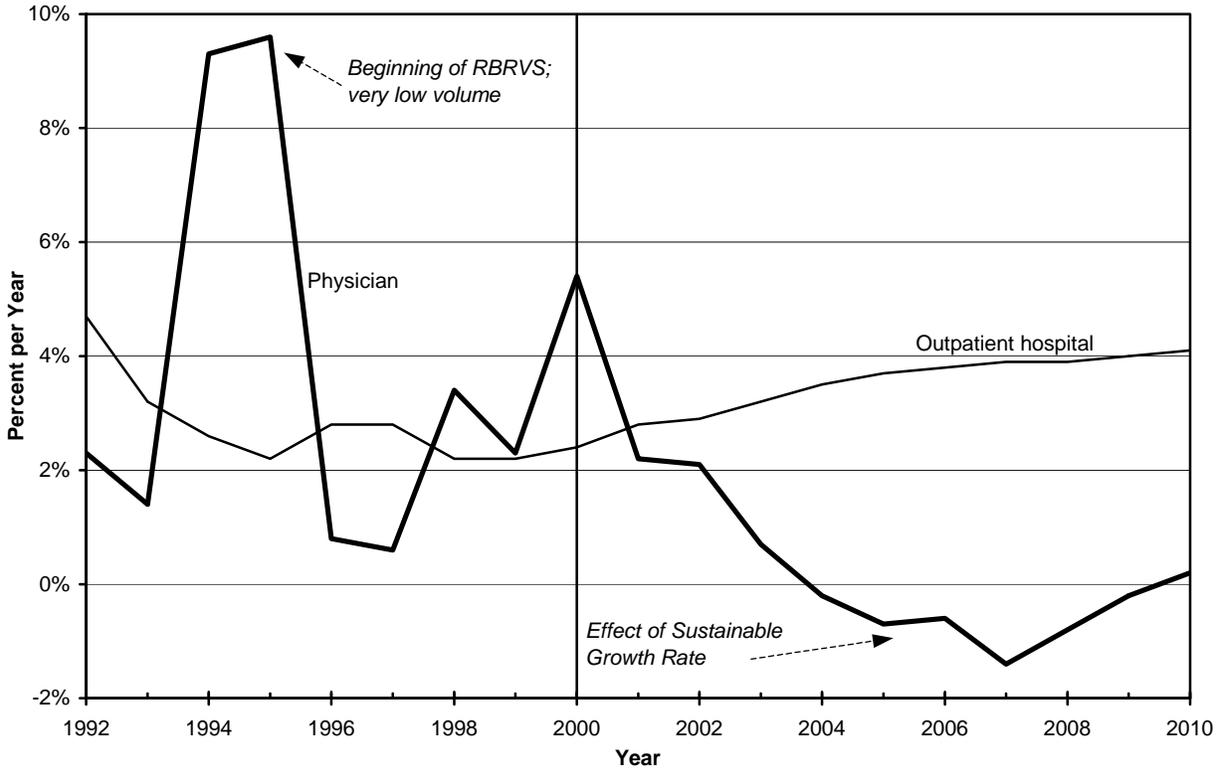
Figures 4-7 show the forecasts of quantity changes, divided into the utilization of HI services (figure 4); case mix change in HI (figure 5); the total residual for the largest SMI components, physicians, and hospital outpatient departments (figure 6); and the total residual for the smaller SMI components (figure 7).

In recommendation I-5, the Panel recommends viewing short-term forecasts in a two-part framework, with one part consisting of an underlying growth trend and a second part consisting of shifts in spending that affect the level of spending but not the trend.

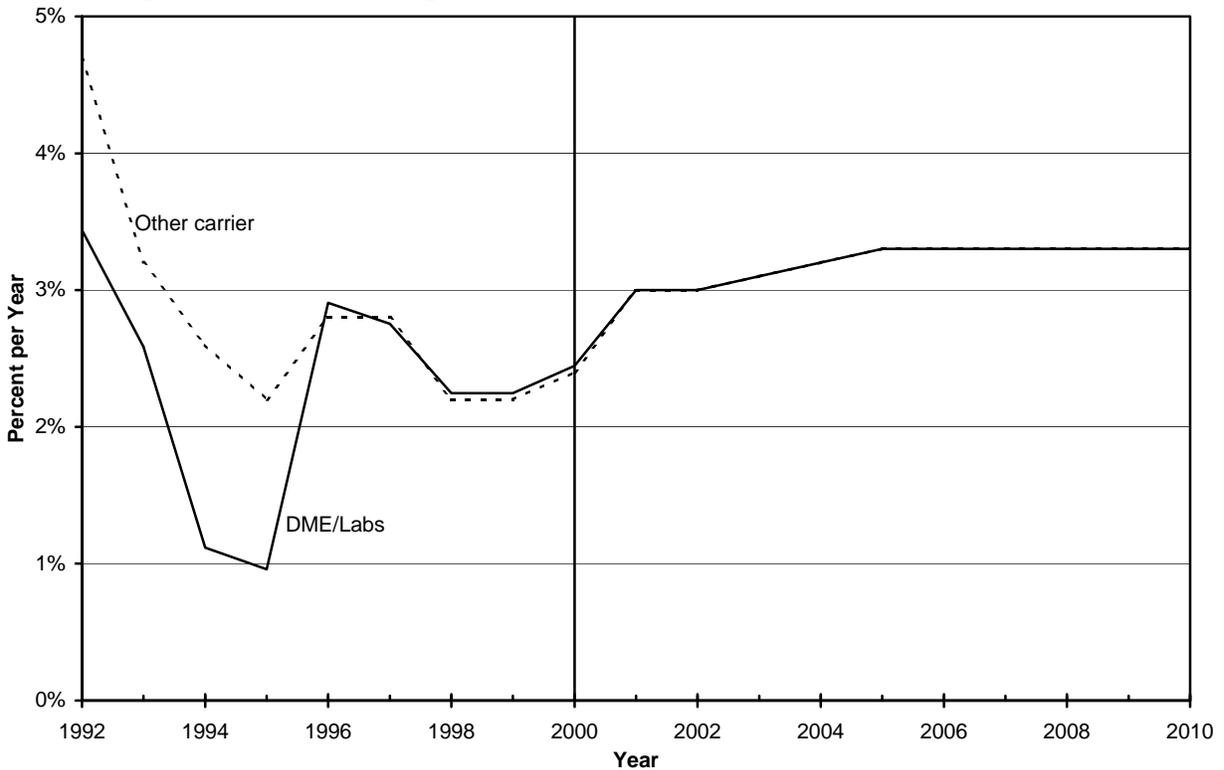
**Figure 1: Price Changes For HI Services**



**Figure 2: Price Changes for Physician and Outpatient Hospital Services**



**Figure 3: Price Changes for DME/Labs and Other Carrier Services**



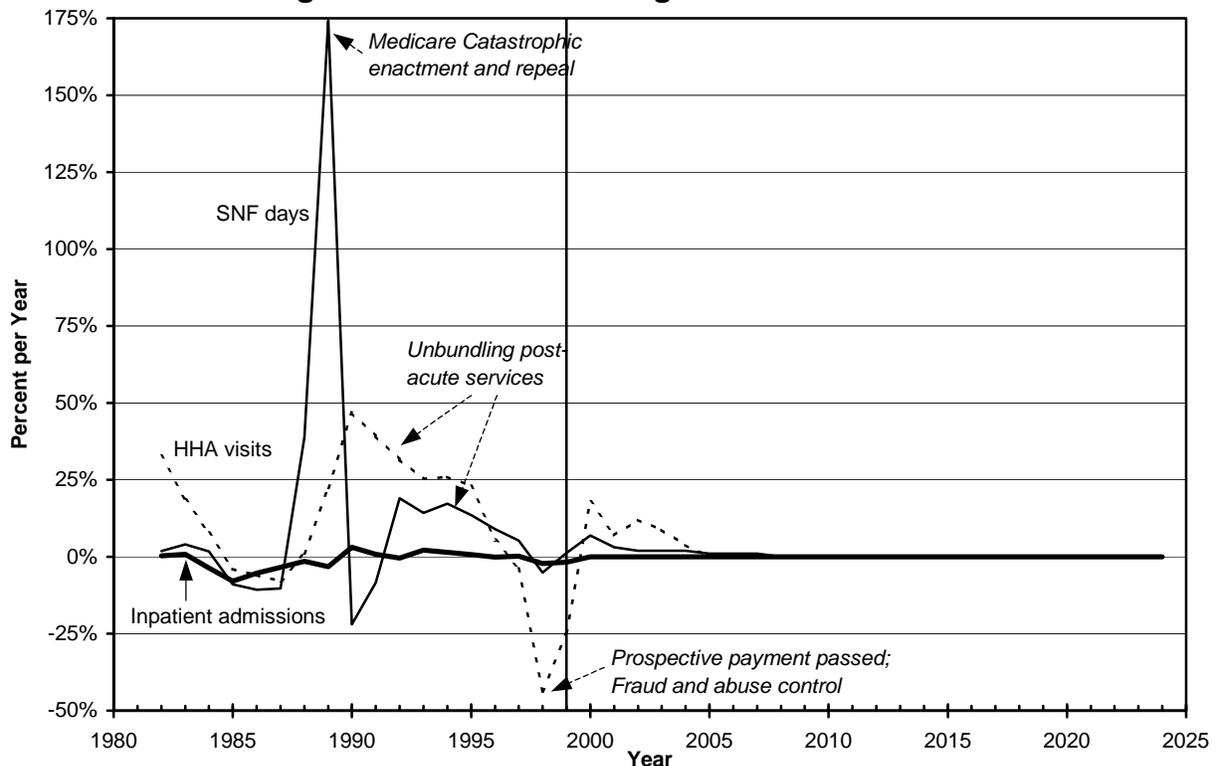
*Underlying growth trend*

The Panel considered substantial evidence about the underlying growth rate of medical care spending. As discussed in detail in chapter III of this report, the most important factor that has contributed to trend rates of spending growth is technological change in medical practice. The Panel considers estimates of the underlying growth of medical costs attributable to technological change in chapter III and bases its assumptions about the underlying trend growth rate in the short term on that analysis. In brief, the Panel considered the historical record of technology-induced changes in medical spending, analysis of specific innovations likely to occur in the near future, and evidence on the sustainability of such spending increases. In light of these factors, the Panel makes the following specific recommendation.

**Recommendation II-2: The Panel recommends setting the trend component of the growth rate in such a way that age- and gender-adjusted, per-beneficiary spending growth exceeds the growth of per-capita GDP by 1 percentage point per year.**

Technological change is primarily reflected in case-mix increase. Replacing an older technology with a newer technology, for example, increases the intensity of medical service provision. All of the Medicare prospective payment systems allow greater payments for services with higher intensity than for those with lower intensity. Thus, in its specific recommendation later in this chapter (recommendation II-5), the Panel suggests implementing this assumption through forecasts of case-mix index change.

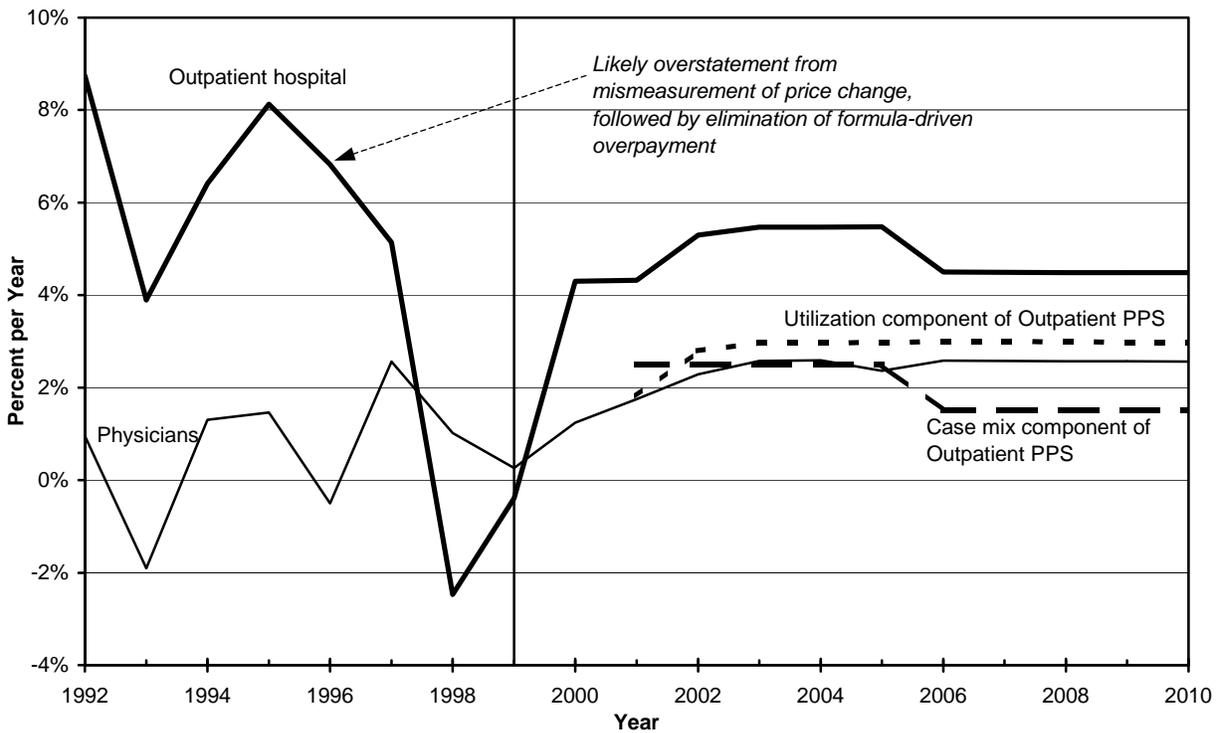
**Figure 4: Utilization Changes for HI Services**



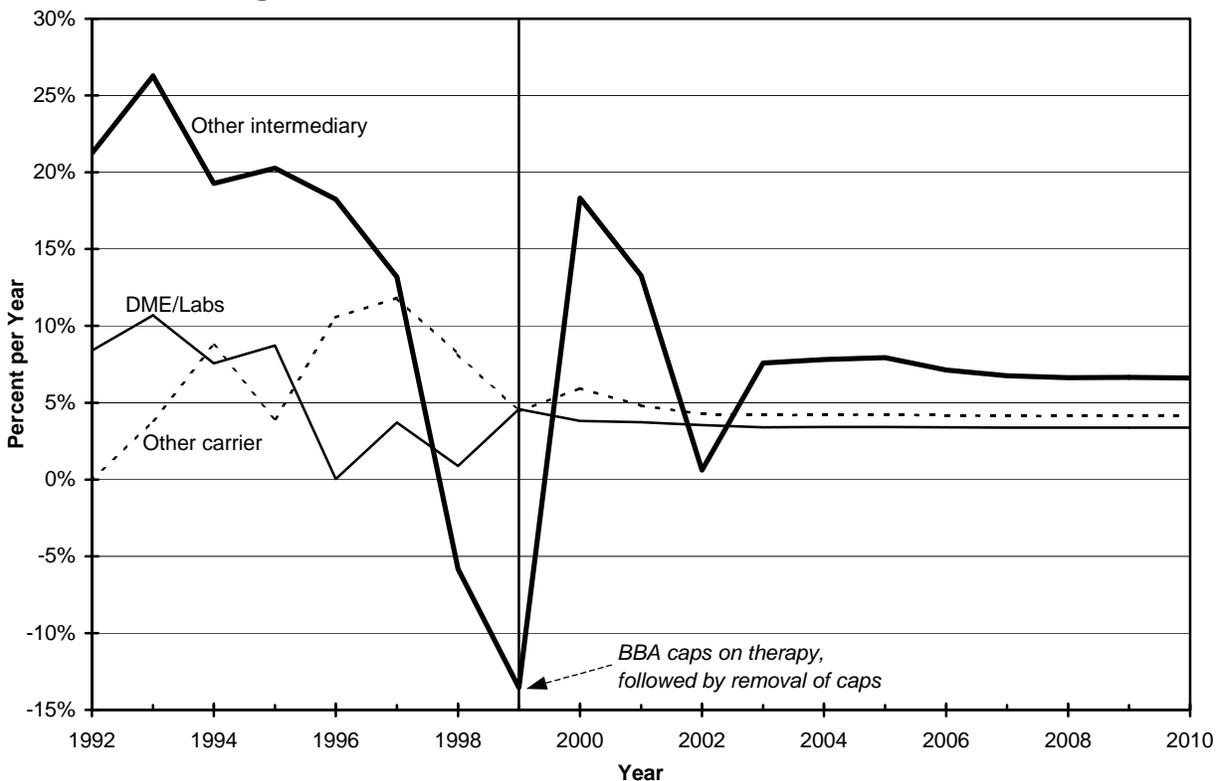
**Figure 5: Case-Mix Changes for HI Services**



**Figure 6: Residual Increase for Physicians and Outpatient Hospital Services**



Note: Utilization and case mix are components of the residual increase for outpatient hospitals

**Figure 7: Residual Increase for Other SMI Services**

**Recommendation II-3: The Panel recommends a trend in the next decade toward lower inpatient hospital utilization, increased utilization of ambulatory care services, and no change in utilization of home health or skilled nursing facility services.**

The Panel believes that technological change has had differing impacts on utilization of inpatient and ambulatory care in recent years. In particular, technological change has reduced the use of inpatient services and increased the use of ambulatory care services. For instance, advances in surgical techniques, including the development of minimally invasive surgical procedures, have in many cases resulted in a dramatic substitution of ambulatory care for inpatient care (Gelijns and Fendrick, 1993). Examples include cholecystectomy, which, because of laparoscopic techniques, can generally be done in outpatient settings, and cardiac catheterization, a procedure that, though now frequently done on an outpatient basis, initially required an inpatient stay. The Panel believes that these trends will continue for at least the next decade.

This recommendation is consistent with recommendation I-6, calling for explicit and consistent modeling of the effects of shifting site of care. The Panel does not offer a specific recommendation about forecast changes in utilization of each service component resulting from these trend factors. The Panel believes that such a forecast should be made by considering admissions changes for a few representative conditions over time.

Changes in admissions patterns may have a subsequent effect on case-mix increases. For example, if technological change moves less severe procedures out of the hospital, the average case-mix index will increase for both HI and SMI. This case-mix index increase would be in

addition to the 1-percent growth rate attributable to technological change generally. The Panel does not offer a firm recommendation about the magnitude of this additional effect but, again, believes that such a forecast should be made by considering historical trends for a few representative conditions.

*Shift effects*

The shift component of growth rates includes changes in utilization and/or case mix resulting from such factors as provider behavioral response to changes in payment rules, changes in covered services or reimbursement rates over time, and policies to control fraud and abuse. These effects may increase or decrease Medicare spending for a period of several years, leading to cumulative increases or decreases in the level of expenditures, but they do not affect the long-term growth rate of spending. The Medicare program has experienced a series of very large swings in utilization and case mix over the past two decades, generally due to these shift effects. The Panel discusses the nature of these effects briefly to illustrate the phenomenon they capture. Figures 4-7 document them, and table 3 provides a summary.

**Table 3: Description of Shift Component of Medicare Growth Rate**

Type of Change	Examples	Notes
Behavioral response to payment system changes	Upcoding to higher payment categories (inpatient hospitals, skilled nursing facilities)	Offset over time with initiation of prospective payment systems and increased fraud and abuse control activities
	Unbundling post-acute services (skilled nursing facilities, home health care)	
	Cost accounting to shift costs away from prospectively reimbursed services and towards cost-reimbursed services	
Financial incentives to use particular services	Liberalized coverage (skilled nursing facilities)	Utilization of services often increases very rapidly
	Behavioral offset by physicians	Evidence of behavioral offset for physician services but not inpatient services.
Fraud and abuse control	Inpatient hospitals and home health in the late 1990s	Had very large effects throughout Medicare

Accounting changes with few real effects. Providers may respond to payment system changes by increasing their revenues without generating additional costs. There are at least three ways this result can occur, each of which has been important in the past two decades.

*Upcoding* refers to the classification of patients into higher-weighted disease groups for services paid on a prospective basis. Since higher-weighted disease groups pay more, upcoding allows the provider to collect additional revenues without incurring additional costs. Inpatient hospital services experienced significant upcoding with the implementation of the prospective payment system in fiscal year 1984 (Carter, Newhouse, and Relles, 1990). The case-mix increase in that year was 5 percent (figure 5), moderating over the next decade as upcoding opportunities declined. By 1997, the case-mix increase was about 1 percent per year, roughly the rate of underlying technological change noted above. The movement to prospective payment appears to be associated with substantial upcoding for skilled nursing facility stays as well. The skilled nursing facility case mix increased by 5 percent in 1998, the first year of prospective payment.

*Unbundling* refers to the practice of splitting a single payment episode into two or more episodes so that multiple payments can be collected. It is most apparent with post-acute care services (skilled nursing facility stays and home health visits) in the early 1990s. Use of skilled nursing facilities increased by 10 to 20 percent per year between 1992 and 1995, and home health visits rose by 20 to 50 percent per year between 1989 and 1995. These changes are widely attributed to hospitals learning that post-acute services could be substituted for days in acute care facilities. Reducing hospital stays did not lower diagnosis related group (DRG) payments, but providers received additional reimbursement for the skilled nursing or home health care that replaced the inpatient days.

*Cost allocation changes* can be used by hospitals to allocate general or specific overhead costs in such a way that aggregate Medicare reimbursement is maximized. In the past, for example, hospitals could assign certain costs incurred in their inpatient departments (where a fixed prospective payment is intended to cover all costs) to their outpatient or other departments (which, until 2000, were reimbursed on a reasonable cost basis). Similarly, general overhead costs that might normally be allocated among all departments could be assigned solely to non-inpatient cost centers. Such practices would result in greater reimbursement of “reasonable costs” by Medicare than would otherwise occur, with no reduction in inpatient revenues.

For upcoding, unbundling, and cost allocation devices, there is some evidence that providers used these to excessive, if not illegal, levels. As discussed below, case-mix increases for inpatient hospitals fell sharply with the initiation of fraud investigations in the late 1990s. Similarly, home health visits fell markedly when fraud and abuse control activities were stepped up, and growth in skilled nursing days declined sharply when the prospective payment system was mandated (even before it was implemented). As for accounting devices, data from hospital cost reports routinely show sizable Medicare profit margins for inpatient departments but substantial losses in most other departments.

Payment-induced changes in service use. Payment rules influence the desire of providers to use different types of services. These changes in service use can be large.

The effects of liberalizing coverage are apparent for skilled nursing facility use in the late 1980s. Stays in skilled nursing facilities rose by 174 percent in 1989, the year the Medicare Catastrophic Coverage Act went into effect (figure 4). In the 2 years after that legislation was repealed, nursing home stays fell by 30 percent.

Reductions in payment rates could either reduce or increase service use. The latter situation can occur when payments are reduced but still remain above marginal costs. Providers seeking to keep their income constant might respond to a payment cut by increasing volume of services, since increased volume helps to maintain income in a period of falling prices. Substantial evidence shows that when fees have been cut, physicians respond in this “target income” fashion. Current empirical evidence suggests that physician behavioral offsets in response to price reductions are roughly 30 percent (Codespote, London, and Shatto, 1998). Older studies noted a behavioral offset of about 50 percent (Christensen, 1989), 40 percent (Nguyen, 1997), and 30-40 percent (PPRC, 1991-93)--an indication that such changes may be more difficult to effect now than in the past. Evidence further suggests an asymmetric response by physicians: rising volume when prices fall, but no reduction in volume when prices rise.

Of course, one would expect such behavior only for services in which price still exceeds marginal cost. If price falls below marginal cost, one would expect payment reductions to be accompanied by lower utilization.

In addition to behavioral changes by each provider, an offset pattern might be generated by changes in the mix of providers. If price reductions induce less efficient providers to shut down and more efficient providers to take their place, this change could also produce the reversal pattern noted above.

Fraud and Abuse. HCFA has recently stepped up efforts to reduce fraud and abuse in the Medicare program. These efforts appear to have led to dramatic changes in provider behavior. In the late 1990s, the case-mix increase for inpatient hospitals was negative (figure 5), most likely in response to increased fraud and abuse control activities undertaken by HCFA and the Department of Justice (in particular the investigation of Columbia/HCA for inappropriate upcoding). Some of the reduction in home health visits in the late 1990s (figure 4) has also been attributed informally to increased fraud and abuse monitoring, principally the “Operation Restore Trust” investigations and prosecutions.

**Recommendation II-4: The Panel recommends that, as a general principle, forecasts of trend growth rates and shift effects that are different from their long-term values be partially offset by changes in the opposite direction before the ultimate value is reached.**

In considering this history, the Panel observes that provider behavioral responses, such as upcoding and service utilization changes, are typically followed by a reversal of that pattern. Rapid increases in the case-mix index for inpatient hospitals were followed several years later by negative growth rates, as some of the upcoding was reversed. Large increases in home health visits and skilled nursing facility stays, as a second example, were followed by the passage of prospective payment legislation and the initiation of fraud and abuse investigations. The Panel suggests recognizing this principle in making forecasts of the shift component of Medicare growth rates.

The Panel proposes this as a general principle, but not an absolute standard. For example, if a new benefit were added to Medicare for which a behavioral response was very difficult, it might be most appropriate to forecast that use of that service would rise to the steady state without oscillating increases and decreases. Similarly, in those situations in which equilibrium values are

reached far in the future, forecasting an oscillation many years hence will not add much value in light of the underlying uncertainties over that time period.

This recommendation does not imply that such oscillations average out to no net change in service use. The increased use of home health and skilled nursing facility services as a result of unbundling in the early 1990s will likely result in increased total use of these services over time, even accounting for the recent reduction in their use.

## Specific Assumptions

In considering the implementation of these recommendations, the Panel reached several recommendations about particular assumptions made in the short-term forecasts. The Panel concentrated most heavily on assumptions regarding the HI service categories other than hospice care and regarding the physician and outpatient hospital components of SMI spending. Together, these service categories account for over 98 percent of HI expenditures and two-thirds of SMI expenditures (chapter I).

### *Assumptions regarding case-mix index*

Trend growth rates in the intensity of medical service utilization resulting from technological change are most apparent in the case-mix index increase. Thus, the Panel's recommendations concerning the trend component of Medicare growth rates have the most import in that situation.

**Recommendation II-5: In implementing recommendation II-2, the Panel recommends that the case-mix increase for inpatient hospital, skilled nursing facility, home health, and hospital outpatient services paid on a prospective payment basis be projected to have an underlying trend growth rate increasing at 1 percent per year.**

In current forecasts, the ultimate case-mix increase for inpatient hospital, home health, skilled nursing facilities, and hospital outpatient services is projected to grow at 0.5 percent per year. The transition time until this ultimate assumption is reached is a few years for inpatient hospital services (through 2002) and somewhat longer for the other services (through 2010 and 2012). The impact of recommendation II-2 is that the underlying technological change component of these services should be increased to a rate of 1 percent per year, or an increase of 0.5 percent per year above the current assumption.

**Recommendation II-6: In implementing recommendation II-4, the Panel recommends that the case-mix index for inpatient hospital services be forecast to increase above the ultimate, steady-state growth rate before the steady state is reached.**

This recommendation concerns the transition to the steady state or ultimate assumptions. As figure 5 shows, the increase in the case-mix index for inpatient hospital services has been below the steady-state growth rate for the past few years. Current forecasts project that case-mix increases for inpatient hospitals will trend smoothly to the steady-state growth rate by 2002. As noted in recommendation II-4, the Panel believes that it is more likely than not that, as providers reinstate some of the upcoding that occurred previously, the index will increase above the steady-state growth rate before the new steady state is reached.

**Finding II-7: The Panel finds reasonable both the assumptions about increases in case mix for home health services and hospital outpatient services in the first year of prospective payment and the assumptions that case-mix index increases for these services and for skilled nursing facilities will decline to a steady-state growth rate over time.**

Prospective payment systems have just been implemented for two payment categories: home health and hospital outpatient services. Prospective payment for a third category--skilled nursing facilities--was implemented in 1998. The initial increase in the case mix for skilled nursing facilities was rapid with the implementation of that program--5 percent in the first year. Current forecasts assume that the case-mix index increase in the first year of prospective payment will be 5 percent for home health care and 2.5 percent for hospital outpatient services and that the growth rate of the case-mix index for those services and for skilled nursing facilities will decline over a period of about 15 years to the new steady-state growth rates.

This pattern of high case-mix increase at the start followed by a gradual decline to a steady-state growth rate matches the historical pattern observed for inpatient hospitals (figure 5) and is consistent with the Panel's assumption about variables trending to steady-state growth rates. The Panel therefore finds these assumptions to be reasonable.

Additional information about some of these assumptions will be known in the near future. Since prospective payment for outpatient hospital and home health services was implemented during calendar year 2000, the initial case-mix index increases will be known within a year or two. This information can be used to modify the course of assumed case-mix index increases over the subsequent time periods.

The analysis described above argues for some oscillation of case-mix index increases before the new steady state is reached. In light of the substantial transition period to the new steady state, however, forecasting such an oscillation would appear to overstate the confidence the Panel has in those specific forecasts. Thus, the Panel does not specifically recommend such an oscillating pattern in this instance.

#### *Assumptions regarding utilization*

Current forecasts project no increase in per-beneficiary utilization of HI services after the next few years. As noted in finding II-3, the Panel concludes that this assumption is generally reasonable and suggests a slight decrease in the use of inpatient hospital services in this time period.

Utilization of outpatient hospital services is projected to increase at about 3 percent annually in the next decade. This 3-percent forecast is quite tentative, since there is no accurate historical information on utilization of outpatient hospital services that can serve as a guide for projections. Rather, the current projection is made in such a way that projected cost growth for those services will approximate growth rates in the past. The next few years will provide substantial information that will be of use in modifying this assumption. Historical data do not allow a decomposition of outpatient spending increases into price, utilization, and case mix components, but such information should be available in the near future. Decomposition of this spending growth is noted as a research priority in chapter V of this report.

*Assumptions regarding other SMI services*

**Finding II-8: The Panel finds reasonable the short-term spending forecasts for physician and other SMI services not paid on a prospective payment basis.**

No accurate data are currently available that could be used to construct a decomposition of residual increases in other SMI services--of which the largest is physician expenditures--into utilization and intensity components. Thus, forecasts have been made on the basis of only the total residual.

Such forecasts are generally made using historical information about cost increases. The historical record involves both technology-driven trend growth in spending and shift effects influencing the level of spending. Since the Panel recommends continuing the trend growth rate at its historical rate (believed to be about 1 percent per year), using historical data as the basis for the forecast accurately captures the trend growth and shift components of spending increases. The Panel, therefore, does not recommend any changes in spending forecasts for other SMI services.

The Panel notes two additional points about this finding. First, its practical import is limited. Physician services represent the dominant part of this expenditure, and physician prices are governed by the Sustainable Growth Rate legislation. As a result, increases in the assumed utilization and/or intensity of physician services would be largely offset by forecasts of reduced price growth.

More fundamentally, the Panel finds it essential that additional information be gathered and analyzed about the sources of cost growth for physician expenditures. Under the resource-based relative-value scale (RBRVS), it is theoretically possible for spending to be decomposed into price effects, volume effects, and case-mix effects. Given the dominant role of the physician services in Medicare spending and the strain that may be placed on the Sustainable Growth Rate legislation in the future because of the expected reduction in fees, analyzing such data is a high research priority. This need is noted specifically in chapter V.

*Assumptions regarding behavioral offsets*

**Finding II-9: The Panel finds reasonable the current assumptions of behavioral offset due to specific payment systems.**

In projecting future Medicare expenditures, OACT must often anticipate possible changes in the behavior of health care providers in response to increases or decreases in Medicare payment rates specified under current law. Examples of such behavior changes were shown in this chapter's earlier discussion of shift impacts on expenditure growth rates. Estimating future utilization of physician services, for instance, will depend on the payment rate bonuses or penalties established by the Sustainable Growth Rate provision.

For physician services, OACT generally assumes that 30 percent of the savings impact of a reduction in fees would be offset by increases in the volume and intensity of services. In practice, such reductions are measured relative to the Medicare Economic Index (MEI), the input price index used in the determination of physician fee increases. No offset is assumed in the case

## *Chapter II*

of price increases relative to the MEI. The 30-percent assumption for physician services is used only as a guideline and may be modified if warranted.

For other categories of health services, no studies of behavioral offsets exist. Therefore, OACT determines such offsets judgmentally, on a case-by-case basis.

The Panel reviewed the data, analyses, and judgments underlying the behavioral offset assumptions and finds the assumptions to be reasonable.

## Chapter III: Long-Term Expenditure Growth

**Recommendation III-1:** The Panel recommends that, for the period extending from 25 to 75 years into the future, age- and gender-adjusted, per-beneficiary expenditures for both SMI and HI be assumed to grow at a rate 1 percentage point above per-capita GDP growth.

### Background

For many years, the Medicare projections in the annual Trustees Reports have been based on an assumption that, in the long run, average per-beneficiary costs would increase at about the same rate as the underlying sources of funding for the program. Thus, because a majority of SMI revenue is drawn from Federal government general revenues, per-beneficiary SMI costs have been assumed to ultimately grow at the same rate as per-capita GDP. Similarly, expenditures for HI have been assumed to increase at the same rate as average hourly earnings, since the primary sources of HI revenues are the FICA and SECA payroll taxes on wages, salaries, and net earnings from self-employment.

These assumptions are clearly inconsistent with Medicare experience over virtually any historical period. They were chosen, however, for two primary reasons:

- *Some* assumption was required to enable longer-range Medicare projections to highlight the anticipated impact of the retirement of the post-World War II “baby boom” generation. This demographic impact will be substantial, and it can be projected with a reasonable degree of certainty based on estimates of the future numbers of Medicare beneficiaries and covered workers. By assuming per-beneficiary cost growth equal to revenue growth, future cost increases attributable to demographic factors could be calculated and highlighted.
- Medicare costs cannot continue to increase at rates considerably faster than underlying wage or GDP growth over extremely long periods. The Medicare projections in the annual Trustees Reports assumed that, over a 75-year period, the historical growth difference between health care spending and GDP could not persist unless Medicare were to absorb an implausible share of society’s total resources. As costs increased more rapidly than the ability to finance them, pressures to reduce cost growth would inevitably result. The Trustees Reports assumed that such pressures would not necessarily involve further legislation.

Accordingly, the Trustees and OACT assumed that growth rates would moderate over the first 25 years of the projection and would match average wage or per-capita GDP growth thereafter. This assumption focused attention on the effect of the demographic changes, since unit costs would then increase at the same rate as funding sources.

The prior Medicare Technical Panel reviewed these assumptions in 1991 and characterized them as “not unreasonable.” They recommended “that further experience ... should be closely monitored and that long-range assumptions ... should be adjusted, if necessary, as further experience develops ...” (Advisory Council on Social Security, 1991).

In keeping with the 1991 recommendations, the Panel has reviewed the current assumptions for long-range Medicare growth rates. After substantial consideration, the Panel believes that the current assumptions are no longer reasonable for two reasons. First, since 1991, when the prior review was conducted, additional evidence has emerged that provides greater understanding of the determinants of health care expenditure growth (see “Rationale” for further discussion). Secondly, the Panel believes that the long-term forecasts should reflect the impact of changes in per-beneficiary spending on expenditures in addition to the impact of demographic changes. In particular, the Panel believes that the long-term, age- and gender-adjusted growth rate of medical spending per beneficiary should be revised upward to a rate that is 1 percentage point above the expected growth rate of GDP per capita.

The differential growth between per-beneficiary medical spending and per-capita GDP that the Panel recommends is in nominal terms. The differential growth recommendation would be the same in real terms assuming that prices for medical care services increase no more rapidly than prices in the economy as a whole. As discussed below, the Panel believes this to be a reasonable forecast. The balance of this chapter describes the rationale for this recommendation.

## **Rationale**

The Panel recognized that estimating average, age- and gender-adjusted, per-beneficiary expenditure growth for a period of 75 years is extraordinarily difficult. Many factors will come into play that cannot be anticipated at the present time, including the effects of technology, changing benefit levels, changing provider market structure, and rising incomes. Nevertheless, any projection of HI and SMI expenditures requires such an estimate.

To examine this issue, the Panel considered

- historical experience, in particular the portion of historical health care expenditure growth one could expect to persist into the future;
- the determinants of health care expenditure growth, how those determinants may evolve in the future, and the associated cost implications;
- factors that might cause future trends to deviate from historical trends;
- the role of managed care in slowing historical growth rates;
- other forecasts about long-term health care expenditure growth; and
- the criteria that could be established to judge the reasonableness and sustainability of expenditure growth projections.

### *Historical experience*

One way to examine the issue of long-term Medicare expenditure growth is to consider the historical record. Of course, the future is not guaranteed to resemble the past, but analysis of past trends is a useful starting point in considering the issues that are likely to arise in the future.

The Panel’s analysis is based on examination of the growth of national health expenditures (NHE) compared to GDP. The Panel chose NHE, as opposed to Medicare spending, as the basis of the analysis partly because Medicare expenditures are affected more heavily than NHE by legislative changes that are not applicable when considering underlying expenditure trends. Moreover, experience with Medicare extends back only to the mid-1960s, so examination of NHE trends provides a longer historical record. The Panel believes that, in the long run, NHE growth is a reasonable proxy for trends in Medicare spending (McClellan, 2000).

Table 4 shows the growth rate of medical spending in the past 5 decades. Through most of the post-war period, the health care expenditure growth rate exceeded the GDP growth rate, with the exception of a rapid slow-down in the mid- to late 1990s. Since 1945, the real per-capita NHE growth rate averaged 4.1 percent. Fifteen-year rolling averages starting with the 1945-1960 period indicate that real, per-capita health spending growth rate never fell below 3.2 percent, with median spending growth rate at 4.4 percent. The 10<sup>th</sup> percentile of these 15-year rolling averages was 3.8 percent. Examination of 10-year rolling averages yields similar results (table 5). Although these figures are not age and gender adjusted, evidence suggests that such an adjustment would not substantially affect these historical results (Newhouse, 1992).

**Table 4: Real Per-Capita Growth in National Health Expenditures (NHE) versus Gross Domestic Product (GDP): Average Annual Growth Rates over Selected Time Periods**

	NHE	GDP	NHE-GDP
1945-1998.....	4.1%	1.5%	2.7%
1960-1998.....	4.5	1.5	3.0
1970-1998.....	3.8	1.8	2.0
1980-1998.....	3.8	1.4	2.4
1990-1998.....	2.5	1.4	1.1

Notes: 1. The NHE minus GDP differential may not equal the difference between their rounded components.

2. Real per-capita NHE and GDP are derived by adjusting nominal levels for (i) general price inflation (using the chain-weighted GDP price index), and (ii) the number of people in the total U.S. population.

**Table 5: Summary Statistics for Post-WW II Growth Trends in National Health Expenditures (NHE), Medicare, and Gross Domestic Product (GDP)**

	NHE	Medicare	GDP	NHE-GDP	Medicare-GDP
Average.....	4.6%	4.9%	1.8%	2.8%	3.6%
Median.....	4.4	4.7	1.7	2.9	3.3
25 <sup>th</sup> percentile.....	3.8	4.2	1.2	2.5	3.0
10 <sup>th</sup> percentile.....	3.5	4.0	1.0	2.0	2.6
Minimum.....	2.5	3.6	0.3	1.0	2.1

Notes: 1. For the statistics other than the average, the NHE minus GDP column will not equal the difference between the NHE and GDP columns because the periods identified as the median, 25<sup>th</sup> percentile, 10<sup>th</sup> percentile, and minimum may differ among the columns. The Medicare minus GDP column will not equal the difference between the Medicare and GDP columns for the same reason, and also because the Medicare statistics are calculated since 1967 whereas the GDP statistics are calculated from 1945 (see note 3).

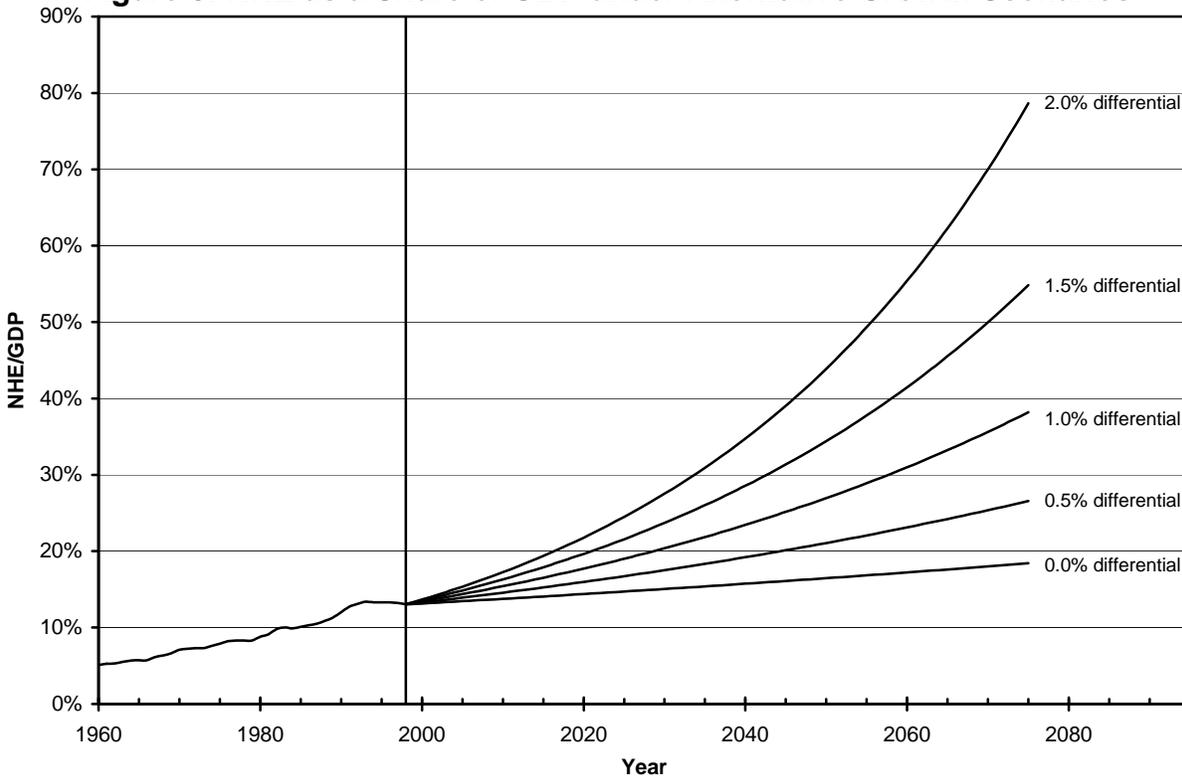
2. Real per-capita NHE, Medicare, and GDP are derived by adjusting nominal levels for (i) general price inflation (using the chain-weighted GDP price index), and (ii) the number of people in the total U.S. population.
3. NHE and GDP statistics are computed from the average annual growth rates over successive 10-year periods (1945-55, 1946-56, 1947-57, ..., 1988-98). Medicare statistics are computed similarly, except using 1967-77 as the first 10-year period.

The real per-capita GDP growth rate was consistently below the real per-capita health spending growth rate. For the 1945-1998 period, the average GDP growth rate was 1.5 percent, yielding a differential between NHE and GDP of 2.7 percent. The average GDP growth rate for the 10-year periods from 1945 to 1998 was 1.8 percent, which is below the minimum of the 10-year rolling average NHE growth rates of 2.5 percent. The median differential between GDP and NHE growth rates for the 10-year periods was 2.9 percent, and the differential at the 10<sup>th</sup> percentile was 2.0 percent. The minimum differential was 1.0 percent, achieved in the period ending in 1956 (table 5).

Figure 8 illustrates the result of this growth--a rising share of GDP devoted to health care. The figure also shows the forecast for health care as a share of GDP under various values of the differential between the rates of GDP growth and growth in NHE. If health care spending were to exceed GDP growth by 2 percentage points per year, which is less than the historical average, health care spending would reach 79 percent of GDP by 2075. Such a share seemed implausibly large to the Panel. A 1.5-percent differential would imply that 55 percent of GDP would be devoted to health care by 2075, and a 1-percent differential would imply a 38-percent share.<sup>1</sup>

<sup>1</sup> These illustrations reflect both the assumed differential in per-capita growth rates and the change in health care costs resulting from future demographic shifts.

**Figure 8: NHE as a Share of GDP under Alternative Growth Scenarios**



*Determinants of expenditure growth*

Historically, the primary long-run determinant of real health care spending has been the development and diffusion of new medical technology. The Panel defines technology broadly to encompass all ramifications of new medical knowledge, including not only utilization of new services or equipment but also new applications of existing services or equipment made desirable because of advances in medical science. The Panel expects technological developments to continue to strongly influence health spending growth in the future. Substantial evidence from aggregate analyses of expenditures and disease-specific studies supports this belief (Newhouse, 1992; Chernew, Hirth, et. al., 1998; Peden and Freeland, 1995; Cutler, 1995; Smith, Heffler, and Freeland, 2000). Other causes, such as rising incomes and changes in benefits, have generally been found to be lesser factors, as indicated in table 6 (Smith et al., 2000).

**Table 6: Research on Causal Factors Accounting for Growth in Real Per-Capita Health Care Spending**  
(Estimated percentage change, 1940-90)

	Newhouse (1992)		Cutler (1995)	
	Percent change	Contribution to growth	Percent change	Contribution to growth
Health spending .....	790%		780%	
Aging .....	15% <sup>1</sup>	2%	14% <sup>5</sup>	2%
Insurance .....	81% <sup>2</sup>	10%	100% <sup>6</sup>	13%
Income growth .....	<180% <sup>3</sup>	<23%	37% <sup>7</sup>	5%
Relative medical price inflation .....	0% <sup>4</sup>	0%	147% <sup>8</sup>	19%
Avoidable administrative expense .....	n. a.	n. a.	101% <sup>9</sup>	13%
Supplier induced demand / defensive medicine.....	Negligible	0%	Negligible	0%
All non-technology factors .....	<276%	<35%	399%	51%
Attributed to technological change .....		>65% <sup>10</sup>		49% <sup>11</sup>

<sup>1</sup> Estimate for 1950-87: relative spending for population over 65 years and population 19-64 years based on application of age distribution of expenditures from the 1987 National Medical Expenditure Survey (NMES) to change in age distribution.

<sup>2</sup> Estimate for 1950-80 extrapolated to cover 1940-90 based on application of price elasticity to decline in out-of-pocket share of spending for 1940-90. Price elasticities from the Rand Health Insurance Experiment (HIE) were -0.1 to -0.2.

<sup>3</sup> Low end of range for income elasticities based on HIE, which implies 35 percent of increase attributable to rising income. High end of range based on macro-economic time-series cross-sectional estimates across countries, and implies 234 percent of increase attributable to rising income. Newhouse estimated an elasticity of "under one," implying a less than 180 percent increase attributable to rising income.

<sup>4</sup> Based on the statement that "a true productivity measure might even go up at or in excess of economy-wide rates...it is not clear that much of the expenditure increase should be attributed to this factor" (Newhouse, 1992).

<sup>5</sup> Estimate for 1940-90, applying relative spending for over-65 population and 19-64 population based on 1977 NMES to change in age distribution.

<sup>6</sup> The difference between Newhouse and Cutler estimates reflects rounding upwards by Cutler; the methodology is the same.

<sup>7</sup> Cutler uses an estimated price elasticity of -0.2 based on Rand experiment--equivalent to low-end of Newhouse range.

<sup>8</sup> Based on assumption that productivity growth in health care is zero, implying long-term growth in relative prices of 2 percent.

<sup>9</sup> Based on estimate of 8 percent for avoidable administrative expense for 1983 (Himmelstein and Woolhandler, 1991), assuming zero avoidable expense in 1940.

<sup>10</sup> Based on Newhouse's discussion, expressed as an approximate point estimate.

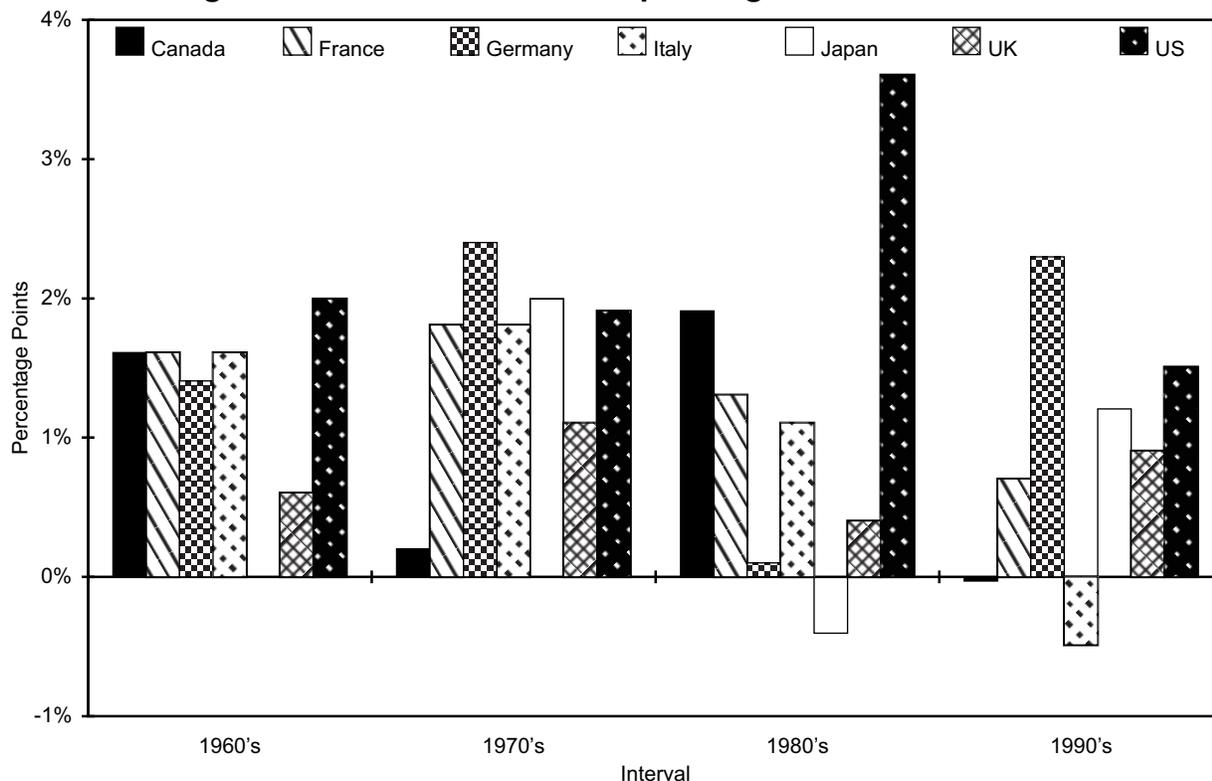
<sup>11</sup> Lower bound for contribution of technological change.

Source: Smith et al, 2000

The important role of technology in driving health care expenditure growth is illustrated by the similar experiences of all OECD countries. The excess of health care spending over general growth of the economy is not unique to the U.S. and our system of health care financing. All OECD countries have experienced relatively higher growth in health care spending than in GDP, though some have had periods of constrained expenditure growth. Figure 9 shows the growth rate of medical spending as a share of GDP for the G-7 countries. Throughout the last 3 decades, health care spending, on average, has outpaced GDP growth in all of these countries. While

there are particular periods in which some countries have experienced less rapid growth rates of medical spending, these are usually followed by periods with rapid growth. The periods of constrained expenditure growth reflect health system reforms--reduced fees to providers, consolidation of hospital facilities, and the like. But the ultimate inability of these systems to constrain expenditure growth reflects the fundamental, and common, expenditure pressure from advances in medical technology (Cutler, 1999).

**Figure 9: Increase in Medical Spending as a Share of GDP**



Examination of expenditure growth associated with the treatment of different diseases (outlined in Chernew, Hirth, et al., 1998) also reveals the importance of medical technology (Scitovsky, 1985; Scitovsky and McCall, 1976; Showstack, Schroeder, and Matsumoto, 1982; Katz, Welch, and Verrilli, 1997; Holohan, Dor, and Zuckerman, 1990). For example, Scitovsky (1985) and Scitovsky and McCall (1976) examined treatments for certain illnesses, such as breast cancer and heart attacks, during the periods 1951-1964 and 1964-1971. They infer that “little ticket” items, such as lab tests, accounted for most of the expenditure increases during the earlier period. They reached a similar conclusion for the later period, though they determined that the introduction of cardiac intensive-care units was also a significant factor contributing to the increased expenditures for treating acute myocardial infarction.

Scitovsky (1985) continued this work, examining expenditures for sixteen diseases between 1971 and 1981. About half of the diseases did not experience substantial expenditure increases, but for those that did, the primary determinant was specific medical innovations, generally big-ticket items. For breast cancer, the expenditure-increasing technologies included radiation therapy in the earlier periods and combination therapies, including chemotherapy, in the later periods. In

the treatment of heart attacks, the prime expenditure-increasing technologies were intracoronary streptokinase infusion and coronary bypass surgery.

Showstack, Schroeder, and Matsumoto examined inpatient resource use for ten diagnoses between 1972 and 1977. They, too, concluded that several new technologies, including ultrasound and nuclear medicine, contributed substantially to expenditure growth.

Table 7 (Cutler, McClellan, et al., 1998, 2000) illustrates technology's role in hospital expenditure increases as they relate to heart attack patients in the Medicare population in 1984 and 1994. The data underlying the table are for every Medicare beneficiary with a heart attack in those 2 years--about 250,000 cases each year. For this population, in the 12 months after the person first had a heart attack, aggregate real Medicare payments to hospitals rose by about 4.8 percent per year--roughly the average for Medicare as a whole.

**Table 7: Analysis of Real Increases in the Hospital Costs of Treating Heart Attacks for Medicare Beneficiaries**

			Average Annual Percent Change	Share of Patients Receiving		Average Annual Percentage Point Change
	1984	1994		1984	1994	
Number of Heart Attacks .....	233,284	238,480	0.2%			
Average Hospital Spending per Case <sup>1</sup> .....	\$11,549	\$18,064	4.6%			
Average Hospital Spending by Treatment Regimen <sup>1</sup>						
Medical management.....	\$10,155	\$13,190	2.6%	89%	53%	-3.6%
Catheterization only.....	\$15,887	\$15,673	-0.1%	6%	16%	1.0%
Angioplasty.....	\$26,661	\$19,309	-3.2%	1%	17%	1.6%
Bypass surgery.....	\$29,176	\$36,564	2.3%	5%	15%	1.0%

<sup>1</sup>In constant 1991 dollars deflated by the chain-weighted GDP price index.

The 4.8-percent increase in spending was not a result of more heart attacks in the elderly population. As the first row of the table shows, the number of heart attacks increased just 0.2 percent annually, despite an increase in the elderly population of about 2 percent per year. Rather, it was average real spending per heart attack, as shown in the second row of the table, that rose by 4.6 percent per year, from \$11,500 in 1984 to \$18,000 in 1994 (both in 1991 dollars).

The explanation for increasing expenditures for treating heart attacks can be seen in the next rows of the table. There are three fundamental ways to treat a heart attack. The first is to “medically manage” the patient, using drugs but not surgical procedures to limit the extent of heart damage. Alternatively, one can attempt “revascularization procedures” to restore blood flow to the heart. The more intensive revascularization procedure is a coronary artery bypass graft, in which veins from elsewhere in the body are used to bypass the occluded arteries. A third treatment is angioplasty, which can be used to dislodge the clot from the occluded artery.

Each of these procedures is preceded by a cardiac catheterization, a diagnostic technique to measure the extent of arterial blockage.

The remaining rows of the table show (a) the average amounts paid by Medicare for these treatments (deflated by prices in the economy as a whole), and (b) the share of patients receiving these different treatments. Real reimbursement amounts for these treatments have been relatively constant over time, with some services (such as angioplasty) actually falling in price and others (such as bypass surgery) rising. The most significant change occurred in the quantity of surgical procedures provided, which increased enormously. In 1984, 11 percent of patients with a heart attack received some surgical care; in 1994, the share was 47 percent. This diffusion of new technologies explains essentially all of the increased Medicare spending--between three-quarters and 100 percent, depending on the specific time period used. Changes in average payments and in the number of people with a heart attack had only minor impacts on spending, or even led to cost savings.

The importance of technology as a primary factor contributing to health care expenditure growth likely reflects the value that consumers place on services that can improve health. Medical advances have undoubtedly generated substantial improvements in life expectancy and quality of life over the past century. Historically, individuals have consistently demanded access to new services, and the Panel believes that such demand will largely continue into the future. The recognition that technological advances are associated with health care expenditure growth is not intended to imply that expenditure growth is too high.

For the medical sector as a whole, estimates from the literature suggest that about half of real health care expenditure growth has been attributable to medical technology (Newhouse, 1992; Peden and Freeland, 1995; Cutler, 1995). The remaining parts are attributable to the spread of insurance leading to increased moral hazard (perhaps 13 percent), increased incomes leading to heightened demand for services (5 percent), an older population (2 percent), and other factors such as administrative expense and rising physician profits (32 percent) (Cutler, 1995). Attributing 50 percent of the median 4.4-percent growth in real per-capita NHE (based on the median of 15-year rolling averages) to progress in medical technology, the Panel estimates a 2.2-percent growth in real per-capita NHE in the future due to medical technology alone. Subtracting the current 1.2-percent growth in real per-capita GDP assumed by the Trustees yields a differential of 1 percent.

One might view this figure as falling in the lower end of the reasonable range because it assumes that non-technological factors will not continue to contribute to health care expenditure growth. For example, one of these non-technological factors is the effect of income increases, which are usually associated with an increase in health care spending over time. Because income should rise in the future, health care spending may rise more rapidly than implied by the recommendation. However, since faster income growth will also be reflected in GDP growth, the extent to which income growth will affect the differential depends on the income elasticity of health care spending. Similarly, the preceding analysis assumes that there will be no increases in medical prices paid above general inflation and no additional administrative burden. To the extent that price increases exceed general inflation, the differential, which combines price and quantity effects, would be higher than that recommended.

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The Panel believes that a common assumption for the long-term period regarding age-adjusted expenditure growth, covering both SMI and HI, would be appropriate because of a lack of a strong a priori belief about whether development and diffusion of new medical technology would differentially affect the trust funds.

#### *Deviations between future and past experience*

Of course, the future need not mirror the past. The Panel recognizes several factors that may cause future experience to deviate from what has been observed historically. Such differences are not uniform in their direction, however, and in light of all the uncertainties, the Panel judges that, as a whole, the 1-percent differential growth estimate is reasonable.

One source of uncertainty is that the analysis is based mainly on comparisons of national health expenditures to GDP. Growth in Medicare expenditures may diverge from growth in NHE. Historically, total spending for the elderly has outpaced that for the general population (Cutler and Meara, 1997). Much of the differential has been for services outside of Medicare coverage, such as prescription drugs. However, if this trend were to continue and affect Medicare-covered services, the differential for Medicare spending would likely exceed the 1-percent recommendation.

Technological change may affect the division between covered and uncovered services. Certain services, such as pharmaceuticals, are at present largely uncovered by Medicare. Improved pharmaceuticals that reduce the need for inpatient hospital services might then lead to reductions in spending for currently covered Medicare services. The Panel's estimates do not account for substitution of these services for those covered by Medicare. A counter view, however, is that if new technology increases the desirability of uncovered services, coverage will expand to include those services, since uncovered services will become increasingly unaffordable otherwise.

Another source of uncertainty is that recently many categories of Medicare spending have shifted to various forms of prospective payment. The implementation of prospective payment--and its corresponding ability to control unit prices--is a significant reason the Panel does not forecast long-term spending increases resulting from medical price increases in excess of the corresponding growth rates for wages and prices in the overall economy. The heart attack example presented above suggests that this is a reasonable assumption. Prospective payment might also affect the use of new technologies. Evidence regarding the effects of these reimbursement rules on long-term expenditure growth is currently limited. It is conceivable that such legislation will constrain expenditure growth beyond the reductions the Panel has assumed. Certainly the sustainable growth rate legislation for physician payments was intended to constrain real per-beneficiary spending on physician services to growth in real per-capita GDP alone.

Finally, the nature and type of technological innovations may change (Weisbrod, 1991), whether for exogenous reasons or due to the incentives provided by managed care. The heart attack example cannot continue forever; at some point nearly all of the elderly would receive intensive surgical procedures, and expenditure increases from that source would slow. The Panel's estimates assume that technological change will continue for other diseases and treatments. On the one hand, this seems conservative, as biomedical research is booming as never before, with

substantial research being done on cancer care, Alzheimer's disease, gene therapy, and so on. On the other hand, the nature of development and diffusion of some of this technology may be altered by managed care. Peden and Freeland (1995) and Weisbrod (1991) note that much of technology-induced expenditure growth was itself induced by the prevalence of health insurance. It is thus sensible to expect that managed care may slow down technology diffusion and encourage development of cost-decreasing technologies. Little evidence exists regarding the impact of managed care on technology development, but estimates suggest that in markets dominated by managed care, new technologies diffuse at a less rapid rate than in areas with less managed care enrollment (Baker and Brown, 1999; Chernew, Hirth, et al., 1998; Cutler and Sheiner, 1998). Whether the net effect of scientific innovation and managed care will be a greater or smaller rate of new technology diffusion is unknown.

The implications of a given rate of innovation for expenditure growth are also difficult to predict, since new technologies can have higher or lower unit costs than current technologies. New surgical techniques using lasers and small probes, or for diseases not well treated now, may come at high costs. Conversely, preventive therapies may be cheaper than current technologies. Pharmaceuticals to clear clotted arteries, for example, could substitute for bypass surgery and reduce per-person costs substantially.

Beyond their effect on unit costs, new technologies that are more effective and less invasive are likely to lead to more people being treated. Past evidence shows that technology-induced increases in the number of people treated can overwhelm even relatively substantial reductions in the unit cost of treating a person. For instance, although the development of laparoscopic cholecystectomy dramatically lowered per-case expenditures for removal of the gallbladder, the utilization of cholecystectomy rose substantially following the introduction of this minimally invasive technique. The increased use (about 60 percent in some delivery systems) outweighed the reduced per-case cost, resulting in an increase in expenditures (Chernew, Fendrick, and Hirth, 1997). Legorreta et al. (1993) report that in one HMO, there was a 25.1-percent decline in per-unit cost of cholecystectomy associated with the laparoscopic procedure but an 11.4-percent increase in expenditures due to the almost 60-percent increase in volume.

While the Panel recognizes the substantial uncertainty about the pace, direction, and implications of future technological innovation, it sees no clear evidence that future expenditure increases resulting from medical technology will be either greater or lesser than past increases. Therefore, the Panel chooses its specific forecast increase on the basis of past experience.

#### *Managed care and the recent slowdown in expenditure growth*

The dominant feature of the health care environment in the past several years has been a less rapid growth in health care expenditures in comparison to GDP than in previous decades. Indeed, health care as a share of GDP has not increased since 1993 (Levit et al., 2000). Part of this slowdown occurred because GDP growth was relatively robust and did not translate immediately into greater health care spending; another factor was that medical spending growth itself has slowed down.

Research suggests that this recent experience is a short-term aberration from a long-term trend of higher expenditure increases. In particular, the spread of managed care in the early 1990s led to

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substantial reductions in prices paid for services and to marginal reductions in medical services provided (days in the hospital, small laboratory tests, etc.). Such changes are one-time adjustments; physicians' salaries cannot be cut forever, and hospital days can fall only so much. Over the longer term, new technologies will likely be the driving force in increasing expenditures. All of this information suggests that the recent expenditure slowdown must be temporary. In fact, many analysts believe that health care expenditure increases will accelerate after their recent slowdown, and some evidence suggests that this escalation is even now occurring (Hogan, Ginsberg, and Gabel, 2000; Heffler et al., forthcoming).

Thus, in developing its longer-term spending projection, the Panel placed more weight on the lengthy historical and international record than on experience during the past few years.

#### *Comparisons to other forecasts*

The Panel also considered other projections of health care expenditure growth. The literature on this question is not overwhelming. Actuarial guidelines do not provide a specific recommendation for what assumption is reasonable. Corporations do make some long-term health care expenditure projections when they provide retiree health benefits. Generally developed in consultation with actuaries and economists, these long-term assumptions are intended to represent management's best estimate of their future expenditure increases. Among the data the Panel reviewed were financial disclosures that employers are required to include in their financial statements if they sponsor retiree medical benefits. These data suggest that, on average, major employers anticipate that long-term per-capita medical expenditures for their retiree populations will increase by 5.3 percent per year in nominal terms. If the Panel projects an underlying inflation rate of 3.3 percent, these employers are using a 2-percent real expenditure-increase assumption. Subtracting a 1.2-percent growth in GDP would yield a per-capita differential of 0.8 percentage points.<sup>2</sup>

Other government forecasters have also considered this issue. The Congressional Budget Office, for example, recently assumed a 1.1-percent differential between per-beneficiary health care spending and wage growth. Had the CBO framed its recommendation relative to GDP growth, the estimated differential would be about 0.9 percent. (The Trustees forecast a long-term annual real wage growth of 1.0 percent and an average per-capita real GDP growth of 1.2 percent.)

Additionally, the Trustees assume a difference between GDP growth and wage growth that is based in part on an assumption regarding the relative growth rate in non-wage compensation. Currently the Trustees Reports assume a differential growth rate between wage and non-wage compensation growth of 1.05 percentage points in 2025, 0.88 percentage point in 2050, and 0.76 percentage point in 2075. Although an assumption is not made explicit regarding the extent to which this differential is attributable to growth in private health insurance premiums, the current differential between wage and GDP growth is not inconsistent with the assumption of a

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<sup>2</sup> Hewitt Associates summary of 1999 financial statements of Fortune 500 companies. For retiree health plans, these long-term growth assumptions apply over the remaining lifetimes of the employer's current work force. This period can extend for as long as the next 75 years, although the *average* term, reflecting future employee withdrawals and other factors, would generally extend 20 to 40 years.

1-percent differential between health care expenditure and GDP growth (see recommendation II-5).

Another analyst who has examined this question is Mark McClellan, whose recent paper assumed real per-beneficiary health care expenditure growth of 2.75 percent per year. When compared to GDP growth, this figure would generate a differential of about 1.5 percentage points. McClellan bases the 1.5-percent assumption on historical experience, noting that it is conservative and, like the Panel, recognizing the important role technology plays in driving health care expenditure growth. This assumption could be reconciled with the Panel's 1-percentage-point differential by assuming either that a greater share of expenditure growth is attributable to technology or that other non-technological factors will continue to contribute to health care expenditure growth.

### *Sustainability*

The Panel spent a substantial amount of time and effort considering whether a 1-percentage-point differential between health care expenditure growth and GDP growth would be sustainable. Although the members agreed that it is important to understand the implications of a differential of this magnitude, they did not believe that, if the implications of such a differential were deemed unsustainable, the assumption is necessarily incorrect. It might be the case that, as health care expenditures grow, legislative action will be required to prevent an unsustainable situation from arising. The current projections are based on the assumption that current law remains in force.

The fundamental question regarding the appropriateness of the assumption is not just whether implied spending is sustainable, but also whether forces other than legislative change would be expected to reduce spending growth. Forces that may act to limit rapid growth of health care spending include employers upset by the implications of rising expenditures for their employees, people not willing to pay for the additional health care spending, or governments not able to finance such spending. Nevertheless, the effectiveness of the tools used by these stakeholders for reducing spending growth has tended to be limited in the past, and the Panel cannot assume that they will become more effective in the future. Moreover, to the extent that many of these forces are focused on the private market, they may have a somewhat more limited impact on Medicare expenditures. Thus, even if the growth rate were deemed excessive by many observers, it could still continue unabated.

Assuming a 1-percent differential between NHE and GDP growth means that the share of GDP devoted to health care in 2075 would be about 27 percent before demographic effects. After such changes--primarily the aging of the population--are accounted for, the NHE share of GDP would be roughly 38 percent of GDP. The Panel does not view this figure as implausible. Under this scenario, the share of total consumption of other goods and services would be reduced by about 20 percentage points relative to what it would otherwise have been--from 82 percent to approximately 62 percent of GDP--to finance the increased health care spending. In judging the reasonableness of this shift, it is important to consider that real expenditures on non-health goods and services would still be substantially above current levels, despite the higher health outlays, as discussed in more detail below.

There is no single definition of “sustainability.” The Panel used as one definition the question of whether health care spending growth could be financed without a reduction in non-health care spending (but with a less rapid increase). Under the assumptions above, average growth in non-health spending would be about 0.9 percent for the entire period and approximately 0.4 percent at the end of the period, in each case still positive. Thus, the Panel considered the 1-percentage-point differential to meet this definition of sustainability for the current forecasting period.

The Panel recognizes that the aggregate analysis described above implicitly incorporates assumptions about both the number of workers in health care and financing decisions concerning how to pay for this care. Either of these factors could influence the effect that increased health care spending has on the economy as a whole.

With regard to financing decisions, the Panel recognizes that increased Medicare spending would require continued increases in Part B premiums, as well as an increase in net government spending or increased taxes (or, alternatively, changes to slow growth in other Federal expenditures). No such changes are assumed in the Trustees Report projections, since these projections are necessarily based on the provisions of present law. For purposes of judging sustainability, it is appropriate to consider the broader fiscal implications of faster Medicare growth. Within the time frame available, the Panel was not able to analyze these implications. Future research on this subject is advisable.

Although the impact of increased health care spending on the economy would depend on which financing option were chosen, the Panel has assumed that appropriate financing decisions will be made. To the extent that appropriate financing requires tax increases, the Panel recognizes that the political feasibility of such tax increases would depend on the value the electorate places on the additional Medicare spending. An unwillingness of the electorate to finance spending increases, even if tax increases are the most appropriate financing mechanism, does not imply expenditure growth will slow without legislative changes.

The second sustainability issue concerns the large share of total output consumed by health care and its resulting implications for the economy. Simply put, if health workers have a below-average rate of productivity growth (as official statistics indicate), will an increase in the share of GDP accounted for by health care require such large increases in health-sector employment that aggregate GDP growth will suffer?

The historical record suggests that the labor input required to produce this additional output is not implausible. Relative to the growth of prices in the overall economy, total spending on health care increased in real terms by about 4.5 to 5.0 percent per year from the early 1970s through the late 1980s. This spending increase was accompanied by average annual growth in health labor input of 3.1 percent. More relevant is the relation between this rate of growth and that of the economy as a whole. Real spending on health care increased by about 1.5 percentage points relative to GDP, while real employment in health care increased by about 1 percentage point relative to total employment in the economy. If this historical relation were to continue, as the Panel assumes it will, the projected differential increase in medical spending relative to GDP of 1 percentage point would require a differential increase in health care employment relative to total employment of about 0.5 to 0.7 percentage point. Thus, health care employment as a share of total employment would increase from about 9 percent currently to approximately 17 percent by the end of the 75-year projection period.

This does not strike the Panel as an implausible estimate. The increase in productivity required in the non-health economy to produce the additional non-health output necessitated by this scenario is trivial.

This employment scenario is not based on the traditional productivity calculation for the medical sector. There are several reasons for this. First, the output that is appropriate in measuring productivity ideally would reflect the health improvement of people who are served by the medical sector. In practice, such output cannot (yet) be measured. Even traditional measures of health sector output cannot be reliably measured, with the result that “true” health price and productivity growth are largely unknown (Cutler and Berndt, 2000). For this calculation, however, the Panel is concerned not with the measurement of health productivity, but solely with the number of people who will be employed in health care as its share of the economy increases, independent of the health consequences of that employment.

Another reason concerns the traditional measurement of health care productivity, which typically uses as prices the health-sector output price indices of the Bureau of Labor Statistics--the consumer price index--and the Bureau of Economic Analysis (BEA)--the producer price index. The price increases reported by these agencies are generally much larger than price increases in the overall economy, suggesting that health care productivity growth is low or, equivalently, that substantial employment increases are required to expand the size of the medical sector. As much research indicates, however (Triplett, 1999; Cutler and Berndt, 2000), current price increase measures are substantially overstated, since the extra expenditure associated with technological change is often incorporated into output prices instead of quantity. Indeed, recent research has found that medical care prices for many conditions are increasing no more rapidly than prices in the economy as a whole. Revisions to the medical care price indices by the BEA in the mid-1990s contributed to a substantial reduction in the measured difference between the inflation rate of the healthcare sector and that of the economy as a whole. The Panel believes that better control of prices by public and private payers, along with properly measured price indices, will result in future increases in health care prices that approximate wage and price growth in the overall economy. Currently, the use of conventional health care price indices gives an overly pessimistic view of productivity gains in medical care.

More fundamentally, in recommendation III-1, the Panel is ultimately taking no stand about whether, using conventional measures, the spending increases it forecasts will be reflected in price increases or quantity increases. A continuation of conventionally measured medical care price increases resulting from technological change--and correspondingly lower measured productivity changes--would be equally consistent with the Panel’s forecasts.

At the Panel’s request, the INFORUM group at the University of Maryland explored the effect of a 1-percentage-point differential between health care spending growth and GDP growth in the context of a general equilibrium model of the economy. For this analysis, the Panel assumed that future health care productivity gains would approximate economy-wide rates. Under this assumption, the INFORUM results confirmed the ability of the economy to cope with expenditure growth of the recommended magnitude. However, the analysis also showed that the results were extremely sensitive to alternative assumptions for health care productivity.

The Panel believes that additional analysis of the sustainability issue is desirable and would facilitate further refinement in the long-range Medicare growth rate assumption. In its review,

the Panel identified many factors affecting the sustainability of more rapid health expenditure growth. A more rigorous analysis of these factors should be conducted. In particular, there is relatively little current research on the potential market forces that could act--without new legislation--to slow Medicare expenditure growth.

## **Conclusions**

The current long-range Medicare growth rate assumptions, which have been used for many years, were originally developed for appropriate reasons. In light of subsequent program experience and research findings, however, the Panel believes it is time to adopt an assumption of faster growth. Since the projected future expenditures of the Medicare program are extremely sensitive to this assumption, additional research and analysis are desirable and could contribute to further refinement of the assumption in the future.

Overall, the Panel unanimously concludes that there is substantially greater evidence in favor of the recommended assumption (of per-capita GDP growth plus 1 percent) than there is in support of the existing HI and SMI Trustees Report assumptions. Thus, despite the remaining uncertainties discussed in this chapter, the Panel believes its recommendation would significantly improve the realism of the long-range Medicare expenditure projections. OACT, outside researchers, and future Medicare technical review panels should continue to assess this critical assumption and to refine it as new information warrants.

## **Chapter IV: Stochastic Forecasting and Uncertainty**

### **Introduction to Discussion of Uncertainty Associated with Medicare Cost Projections**

Forecasting health care costs for the Medicare program over a 75-year period is a formidable task. This can be observed by thinking about the last 75 years. At the beginning of this period, the provision of health care was just beginning to be funded through employer-sponsored programs. Medicare did not yet exist and would not be created for another 40 years. In 1925 the greatest hazards to health included infectious diseases and what are now known as poor public health conditions.

The dominant future trends that will influence health care costs can only be surmised. Possibilities include medical advances achieved through increased knowledge of the human genome; miracle drugs; increased prevalence of smoking, as evidenced by recent trends in smoking by teenagers; and continuing adverse trends in obesity. The insistence that the highest quality of health care services be available for everyone should continue to influence the demand and types of health care services provided.

The only thing certain about such forecasts is that they will be wrong. Yet the need for objectively developed projections is at least as great as ever. If they are to develop appropriate programs, public policy makers must have access to objective health care cost projections and understand the likely drivers for future costs. The public, too, needs to know how to prepare for the future. It is therefore important to recognize the level of uncertainty in the projections in order to convey the extent of the uncertainty associated with the Trustees Reports.

The major sources of uncertainty with these projections and their interactions include the following:

- Demographic changes, which encompass not only the number of people in various demographic classes, such as age and gender, but also their health status and their demand for health services;
- General economic conditions, because the overall economy will influence both health care costs and the amount of funding available through the current tax and premium system; and
- Health care-specific factors, such as the design of Medicare program benefits, behavioral influences of both consumers and providers of health care services, governmental and private efforts to control costs, and advancements in health care technology and medical research.

Several approaches have been used in the Trustees Reports to illustrate the uncertainty associated with future Medicare health care costs, including

- (a) the use of three alternative sets of long-term projection assumptions;

- (b) certain sensitivity tests; and
- (c) an initial application of stochastic modeling showing the projections as a statistical range of results instead of one estimated cost per year.

## Sources and Evaluation of Future Uncertainty

To better recognize and project future health care costs, we need to more fully understand the dynamics and costs associated with health care utilization.

**Recommendation IV-1: The Panel recommends that the Trustees evaluate historical experience on a regular basis to better identify the sources and causes of changes in health care costs.**

The first necessary step in better comprehending the uncertainty associated with future health care costs is to evaluate the historical changes in health care cost experience. The identification and analysis of historical sources of health care cost changes, including demographic shifts and legislated changes in benefits, will contribute to a fuller understanding of the underlying cost trends and the impact of factors such as changes in technology and utilization patterns. This analysis has been difficult to do because of a lack of sufficiently detailed data and adequate resources and because of the complexity of health care and the effect of changes in Medicare provider reimbursement mechanisms and beneficiary behavior over a long period of time. More resources--internal and external--should be allocated for such analyses, thus creating a better baseline from which to project future costs and to evaluate their potential variation.

The 2000 HI Trustees Report includes a “decomposition” of costs for a 1-year period (table II.E.4). The table shows the change in actuarial balance from the prior year due to the passage of time and legislated amendments, as well as deviations from expected assumptions of managed care, hospital, other provider, and economic changes. No decomposition is provided covering a period longer than 1 year. Both the HI and SMI reports contain tables or paragraphs that describe economic, demographic, and health care cost-related assumptions, sometimes in quantitative form. However, the relative contributions of individual assumptions on comparisons of actual experience to projected experience are generally not provided.

The sources of variation in future health care costs can arise from legislative changes to the Medicare program. Isolating the effect of these legislative changes as a source of “forecast error” is not easy. In some cases, the effect of new legislation on health care costs arises from both design and behavioral changes. For example, the current ultimate assumption that health care cost growth per beneficiary approaches overall GDP growth implicitly assumes that, under current law, significant behavioral or technological changes will take place that will prevent health care costs for Medicare from continuing to increase beyond the rate of growth of financing.

**Recommendation IV-2: The Panel recommends that, to the extent possible, the Trustees regularly evaluate and report on the accuracy of past HI and SMI projections over various periods--for example, over 1, 5, and 10 years.**

The Panel believes that a broader range of historical comparisons of previous Medicare cost projections with subsequent experience should be developed and presented in future Trustees Reports using the results of the historical experience analysis described in recommendation IV-1. The primary purposes of this presentation are to (a) gain a greater understanding of differences in actual experience compared to prior reports' assumptions over longer periods of time; (b) provide relevant information that could enhance future projections; and (c) illustrate the range of uncertainty that is inherent in this type of projection.

The analysis should identify historical trends that differ from prior expectations. Comparisons of health care cost projections to actual experience should be presented, if feasible, over 1-year, 5-year, and 10-year periods for HI, SMI, and HI and SMI together. The aggregation of health care costs from HI and SMI can be important because of changes in the payment of certain benefits between funds and due to changes in the usage of certain benefits, such as the trend from inpatient to ambulatory care.

**Finding IV-3: The Panel finds that the current 1-year decomposition of changes in actuarial balance included in the HI Trustees Report is reasonable and can be enhanced through further analysis of contributing causes.**

Currently, only a 1-year decomposition of changes in actuarial balance is presented in the HI Trustees Report. No comparable decomposition is included in the SMI Trustees Report.

In the 2000 HI and SMI Trustees Reports, total income and expenditures for each trust fund for 1999 are compared to the amounts that were forecast at the beginning of 1998 and 1999 (table II.C.2 in both reports). The text near the tables describes the major sources of the deviations without quantifying the relative importance of each factor. To the extent possible, the sources of each forecast difference should be quantified, in particular using the results derived from the implementation of the analysis described in recommendation IV-1 above.

**Recommendation IV-4: The Panel recommends decomposition analysis of the change in SMI cost projections similar to the analysis of change in the HI actuarial balance.**

The Panel recognizes that comparisons of actual experience with projections made many years in the past can be difficult. The likely existence of multiple legislative changes since the projections were made increases this difficulty. Nevertheless, this exercise can provide significant insight and input into the enhancement of current stochastic models, the presentation of alternative projections, and the design of other types of sensitivity projections. Due to the difficulty in analyzing the results over a long period of time, the Panel recommends that the periods presented be gradually lengthened as additional information is gathered, until 10 years of comparisons are reached.

In general, health care cost projections for social insurance programs should reflect the assumption that current legislation/regulations will apply in the future. However, certain aspects of present law (for example, Medicare's current physician reimbursement rules) may not be sustainable over the long term and may prove inconsistent with overall health care cost projections. Consequently, the Panel feels it is appropriate to reflect projected market-based behavioral reactions to current law. In some cases, this approach will produce results similar to those that assume equivalent-costing legislative/regulatory changes exist. Such assumptions should be appropriately discussed and disclosed. If it is determined that the costs associated with present-law benefit provisions are not sustainable, the projection assumptions and range of probable scenarios can become problematic and difficult to develop. Although the Panel does not have specific recommendations in this area, further attention to the difficulties associated with this problem may be warranted.

## **Stochastic Simulation Modeling**

**Finding IV-5: The Panel finds that the stochastic model presented in the 2000 SMI Trustees Report is a reasonable and prudent initial application of stochastic modeling.**

Significant aspects of the uncertainty associated with health care cost projections can be illustrated with stochastic simulation models. Such models incorporate the uncertainties and probability distributions that can be assigned to these elements, as well as the interrelationships of the assumptions. Significant sources of variability and uncertainty can be modeled to provide useful insight into likely futures.

In 1999 OACT developed a stochastic simulation model to illustrate the volatility of health care costs for SMI (described in Appendix C, "Supplementary Assessment of Uncertainty in SMI Cost Projections," of the 2000 SMI Trustees Report).

The SMI stochastic model produces an estimated range of future expenditure levels over the next 10 years, together with an estimated probability distribution for the range. The model assumes that past patterns of statistical variation in per-beneficiary expenditure growth rates will continue in the future. Past variation is analyzed separately by type of service (for example, physician, outpatient hospital, and home health) and by beneficiary eligibility category (aged, disabled, or end-stage renal disease), using quarterly data. The historical variances for the 40 individual service and eligibility categories are aggregated statistically to determine an overall growth-rate variance for each projected year. The mean of each year's growth-rate distribution is set equal to the estimated growth rate under the Trustees' intermediate set of assumptions. A Monte Carlo simulation, using these growth-rate distributions, produces the projected range of future SMI expenditures and the estimated probabilities for specific expenditure levels.

The stochastic SMI model also estimates annual premium and general revenue income to the trust fund by simulating actual decision rules for financing an expected level of expenditures in the following year. The model can thus be used to assess the stability of premiums and the level of trust fund assets needed to guard against unusually rapid cost

growth. This application seems particularly appropriate, since it mirrors actual trust fund financing decisions and can help inform such decisions by identifying the risk and impact of estimation errors.

**Recommendation IV-6: The Panel recommends that the stochastic model used for SMI be further enhanced and that a stochastic model be developed for HI.**

Technical issues with the current model that should continue to be investigated include the following:

- *Covariance relativities.* To enhance the model, additional covariances should be incorporated reflecting expected relationships among variables.
- *Growth-rate autocorrelation.* If autocorrelation exists, it should be estimated and reflected in future models.
- *Variance estimates.* Additional research should be performed to assess the relative size of the uncertainty in projecting short-term and long-term health care costs.
- *Further analysis of the decomposition of health care costs.* This analysis should enhance the understanding of the level and timing of uncertainty in future health care cost trends.

The Panel believes that an extension of the stochastic modeling approach should be applied to HI cost projections. To do so, several areas of investigation will be needed, such as the following:

- *Modeling additional layers of health care costs, possibly in a multi-stage projection model.* Although incorporation of more detailed utilization and cost-per-unit assumptions (as recommended in this report) will create additional complexity to the projection models, it will permit more refined and meaningful evaluations. The addition of these assumptions, however, will generate more complexity in the implementation of HI stochastic models.
- *Reflecting correlations among variables and substitution effects.* To enhance the internal consistency of the modeling, correlations among health care cost drivers and general economic and demographic variables should be reflected when these correlations can be reliably measured.
- *Implementing a longer time period.* It would be useful to run such models over a period longer than 10 years.

Expanding the current SMI stochastic modeling will provide not only a more explicit understanding of possible future variations of the development of the funds but also the following additional benefits:

- The development of stochastic modeling can lead to improvement in the basic model. Stochastic analysis can provide a sound base from which a consistent method of extracting projection assumptions (for example, per-capita growth rates)

from historical data can be derived and from which the reliability of these assumptions can be determined. Consequently, stochastic modeling can enhance the setting and assessing of the many assumptions used in the current projection model. It may be useful, for example, to provide estimates of an assumption's standard deviation along with sensitivity testing results for that assumption. Those assumptions with large standard deviations and a significant influence on projection model results can then be targeted for additional analysis. In summary, stochastic models can provide significant insight into future health care costs, particularly the identification of key variables and the nature and magnitude of their impact.

- Stochastic modeling could be used to assess the credibility of some assumptions by service type, by geographic region, or by time period. For example, service utilization rates by age and gender vary over time. If growth rates for some age/gender cells differ from average growth rates, aggregate utilization or cost trends can be modified. Modern credibility theory can help obtain the most reliable blend of global and local growth rates.
- Stochastic modeling of future costs might also lead to useful recursive projection techniques. For example, state space models employing Kalman filters have been used in this way with many other stochastic processes. Advanced forecasting techniques assume that actual results are a result of a random process caused by external factors that vary over time. An initial analysis is performed to obtain baseline estimates of the underlying costs, as well as their variances and covariances. As future experience is observed, the cost estimates are systematically revised based on the updated modeled results. For instance, the case mix for a population using observed health care services might be estimated and updated as future service utilization information is collected, and this stochastic estimate could serve as the basis for a long-term forecast of the group's future service utilization. This type of modeling enhances the resulting forecast by reflecting changes in the overall health care environment as additional historical experience becomes available.

At the same time, it is useful to consider a number of concerns that stochastic modeling generally shares with deterministic modeling (such as that used in the development of the low-cost and high-cost alternative projections, in which no explicit statistical variation is considered). Following are some of these concerns:

- Stochastic modeling may lend a false sense of reliability to the results. As with any form of modeling, the results of such models are only as good as the assumptions used. Furthermore, it can be difficult to estimate the many additional assumptions needed (such as probability distributions, variances, and covariances) to calibrate the model. An ad hoc projection based on an understanding of the process and the available data may produce more reliable results than those arising from an elaborate--but over-parameterized--stochastic model. Substantial research requiring more data and resources than are currently available for this purpose will

be needed to quantify a significant proportion of the uncertainty in cost projections that would be reflected in such models.

- The results of stochastic modeling always depend on the assumptions underlying the model and may exclude significant sources of variation not modeled. For example, the current SMI simulation assumes a fixed set of economic and demographic values; that is, only the health care cost growth rates from the intermediate set of assumptions are assumed to vary. Without expansion of the number of assumptions that are considered to be uncertain, the potential overall uncertainty in health care costs developed by stochastic models will be underestimated.
- The nature of the models, and their assumptions and results, need to be communicated clearly in the Trustees Reports. In particular, it is important to let the reader know that the ranges reported do not represent the best or worst possible scenario, but rather the potential variations due to differences in specific assumptions.

In summary, although stochastic modeling is complicated, it can result in enhanced insight into the uncertainty associated with health care cost projections.

### **Low-Cost and High-Cost Projections**

Alternative low-cost and high-cost projections have been developed to convey representative lower and higher levels of costs than the set of assumptions used in the intermediate projections. These scenarios consist of a set of demographic, economic, and health care-specific assumptions. However, the alternative projections still do not convey the full range of uncertainties involved. Basically, they represent the intermediate set of assumptions with the health care cost growth rate either lower or higher in the future than assumed under the intermediate set. Moreover, they do not represent specific health care scenario assumptions, but rather are a percentage variation relative to the intermediate annual health care cost growth trends. In addition, the alternatives do not explicitly reflect possible correlations among the various assumptions. The current approach has the advantage of being fairly easy to describe and has been consistently applied over a number of years. Nevertheless, it is quite difficult to quantify the degree of confidence that these two alternative cost estimates represent.

The Panel explored various aspects of these alternative projections, including the following:

- *The “width” of the projection range.* The high-cost and low-cost projections do not represent absolute bounds for Medicare costs. In practice, actual experience could fall outside of this range. It is important that this fact continue to be clearly communicated. The Panel believes that in the future, stochastic simulation modeling may be useful in determining alternative values for the range selected.

- *Symmetry.* One aspect of developing alternative cost projections is whether the range of health care costs should be “symmetric”—that is, whether the probability that the estimate is low is about the same as the chance that it is high.

In the process of evaluating this question, the Panel briefly explored the characterization of the intermediate projection as the mean (expected value reflecting probabilities of all possible values), the median (the chance of future costs being higher or lower with equal probability), or the mode (most likely value). The Panel concluded that, if the uncertainty in the growth rate around a long-term trend is symmetric, it does not matter which characterization applies. In addition, independent of the characterization of the intermediate projection, relatively minor deviations from symmetry would also not result in significantly different results and ranges.

The Panel notes that the symmetry of possible ranges may be affected if the uncertainty in the rate of change is not symmetric. Therefore, this issue should be revisited in the future as the sources of uncertainty are better understood.

- *Simple percentage of annual health care growth rate or more specific health care-related cost assumptions.* The current method of a simple percentage growth rate difference has the advantage of simplicity and consistency over time. Conversely, it may not represent a set of plausible ranges. Stochastic modeling may enable OACT to provide a more rigorous validation and consistent set of assumptions for the alternatives currently used. To provide more insight into possible alternative scenarios, additional variations in health care costs should be displayed (see the next section of this chapter).

**Recommendation IV-7: The Panel recommends that the difference in health care cost trends between those of the low-cost and high-cost assumptions and those of the intermediate assumptions be greater than the difference currently assumed during the short term and that it decline for the remainder of the projection period to a level always different from zero percent.**

Modeled HI and SMI cost projections build on the results from the prior year. That is, the financial results for any future year depend on what happened in previous years. Therefore, the Panel believes that the uncertainty in the annual per-beneficiary health care growth rates in the long-term projection period for each future year should decrease later in the projection period. Currently it is assumed that there is no differential in annual growth rates between the low-cost and high-cost and the corresponding intermediate-cost assumptions after 50 years. However, the Panel considers it appropriate that the range of uncertainty in the annual growth rate continue throughout the projection period, but the percentage differential should be at a reduced rate.

In the future, stochastic analysis from recommendation IV-6 should be used to validate the reasonableness of the low-cost and high-cost assumptions. In addition, the percentage of GDP for both HI and SMI that would result from the low-cost and high-cost projections should be shown in the Trustees Reports.

## **Early Warning Indicators and Sensitivity Analysis**

**Recommendation IV-8: The Panel recommends that a new set of indicators be developed that focuses on sources of uncertainty and sensitivity of health care projections for both HI and SMI with respect to underlying factors that can significantly affect future costs, including the effects of managed care, under alternative scenarios.**

The Panel believes that, in addition to the three alternative projection scenarios and four HI sensitivity analyses included in the current Trustees Reports, additional indicators of future Medicare costs and results of expanded sensitivity analyses should be developed and presented.

The analysis of relative sources of uncertainty in projections (recommendation IV-1) should provide the information needed to derive a useful set of early warning indicators that would be regularly monitored and reported on by the Trustees.

One approach to study the significance of various cost drivers of the health care environment (in addition to demographic and general economic factors) is to use sensitivity tests. Although low-cost and high-cost projections provide some insight into the uncertainty and importance of the different aspects and variables involved, these projections represent broad-brush approaches. Additional specific sensitivity analyses are needed.

The HI Trustees Report currently shows the sensitivity of the summarized income rates, cost rates, and actuarial balance to changes in certain variables. Specific sensitivities are shown for variations in the real-wage differential, the consumer price index, the real-interest rate, and overall health care cost trends. The Panel believes that further tests of sensitivity for HI should be added, including variables such as the enrollment in managed care programs, the continued substitution of ambulatory care for inpatient services, and variations in the ratio of costs in the year-of-death to average costs for all other beneficiaries.

Although not a sensitivity or actuarial balance test per se, the year of exhaustion of the HI Trust Fund is currently viewed as an important indicator of the program's degree of funding, as an early warning measure, and as a gauge of the accuracy of the Trustees' projections. This measure can be quite sensitive to the economic and demographic assumptions used. Therefore, the sensitivity of this indicator should be included with the sensitivity values shown.

Currently, no sensitivity tests are shown in the SMI Trustees Report. The Panel believes that such tests, expressed in terms of the effects on overall SMI costs and on per-beneficiary costs, should be included.

In addition, these measures can be communicated more effectively through graphs and charts than through tables of numbers. The Panel recognizes that such analysis may add substantially to the size of the current Trustees Reports. If this analysis is prepared, it

might be advisable to add this extra information only to electronically available copies downloadable from HCFA's web site.

## **HI Actuarial Balance and Measures of the Size of SMI Costs**

### **Finding IV-9: The Panel finds that the current measures of actuarial balance of the HI Trust Fund reasonably satisfy the objectives of actuarial soundness.**

The current objectives of the HI actuarial balance tests are to (a) provide an indication of the future funding levels of the program, and (b) serve as early warning indicators of the urgency with which funding-related issues must be addressed, depending on the test scores.

The actuarial balance for the HI program is determined in a manner similar to that for the OASDI program. Both compare--in a summarized fashion over various periods of time--the expected payroll tax and other revenue with the corresponding expected costs.

Paragraph 3.6.6 of the Actuarial Standard of Practice Number 32 (Social Insurance) indicates that:

An actuarial report on the financial adequacy of a program with a statutory mechanism for setting the level of financing should state whether the program financing is sufficient as determined by a test of financial adequacy that the actuary deems appropriate. Tests of financial adequacy may be based on criteria such as the following: (1) required trust fund levels under best estimate assumptions, (2) positive trust fund levels under pessimistic assumptions, or (3) a sufficiently low probability of ruin or an acceptable range of possible outcomes under a stochastic model.

In the future, an application of stochastic modeling by OACT could help confirm the adequacy of funding over different time horizons and over an acceptable range of outcomes.

Appendix A of the HI Trustees Report describes the "Modified Average-Cost Method," which measures actuarial balance in a different way for the HI Trust Fund. Although the existence of two such measures of actuarial balance could prove confusing in the future, the Panel has no recommendations with respect to this alternative measure.

### **Recommendation IV-10: The Panel recommends that a broader set of indicators be developed to assess the implications of estimated SMI cost growth.**

Since the funding level for SMI (premiums and general revenue allocations) is adjusted each year, the SMI program is judged automatically to be in actuarial balance. As a result, an actuarial balance test or measure is not needed to determine whether present-law financing provides adequate funding for SMI benefits. The primary measure used currently to help assess the sustainability of SMI is projected SMI costs as a percentage of projected GDP.

In addition to the overall percentage of GDP that is represented by SMI costs (as shown in Appendix B of the 2000 Trustees Reports), the "affordability" of projected costs and

corresponding SMI revenue requirements needs to be assessed. Such an assessment should be based on the perspective of those paying the premiums (the Medicare beneficiaries) and relative to the size of overall Federal government general revenues. The lack of such indicators may contribute to the assignment of HI-related costs to SMI simply to avoid an adverse actuarial balance or trust fund exhaustion date.

It is difficult to determine by GDP ratios alone when such costs are becoming unsustainably large. These ratios do, however, provide a useful common base from which to compare the relative costs of the HI, SMI, and OASDI programs.

One aspect of future SMI costs that should be considered is whether SMI enrollment assumptions remain reasonable. A contributing factor is the relative proportion of OASDI retirement benefits that is represented by the Part B premium. This cost to beneficiaries can be measured by the ratio of projected SMI premium rates to average retirement benefit levels. At the request of the Panel, ASPE compared the current projected SMI premium rate to the average OASDI retirement benefit, with the resultant percentage for the next 10 years increasing from 6 percent to 8 percent and presumably increasing further after the 10-year period. Since there is no minimum OASDI benefit, the use of another level of OASDI benefits (such as the 25<sup>th</sup> percentile) might provide a useful additional perspective. An example is provided in the current SMI Trustees Report in the form of a representative recipient over the next 20 years. This example should be expanded and shown in a tabular or graphical display.

Other potentially useful measures could include (a) the per-beneficiary cost of SMI benefits, and (b) SMI general revenue contributions expressed as a share of the overall U.S. budget. The current SMI Trustees Report shows a similar example, expressed as a percentage of total Federal income tax revenues. A comparison of this type should be expanded and shown in a tabular or graphical display.



## Chapter V: Research and Presentation

This chapter is divided into two parts: research needs and presentation issues.

### Research

**Recommendation V-1: The Panel recommends that more resources be devoted to serving the analytic research priorities of OACT and the Trustees. This increased resource commitment should include additional staff inside OACT and additional funds for sponsored research directed by OACT, as well as adequate dedicated research funds from outside OACT that can address Trustees Report-related issues.**

Current resource constraints frequently impede OACT from conducting or benefiting from timely research and information of various types.

Determining when and how much to invest in data collection and research activities is part of the public trust that is bestowed upon the Trustees, OACT, HCFA, HHS, and elected Federal policy makers. When a new Trustees Report with Medicare financial projections is released, the public has every right to expect that the best feasible analysis has been conducted so that the forecasts and policy inferences are as accurate as possible. While efforts have generally been made within HCFA to ensure that OACT research priorities are indeed studied, staff size limitations often prevent these priorities from being developed or, from time to time, even articulated.

The total number of employees within OACT is virtually identical today (63) to the level in 1985 (64), when many fewer different Medicare payment systems were in place. Seven actuaries have been added since 1985, but the same number--12--is assigned to producing the Trustees Reports. In addition, the overall research budget within HCFA has frequently experienced negative and erratic growth since fiscal year 1996, and in real terms is now virtually identical to the fiscal year 1996 level.

**HCFA Research Budget (in millions)**

	Enacted Appropriation	Earmarked by Congress	Net Discretionary Research Funds	Compounded Annual Growth Rate in Appropriated Research Funds since FY96
FY96 .....	\$53.1	\$13.1	\$40.0	--
FY97 .....	44.0	0.0	44.0	-17.1%
FY98 .....	51.5	4.5	47.0	-1.5
FY99 .....	50.0	0.0	50.0	-2.0
FY00 .....	61.8	9.3	53.5	+3.9

These staff and research budget limitations make it difficult to monitor current developments and to determine research priorities in a timely way. In addition, current staff size limits make the

opportunity cost of in-house research--often the quickest feasible path to a reasonable estimate for forecasting purposes--extremely high.

**Recommendation V-2: The Panel recommends that more resources be devoted to insuring that quarterly cost and utilization data are available with a shorter time lag for analysis by OACT and the Trustees.**

Private-sector insurers acquire and use cost and utilization data in a much shorter time frame than OACT is currently able to do. At present, private-sector firms must make insurance product pricing recommendations in real time. In contrast, OACT must determine the Part B beneficiary premium based on data that are lagged 12-15 months because of traditional vendor practice and data delivery and processing schedules. Furthermore, these time lags make it very difficult for OACT to inform the Trustees and other policy makers of the cost implications arising from recent trends and changes in the behavior of Medicare beneficiaries or providers. Informed response to emerging trends is therefore hindered, even as some kind of yearly legislative response to perceived payment problems appears to be increasingly common. Information regarding the decomposition of expenditure trends into “reasons”--price, utilization, case-mix or intensity, etc.--is especially relevant to this problem. More timely data would give the Trustees more confidence that recent trends are understood and appropriately considered in the forecasts of the Trustees Reports.

**Recommendation V-3: The Panel recommends greater coordination of relevant research projects and agendas across executive branch agencies, congressional support agencies, private foundations, and public and private research organizations.**

Many entities sponsor or perform research relating to the Medicare program. They include a large number of agencies in HHS (AHRQ, HRSA, CDC, ASPE, as well as HCFA); congressional support agencies (MedPAC, GAO, CRS, CBO); private foundations (for example, the Robert Wood Johnson Foundation, the Kaiser Family Foundation, the Commonwealth Fund, etc.); and public and private research organizations (for example, The Rand Corporation, The Urban Institute, Mathematica Policy Research, Inc., various university-based researchers, etc.). If the envisioned coordination effort is led by a governmental entity, it will require new resources to be successful. The effort must extend beyond the executive branch and include congressional support and private sector representatives, as well. The purpose of this coordination is to produce and manage a research agenda that is focused on the key factors, including behavioral responses, that drive cost and quality in the Medicare program.

Under ASPE’s leadership, coordination of research that is sponsored or conducted somewhere within HHS is just beginning. No document compiles, and no research management process exists to coordinate, all Medicare-related research within HHS and across the Congressional support agencies and private organizations. Yet it is clearly in the public interest--and in every research-sponsoring organization’s individual interest--to minimize duplication and maximize cooperation and complementarity in agenda setting, as well as in shared data set arrangements. A useful way to meet this recommendation would be to create an annual report describing current research activities. Ideally, such a report would be broad enough to cover research sponsored by a variety of private and public sources.

New public-private partnerships may be required to create and maintain this kind of coordination. For example, OACT may coordinate efforts with the Academy for Health Services Research and Health Policy. All Medicare-related research efforts outside OACT--whether sponsored by congressional support agencies or by private entities-- should remain, as they have been to date, complementary to efforts within OACT to better understand the dynamics of the Medicare program.

The stunning array of changes within the Medicare program since 1995 has created large gaps in our knowledge of certain issues that are highly relevant to forecasting the Medicare trust funds' prospects in the near-term and in the long term. These knowledge gaps should be the focus of the coordinated research agenda. The key research questions include, but are not limited to, the following:

- Provider reactions to newly implemented prospective payment systems (for example, skilled nursing facilities, home health, hospital outpatient);
- Causes of the decline of intensity in the inpatient hospital case-mix index in 1998-2000;
- Site of care (inpatient vs. ambulatory) changes over time and the cost implications of these shifts;
- Effect of technological change on costs of certain key conditions and procedures;
- Expenditure differentials by health status among different age-gender groups;
- Plan and beneficiary participation trends in Medicare managed care, especially in response to changes in payment or premium cost rates;
- Assumptions underlying the “managed care shift” effect in the current projection methodology;
- Sources of cost growth for physician services;
- Responses to the Sustainable Growth Rate legislation affecting physician payment rates; and
- Sustainability of continued long-term Medicare cost growth.

As an important example of the need for research coordination, consider the new payment systems enacted by the BBA. At this time, no existing research management process appears likely to guarantee that each new system will be studied in a classic pre-post design so that proper inferences about response behavior can be drawn. This absence of knowledge will further hamper the Trustees' ability to predict responses to changes in the new payment systems already passed by Congress (BBRA 1999) and likely to continue in the future. Thus, the need for comprehensive coordination of Medicare-related research efforts and priorities is clear.

## Presentation

In general, the Trustees Reports are well written, but they are designed to appeal to many different audiences. This is a daunting challenge with material that is both technical and highly charged politically. The Panel's presentation recommendation is offered in the spirit of adding clarity for the less technical reader without calling for a wholesale revamping of the reports' style.

### **Recommendation V-4: The Panel recommends that the clarity of the Trustees Reports be enhanced with a number of specific changes and additions.**

At a minimum, these changes should include the following:

- Both the HI and the SMI reports should have a section that includes HI costs per beneficiary, SMI costs per beneficiary, and total costs per beneficiary.

This section would enable the reader to easily view summary measures of the overall program's financial condition without examining two reports simultaneously. Many readers are not familiar with the specific lines of demarcation between HI- and SMI-covered services. Moreover, these distinctions can change over time (as illustrated by the BBA's shift of a substantial portion of home health care services from HI to SMI). For such readers, it is more natural to focus on cost per beneficiary than on cost per unit of service.

- The discussion of some key tables--II.F.1 in each report is a salient example--should include an explanation of how the columns relate to (and may be derived from) each other.

This table is vitally important to understanding recent trends, yet only an extremely knowledgeable reader can grasp the current presentation. Alternatively, a more complete explanation of some tables could be posted on the HCFA web site. The general point, though, is that more of the important decomposition analysis within the Trustees Reports should be made more transparent to the interested reader.

- The use of charts should be expanded.

In the current Trustees Reports, charts are used very effectively in the "Overview" sections to facilitate understanding of key aspects of the trust funds' financial operations and status. Expanded use of graphical presentations in the subsequent sections of each report would also be very helpful and informative.

# **Appendix A**

## **Summary of Current Methodology**

This appendix provides an overview of several of the components of the software model employed by the HCFA OACT staff in calculating the annual Medicare HI and SMI Trust Fund projections. A more detailed document summarizing the current methodology has been provided by the Panel to the OACT staff. Not all aspects of the current model are reviewed in the following summary. Emphasis has been placed on key population and benefit incurral components.

The following table outlines the key characteristics and differences between the HI and SMI population, service utilization, and benefit incurral models used in the trust fund projection process.

Appendix A

<b>Population Projection</b>		
Item	HI Model	SMI Model
Timeframe	Quarterly through Q4 2024	Quarterly through Q4 2011
Non-Managed Care	Aged Insured x Age Group x Sex Aged Uninsured x Age Group x Sex Aged DIF x Age Group x Sex Aged Buy-In Disabled	Aged non-ESRD Aged ESRD Disabled non-ESRD Disabled ESRD Other ESRD
Managed Care	Aged x Age Group x Sex Disabled	Aged non-ESRD Aged ESRD Disabled non-ESRD Disabled ESRD Other ESRD
ESRD	Separate model	Integrated
Method	Age/sex projection from SSA Enrollment segment distribution by sex/birth cohort Assume survivorship does not vary by enrollment status within sex/birth cohort. Managed Care: Historic managed care enrollments by year, sex/age group (aged), and disabled are inflated at specified annual growth rates by aged vs. disabled. Same growth rate for each sex/age group within aged.	Aged (including ESRD & MC): Constant percentage of projected SSA aged Disabled (including ESRD & MC): Fixed percentages of projected HI disabled population ESRD: input values Managed Care: Total MC projection from separate analysis is prorated by status using total SMI projection.

<b>Service Utilization</b>		
Item	HI Model	SMI Model
Non-Managed Care	Hospital admissions SNF days HHA visits By population breakdown	Carrier services: Physician DME Laboratory Other Carrier Intermediary services: Outpatient PPS Other Hospital Outpatient Laboratory Other Intermediary No explicit service unit projection Part of projected cost per enrollee
Managed Care	Separate model: No explicit units projection	
ESRD	Separate model	
Method	Age/sex utilization rate pattern by service and enrollment status  Historical utilization rates by service, status, and quarter  Assume independence of age/sex pattern and quarter within each status for each service to impute historical utilization rates by quarter, sex, age group, service, and status.  Project using annual growth rates by service and quarter. Note that these growth rates include a managed care shift effect that offsets the reduction in FFS-population count due to growth in the managed care population.	
Units Projection	Multiply population projection by utilization rate projection and summarize by service, enrollment status, and quarter.	

Appendix A

<b>Incurred Benefits</b>		
Item	HI Model	SMI Model
Cost-per-Unit Growth Rates (HI)	Aggregation of quarterly projected growth-rate components:	Aggregation of quarterly projected growth-rate components:
Cost-per-Capita Growth Rates (SMI)	Market basket growth	MEI or CPI growth
	Case mix growth	MPA (SGR) adjustment for Physician payments
	Short-term payment adjustments	Other price cuts
	By Hospital, SNF, and HHA	Legislative effects
		Behavioral effects
		Residual effects
Method (Managed Care)	Separate analysis: Historic costs per capita are inflated using aged/disabled growth rates derived from FFS cost per-capita growth-rate projections. Adjustments to FFS growth include MC payment constraints, GME adjustments, and impact of risk adjustment.	Similar methodology to HI MC, with same adjustments to FFS growth rates as used in HI MC analysis.

**Incurred Benefits (continued)**

Item	HI Model	SMI Model
Method (Non-MC)	<p>Historical benefits per unit by quarter, status, and service.</p> <p>Historical cost sharing amounts by quarter and service.</p> <p>Construct historical costs per unit by adding benefits per unit to cost sharing per unit.</p> <p>Project cost per unit using growth rates.</p> <p>Project cost sharing: deductible count based on unit projections and deductible amounts using unit cost growth rates.</p> <p>Subtract projected cost sharing per unit from projected cost per unit to obtain benefits per unit.</p> <p>Multiply units projection by benefits per unit projection and aggregate by year, enrollment status, and service (inpatient, SNF, HHA).</p> <p>Hospice services projected separately.</p> <p>ESRD services projected separately.</p>	<p>Project price growth rates and impact of legislated reductions as given values.</p> <p>Project MPA (for Physician services only) by SGR formula.</p> <p>Assume behavioral effect is fixed percentage offset to any net price reductions from MPA or legislation (e.g. 30% offset for Physician services).</p> <p>Historical residual growth rates are obtained as balancing items in the observed growth of per capita costs. These values are trended forward using ad hoc analyses.</p> <p>Future total per capita growth rates are obtained by aggregating projected components.</p> <p>Future costs per capita are projected by applying the projected growth rates to recently observed costs per capita.</p> <p>Projected costs are obtained by multiplying the projected per-capita cost factors by projected SMI population counts.</p> <p>Historical copayments are split between deductibles and coinsurance and trended forward.</p> <p>Projected incurred benefits are computed as projected costs less projected copayments.</p>

## Appendix B

### A Cohort-Based Managed Care Enrollment Model

The managed care penetration rate for any demographic/geographic cohort 'i' at time t+1 depends on the penetration rate for that cohort at time t, adjusted for new enrollment, disenrollment, and mortality. The appropriate transition probabilities could be computed from existing data. The appropriate formula for cohort i would be:

$$P_{t+1}^i = \frac{P_t^i (1 - Mort_{MC,t}^i) (1 - P_{dis,t}^i) + (1 - P_t^i) (1 - Mort_{FFS,t}^i) P_{enr,t}^i}{P_t^i (1 - Mort_{MC,t}^i) + (1 - P_t^i) (1 - Mort_{FFS,t}^i)}$$

Where:

$P_{t+1}^i$  = managed care penetration rate for cohort i in period t + 1

$P_t^i$  = managed care penetration rate for cohort i in period t

$Mort_{MC,t}^i$  = mortality rate for cohort i managed care enrollees in period t

$Mort_{FFS,t}^i$  = mortality rate for cohort i FFS enrollees in period t

$P_{dis,t}^i$  = disenrollment rate for cohort i in period t, excluding death

$P_{enr,t}^i$  = enrollment rate for cohort i in period t.

Enrollment and/or disenrollment rates could be adjusted to generate the desired aggregate penetration rates. However, it is also possible that this approach could be used to generate enhanced estimates of aggregate penetration. Regardless of whether aggregate enrollment rates are derived or justified via this approach, this exercise would ensure more internal consistency in the forecasts and would provide a validation of estimates of annual enrollment.

## Appendix C

### Managed Care Impact on Fee-for-Service Cost Growth: Estimating the Selection Effect

*Key assumptions:*

- No deaths (or, more importantly, no bias in mortality)
- Spending per enrollee is constant over time (that is, no regression to the mean)

*Average spending for FFS beneficiaries in year t:*

$$(1) E_t^a = (1 - B_t^s) E_t^c + B_t^s E_t^s$$

Where:

$E_t^a$  = average FFS spending per FFS beneficiary at time t

$E_t^c$  = average spending of FFS enrollees at time t who would remain in FFS at time t+1

$E_t^s$  = average spending of FFS enrollees at time t who would switch to managed care at time t+1

$B_t^s$  = share of FFS enrollees at time t who would switch into managed care at time t+1.

$$(2) K^S = E_t^s/E_t^c, \text{ measures the enrollment bias.}$$

Therefore:

$$(3) E_t^a = (1 - B_t^s) E_t^c + B_t^s E_t^c K^S$$

*Average spending for FFS beneficiaries at time t+1:*

$$(4) E_{t+1}^a = (1 - B_{t+1}^d) E_{t+1}^c + B_{t+1}^d E_{t+1}^d$$

Where:

$E_{t+1}^a$  = average FFS spending per FFS beneficiary at time t+1

$E_{t+1}^c$  = average spending of FFS enrollees at time t+1 remained in FFS from time t

$E_{t+1}^d$  = average spending of FFS enrollees at time t+1 who disenrolled from MC at time t

$B_{t+1}^d$  = share of FFS enrollees at time t+1 who disenrolled from managed care at time t.

$$(5) K^d = E_{t+1}^d/E_{t+1}^c, \text{ measures the disenrollment bias.}$$

## Appendix C

Therefore:

$$(6) E_{t+1}^a = (1 - B_t^d) E_{t+1}^c + B_t^d E_{t+1}^c K^d$$

*Growth in spending due to the selection effect:*

Dividing (6) by (3) will yield the selection effect.

The MedPAC report suggests:  $K^s = 0.77$  and  $K^d = 1.02$

Note that spending of individuals while enrolled in the managed care is irrelevant to this calculation. Payment rates to managed care plans, which will affect the trust fund expenditures, are dealt with elsewhere in the projection methodology.

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