Prospective payment system and quality: Early results and research strategy

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The implementation of the prospective payment system (PPS) in Medicare has raised concerns in both the public and private health sectors about the potential for compromised quality of care resulting from the financial incentives inherent in the system. As part of this concern, Congress has mandated annual reports from the Health Care Financing Administration (HCFA) on the impact of PPS, including the impact on Medicare beneficiaries. In order to meet this mandate, HCFA has initiated several studies concerning quality of care issues. Those activities and selected results from the 1985 PPS impact report are presented in this article.

Introduction

With the passage of Public Law 98-21 in 1983, Congress initiated the most sweeping change in payment for hospital services in the history of the Medicare program. The major rationale for this system is to reverse the financial incentives inherent in the original cost reimbursement system. Under cost reimbursement there is little, if any, incentive to control costs. Under a system of prospectively set rates, there is every incentive to economize and institute efficiencies.

At the time of the passage of this act, Congress was aware of the potential for economizing at the expense of the patient. Consequently, section 603(a)(2)(A) of that legislation requires the Secretary of the U.S. Department of Health and Human Services to:

> ". . . study and report annually to the Congress at the end of each year (beginning with 1984 and ending with 1987) on the impact of the payment methodology under Section 1886(d) of the Social Security Act during the previous year, on classes of hospitals, beneficiaries, and other payers for inpatient hospital services, and other providers . . . ."[1]

The impact of the prospective payment system (PPS) has, subsequently, been interpreted to encompass the issue of quality of care. Various organizations such as the Office of Technology Assessment (OTA) (1985); the Prospective Payment Assessment Commission (1986); the General Accounting Office (1986); the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services (1986); and Lohr (1985) have pointed out the need for indepth evaluations of the impact of PPS on the quality of health care.

Despite a near unanimous opinion that there is a need for research on the quality of care under PPS, there is little guidance on how to measure PPS impacts or what specific problems to look for. OTA states, "How hospitals and other providers actually will respond to the financial incentives inherent in PPS is by no means well understood . . . . Thus, the magnitude and direction of PPS effects on health care costs and benefits cannot be predicted with confidence . . . ." (Office of Technology Assessment, 1985). For instance, it is entirely possible that a single response could have both negative and positive effects on Medicare beneficiaries. Specialization of services is an example. Should hospitals respond to PPS by increased specialization, it is generally believed that quality of care would improve as the volume of services increases in fewer hospitals. However, this specialization could also result in a centralization of needed services in hospitals farther removed from many beneficiaries, in which case, access to care could be compromised.

The Office of Research and Demonstrations (ORD), Health Care Financing Administration (HCFA), has adopted an evolving approach to assessing PPS impacts. Initially, the plan centered on issues of access to hospital care and quality of care within the hospital setting. However, more recent events have led to the addition of other areas of interest. In particular, the large reductions in length of stay occurring with the introduction of PPS have raised the "sicker and quicker" issue. That is, concerns have been raised that shorter lengths of stay (quicker) will lead to patients being discharged in a less stable medical condition (sicker). Thus, efforts have been included to assess access to post hospital subacute health care services. Additionally, the unanticipated drop in admission rates has raised the possibility of changes in case severity that could impact on outcome measures such as mortality and rehospitalization rates. Thus, there is a need for work in the area of severity adjustment research, as it relates to quality of care issues.

Finally, the Omnibus Reconciliation Act of 1986 (section 9313(d)) has mandated that the Secretary of the U.S. Department of Health and Human Services, ". . . shall arrange for a study to design a strategy for reviewing and assuring the quality of care for which payment may be made under title XVIII of the Social Security Act." ORD's response to this mandate is currently in the development phase.

[1] More recently, the Omnibus Reconciliation Act of 1986, Public Law 99-509, has extended the annual reports through 1989.

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Current work in progress

The Office of Research and Demonstrations (ORD) has 13 extramural efforts in the area of PPS quality impact and a significant intramural effort as well. Essentially these efforts are directed at three major issue areas within the quality of care domain: access to inpatient care, the quality of inpatient care, and access to post-discharge services, that is, the "aftercare" issue.

Access to inpatient care

The concern in this area is that one of the incentives of PPS is to encourage providers to selectively market to patients who are relatively easy and inexpensive to treat and avoid those patients who are difficult and more expensive to treat. That is, hospitals could avoid some of the high costs of expensive patients either by not admitting them in the first place or by discharging them earlier than other patients. This could show up either in admission rates or average lengths of stay.

ORD is approaching this problem through an intramural analysis of utilization rates such as discharges per 1,000 Medicare beneficiaries and average lengths of stay. Because there are no acceptable standards of what constitutes appropriate use rates, the analysis is directed toward changes in utilization rates that are disproportionately large. For instance, there have been large decreases in average length of stay. To the extent that these decreases are consistent across types of patients—aged, disabled, and those with end stage renal disease (ESRD), and demographic breakdowns of age, sex, and race—there is no evidence that specific groups have been denied access to inpatient care. In other words, the impact of PPS on access to care—whether good, bad, or indifferent—would be at least consistent across beneficiary groups. Early results from this analysis are presented later in this article.

There is one extramural effort in this area that is being conducted by the Urban Institute, Learning From and Improving DRG's for End Stage Renal Disease (ESRD) Patients. In that study, the utilization patterns for ESRD patients prior to and after the implementation of PPS to determine the potential adverse consequences of PPS are examined. Because ESRD patients are a potentially high-risk and high-cost group, it was felt to be important to examine them in some detail.

Quality of inpatient care

Originally, this was the area in which it was thought that quality of care problems might occur. That is, with the fixed PPS payment, the concern is that hospitals might cut back on needed services as well as unnecessary care, to the detriment of the patient. This could occur as reductions in ancillary services, reductions in staff levels, or as premature discharges.

There are a number of studies in this area to determine if such changes have taken place. First, there are intramural studies in which hospital related mortality, overall population mortality, and rehospitalization rates are examined. The mortality analyses use both Medicare and National Center for Health Statistics time trend data to determine if death rates are changing for the Medicare population. Rates of rehospitalization (usually within 30 days) are being examined to determine whether there has been an increase since PPS went into effect. Such an increase could indicate that patients are being discharged too early and require additional hospital care as a result.

There are limitations to using the Medicare data bases for these kinds of analyses. First, the amount of clinical detail available from the administrative claims data is somewhat limited. Each inpatient stay can have up to five diagnoses and up to three procedures. Additional clinical data that could indicate important risk factors (such as blood pressure, serum creatinine levels, and hematocrit) are not available from the billing system. Second, the change in coding and data collection that occurred with the advent of PPS makes it difficult to do time trend analyses. Therefore, the intramural analyses have been supplemented with a number of extramural efforts.

ORD has cooperative agreements with the Commission on Professional and Hospital Activities (CPHA) to do two studies on quality of care. In the first study, Impact of the Prospective Payment System on the Quality of Inpatient Care, CPHA uses their Professional Activities Study (PAS) data set to examine trends in inpatient care prior to and after PPS implementation. It has two major advantages over what ORD can do intramurally. First, the PAS data system is considered to be more consistent over time. The data elements collected did not change at the time PPS was implemented. Of course, the more general problem of diagnosis-related group (DRG) creep (Carter and Ginsburg, 1985) could affect this study as well as studies based on Medicare data. (DRG creep is a term used to describe changes in the distribution of DRG's that are a result of changes in coding practices.) Second, CPHA data include information on the non-Medicare patient population. Thus, this study will compare Medicare trends with trends for persons not directly affected by changes in reimbursements because of PPS. In the second study, Develop Indexes of Hospital Efficiency and Quality, CPHA is using a multivariate classification approach (data envelopment analysis) to assess the changes that have occurred in the process of care (to measure efficiency) and to relate these to changes that have occurred in patient outcomes (to measure quality). Data envelopment analysis is a mathematical procedure for making comparisons between units (in this case, hospitals) delivering similar services with similar resources. It constructs a set of weighted values for inputs (staff, capital, etc.) and outputs (days of care, procedures, etc.) that maximize differences among hospitals. Efficiency, as measured by a ratio of outputs to inputs is then compared with

patient quality (measured as inpatient mortality). This procedure has been used in the health care field by Sherman (1984) and Nunamaker (1983). This study also uses the PAS data set.

ORD also has cooperative agreements with The Rand Corporation to do two studies related to quality of care assessment. The first, Impact of the DRG-Based Prospective Payment System on Quality of Care for Hospitalized Medicare Patients, is a large-scale effort to examine changes that have occurred in the process of care provided to patients in the inpatient setting that might be attributable to PPS. Rand has selected conditions for which the acceptable standards of care are well known and have remained more or less constant in the past few years. These include myocardial infarction, congestive heart failure, hip fracture, depression, pneumonia, and cerebrovascular accident. Criteria sets of appropriate care have been developed for these six conditions through consensus panels of physicians. A total of 17,000 inpatient medical records in these six categories are being sampled for data abstraction and analysis, one-half in the pre-PPS period (1981-1982) and one-half in the post-PPS period (1985-1986). The study is being carried out in five States: California, Florida, Indiana, Pennsylvania, and Texas. The results of this study, although not strictly generalizable to hospital care nationwide, will be a major indepth assessment of how the care provided to patients may have changed since PPS was introduced.

The second Rand study is the Non-Intrusive Outcome Measures: Identification and Validation. The intent of this study is to determine the extent to which the administrative data base maintained by HCFA can be used as a monitoring tool for quality of care. Both ORD and the Health Standards and Quality Bureau already use the administrative system for this purpose. However, this study will relate outcomes as measured by administrative data with more clinically oriented data from discharge record abstractions. Rand is using myocardial infarction and congestive heart failure as tracer conditions, and the study is being carried out in the States of California, Illinois, Minnesota, and New York.

One issue that has recently become more evident is the extent to which changes in admission rates may indicate changes in patient mix. In 1984, there was a reduction in Medicare admissions for the first time since the Medicare program began. In 1985, there was an even larger reduction. It is likely that these reductions came at the expense of the easier, less problematic cases. For example, it is well known that certain surgical procedures, such as lens extractions, are being shifted to outpatient settings. Because these procedures have very low mortality rates, this shift will tend to increase the overall mortality rate. This increase may have nothing to do with quality changes but may merely be the result of a more severe case mix. It is unlikely that DRG mix changes will be adequate to measure the more subtle indicators of case mix. Therefore, ORD has contracted with SysteMetrics, Inc., to assess case-mix changes in a study entitled A Mortality Based Case-Mix Severity Index. The purpose of this study is to determine any shifts in case mix that have occurred within diagnostic categories that would affect mortality rates. SysteMetrics is using their staging methodology to conduct this analysis.

In Summer 1987, ORD awarded two additional studies directed toward refining the analysis of case-mix effects on quality of care evaluation. The first is Patient Classification Systems: An Evaluation of the State of the Art being conducted at Queens University. This study will compare 15 patient classification systems in terms of their usefulness both for refining the DRG payment system and for the monitoring of and research on the quality of care. These systems will be compared in terms of reliability, predictive validity, and cost, using a data base constructed from 30,000 abstracted medical charts. The second study is An Automated, Data-Driven, Case-Mix Adjustment System for Studies of Quality of Care being conducted at the University of California at San Francisco. The main objectives of this project are to develop and validate predictors of medical outcomes based on patient status at admission. Patient status will be assessed based on early lab tests, diagnostic codes, and demographic data.

Access to post-discharge services

This is the area in which many of the more recent efforts have been channeled. The concern in this area is that because patients are being discharged earlier than before, they still have rehabilitative and subacute care medical needs for which services may not be available. A number of extramural efforts have been initiated to examine this issue.

Among these is the health status at discharge research project being conducted by the Northwest Oregon Health Systems Agency. The purpose of this study is to develop an instrument for measuring dependency at discharge and then to determine the extent to which dependency has changed since PPS was introduced. The results so far indicate that there has been an increase in discharge dependency since PPS was begun. It does not indicate, however, whether this increased dependency indicates an increased need for subacute care or the extent to which subacute care needs are being met. To address these concerns the Office of Research and Demonstrations has three other extramural efforts.

The first is the study, Changes in Post-Hospital Service Use by Medicare Beneficiaries, being conducted under contract by Abt Associates. The purpose of this study is to examine Medicare post-hospital use patterns pre- and post-PPS implementation to determine whether any changes have occurred. The analysis will examine skilled nursing facility (SNF), home health agency (HHA), and physician use patterns. This analysis will be a longitudinal assessment of these patterns from 1981 through 1986. It is, however, confined only to

Medicare covered services. An inherent shortcoming is that much of aftercare needs are long-term care needs that Medicare does not cover. Most long-term services are paid for out of pocket or by Medicaid.

The second study, The Impact of Medicare Prospective Payment on Post Hospital Care Among Medicaid Recipients, conducted by SysteMetrics, Inc., is an attempt to fill in this gap. Using State Medicaid data, the intent of this study is to determine the extent to which use of Medicaid covered services (post discharge) have changed as a result of PPS. The analysis will be limited to persons with entitlement to both Medicare and Medicaid in Michigan and California. Although not strictly generalizable to the Nation as a whole, it will provide some important information on the impact of PPS on Medicaid covered services.

These two studies have several major limitations. First, neither study will have measures of the need for aftercare services. That is, even if the rates of aftercare use remain constant over time, there could be a problem if the need has increased (as suggested by the health status at discharge research project). Second, neither study will provide any information on the provision of informal care services. That is, to what extent are informal caregivers (wives, husbands, children, and neighbors) providing care to patients after discharge from the hospital? Nor will either study be able to identify the types of patients who encounter aftercare problems or the causes of these problems (e.g., financial, travel, access).

These issues are being addressed in the pilot study Development of a Study Plan for the Appropriateness of Post-Hospital Care Received by Medicare Beneficiaries Under the Prospective Payment System. This study, being conducted by System Sciences, Inc., and Mathematica Policy Research, Inc. (and jointly sponsored by the Assistant Secretary for Planning and Evaluation and HCFA), is an attempt to design a study to address patient aftercare needs at discharge and the subsequent use of services, including Medicare, Medicaid, and informally provided care. This pilot project is intended to develop the methods necessary to conduct a national study of these issues. Key tasks under this project include the following:

- Developing a classification scheme of patients based on the need for skilled and unskilled aftercare services.
- Constructing professionally developed guidelines of minimally acceptable aftercare service needs.
- Developing a plan to sample patients at varying risks of receiving inadequate aftercare.
- Developing an overall study plan that uses the above methodologies in a national study of aftercare use.

This study relies heavily on primary data collection including telephone interviews and patient health assessments. Because it requires primary data collection, a pre- and post-PPS study is not feasible.That is, it is not possible to interview patients and determine their aftercare needs and use patterns for a hospital stay that occurred 4 years ago. Consequently, the goal of this study is to determine current aftercare needs and access to needed services, not whether these needs and access have changed over time with respect to PPS.

In Summer 1987, ORD awarded a cooperative agreement to Duke University to do a study of the use of post hospital subacute care services; the study is entitled Trends in Patterns of Post-Hospital Service Use and Their Impacts on Outcomes. Grade of membership analysis will be used to categorize patients according to mortality risk levels and need for skilled nursing and home health care. This analysis will then be integrated into basic life table analyses to determine the changes that have occurred over time (pre- and post-PPS implementation) in mortality, in site of death, and in the use of post hospital services.

Findings

Findings on utilization of inpatient services and mortality analyses from the Impact of the Medicare Hospital Prospective Payment System 1985, Report to Congress (Health Care Financing Administration, 1987) are presented in this section.

Utilization of inpatient services

Medicare discharge rates and average length of stay for the years 1980 through 1984 are shown in Table 1. From 1980 through 1983, the discharge rate in the United States increased from 371 per 1,000 beneficiaries to 394 per 1,000, an average annual rate of increase of 2.1 percent. This was a continuation of the trend since 1968. The rate of increase was somewhat lower in PPS States (2.0 percent) than in the four waiver States (2.5 percent).[2] In 1984, the discharge rate declined for the first time since the beginning of Medicare. The decline was 2.9 percent. However, the change was markedly different between PPS and waiver States. The discharge rate declined by 3.5 percent in PPS States and increased in waiver States. The increase in the waiver States was, however, much less than the pre-PPS trend had been. It would appear that the slower rate of growth in the discharge rate in waiver States represents a spillover effect of PPS and that providers in these States were reacting to the PPS changes in ways similar to providers in PPS States.

This decline in the PPS States was contrary to expectations, and it has raised considerable speculation as to the causes. Some analysts have suggested that it is a temporary phenomenon and that, once hospitals and physicians adjust to the PPS system, there will be a return to increasing rates.

[2]Hospitals in Maryland, Massachusetts, New Jersey, and New York were waived from inclusion at the inception of the PPS, because they were participating in demonstrations of other payment systems. Currently, Maryland and New Jersey retain waiver status, and New York and Massachusetts have been incorporated into the PPS.

Table 1

Discharge rates per 1,000 aged Medicare beneficiaries, average length of stay, and annual percent change by area: 1980-84

Area	CY 1980	CY 1981	CY 1982	CY 1983	FY 1984	Annual percent change 1980-83	Annual percent change 1983-84
			Discharge rate per 1,000				
United States	371	371	388	394	386	2.1	-2.9
PPS States	380	382	398	403	393	2.0	-3.5
Waiver States	322	316	338	346	349	2.5	1.0
			Average length of stay				
United States	10.3	10.1	9.9	9.6	8.7	-2.3	-11.5
PPS States	9.9	9.7	9.5	9.2	8.3	-2.3	-13.2
Waiver States	12.9	12.5	12.3	12.1	11.5	-2.1	-5.7

NOTES: PPS is prospective payment system; CY is calendar year; FY is fiscal year.
SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Office of Statistics and Data Management.

Table 2

Discharge rates per 1,000 aged Medicare beneficiaries in PPS States, and annual percent change, by sex, race, and age: 1980-84

Sex, race, and age	CY 1980	CY 1981	CY 1982	CY 1983	FY 1984	Annual percent change 1980-83	Annual percent change 1983-84
			Discharge rate per 1,000				
All persons	380	382	398	403	393	2.0	-3.5
Sex							
Male	409	409	421	428	415	1.5	-3.9
Female	361	363	382	387	377	2.4	-3.2
Race							
White	387	388	403	409	398	1.9	-3.6
Other	437	440	471	483	475	3.4	-2.3
Age							
65-69 years	294	295	300	302	289	0.8	-5.7
70-74 years	353	354	368	374	362	1.9	-4.0
75-79 years	424	426	445	453	442	2.2	-3.2
80-84 years	487	493	518	526	514	2.6	-2.9
85 years or over	532	531	561	569	564	2.3	-1.2

NOTES: PPS is prospective payment system; CY is calendar year; FY is fiscal year.
SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Office of Statistics and Data Management.

Others have argued that the decreased hospitalizations represent a change in the basic practice of medicine (in part a result of the PPS). Primarily, this line of reasoning contends that closer attention is now being paid to possible alternatives to inpatient care and that there will be a continuing trend toward less costly alternatives such as ambulatory surgery. A related explanation is that the peer review organizations are taking a more effective role in admission review and that hospitals and physicians are adopting more stringent criteria for admission.

It was in the area of length of stay that PPS had its greatest apparent effect. Unlike discharge rates, average length of stay had been declining every year prior to the start of PPS. From 1980 through 1983, it declined from 10.3 days per stay to 9.6 days per stay, an average annual decline of 2.3 percent. In 1984, the decline was 0.9 day, or 11.5 percent. Waiver States (actually, the entire Northeast section of the country) have historically had longer lengths of stay than the rest of the country. In 1980, there was a 3.0-day differential (9.9 days in PPS States and 12.9 days in the waiver States). During the 1980 to 1983 time span, lengths of stay declined somewhat more rapidly in the PPS States (2.3 percent) than in the waiver States (2.1 percent). However, in 1984, there was a 13.2 percent decline in the PPS States, and a 5.7 percent decline in the waiver States. Although not as large as the PPS State decline, the 5.7-percent decline in the waiver States is still almost three times as great as the historical trend, suggesting that there was again some spillover effect from PPS. As a result, the mean length-of-stay difference (3.2 days) between waiver States and the rest of the country was greater in 1984 then it had been in 1980.

A major concern is whether or not any changes in utilization rates fell disproportionately on high-risk groups or on groups with potential access problems. Discharge rates and average lengths of stay by age, sex, and race in PPS States are shown in Tables 2 and 3. The data in Table 2 indicate that changes in discharge rates were not borne disproportionately by the highest risk groups. To the contrary, in 1984, persons in the oldest age group (85 years of age or

Table 3

Average length of stay for aged Medicare beneficiaries, in PPS States, and annual percent change, by sex, race, and age: 1980-84

Sex, race, and age	CY 1980	CY 1981	CY 1982	CY 1983	FY 1984	Annual percent change 1980-83	Annual percent change 1983-84
	Average length of stay						
All persons	9.9	9.7	9.5	9.2	8.3	-2.3	-13.2
Sex							
Male	9.5	9.4	9.3	9.0	8.1	-2.0	-12.6
Female	10.1	9.9	9.7	9.3	8.4	-2.6	-13.7
Race							
White	9.7	9.6	9.4	9.1	8.2	-2.4	-13.1
Other	10.9	10.8	10.6	10.2	9.1	-2.2	-14.2
Age							
65-69 years	9.1	8.9	8.8	8.5	7.7	-2.2	-12.4
70-74 years	9.5	9.4	9.2	8.9	8.0	-2.3	-12.8
75-79 years	10.0	9.9	9.7	9.3	8.4	-2.4	-13.4
80-84 years	10.5	10.3	10.1	9.7	8.6	-2.6	-14.3
85 years or over	10.9	10.7	10.5	10.0	8.9	-2.7	-14.3

NOTES: PPS is prospective payment system; CY is calendar yeara; FY is fiscal year.
SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Office of Statistics and Data Management.

over) had a lower rate of decline (1.2 percent) than those in the younger age groups (5.7 percent for persons aged 65-69). Further, the declines were greater for males (3.9 percent) than for females (3.2 percent) and for white persons (3.6 percent) than for persons who are not white (2.3 percent).

The trend in average length of stay for Medicare beneficiaries for the years 1980 through 1984 by age, sex, and race is shown in Table 3. Lengths of stay are directly related to the age of the patient. However, the trend has been to narrow the age difference. In 1980, persons 85 years of age or over had a length of stay 1.8 days longer than persons 65-69 years of age (10.9 days and 9.1 days, respectively). By 1983, this difference had decreased to 1.5 days (10.0 days and 8.5 days, respectively). All age groups experienced large declines in average length of stay in 1984, with the largest decline experienced by persons 80 years of age or over (14.3 percent). By 1984, there was only a 1.2-day differential in length of stay between the oldest and the youngest aged Medicare beneficiaries.

The changes in discharge rate and average length of sta'y by age, sex, and race largely offset each other in terms of total days of care.[3] That is, males had a larger decline in the discharge rate, but females had a larger decline in length of stay. The result is that there is virtually no difference between males and females in the decline in the days of care rate. The same is true for race. Minority persons had a slightly smaller decrease in discharge rates, but white persons had a smaller decline in average length of stay. By age group, persons 65-69 years of age had a slightly greater decline in days of care than persons 85 years of age or over did.

In summary, the trends in use of inpatient services indicate that there has been little change in the relative utilization levels (or access) across age, sex, or race categories. To the extent that the reductions in discharges and length of stay represent decreased access, the decreases have been relatively evenly distributed across demographic categories. Similarly, to the extent that these reductions represent decreases in overuse, the decreases have been equitable (in a purely statistical sense).

Mortality

Interpreting death rates is not the straightforward task it might appear to be. First of all, death is the most extreme outcome that one can relate to the provision of health care. To the extent that changes in mortality rates can be attributed to changes in the practice of medicine, then, indeed, there are quality of care problems. However, poor quality of care could result in increased disability, discomfort, or hardship without having a measurable effect on mortality. Thus, the absence of a measurable change in mortality does not necessarily mean that there has been no change in the quality of care. In a sense, testing for changes in mortality represent a worst case scenario. If one finds increases in mortality that appear to be related to the introduction of PPS, then there is likely to be a severe quality of care problem. No change in mortality does not necessarily mean that quality has not changed, however.

A second problem with using mortality rates to test for changes in the quality of care because of PPS is the issue of attribution. There are many other factors that will have an impact on mortality independent of the effectiveness of medical care. These include changes in general standards of living, personal health practices, as well as periodic events such as influenza epidemics. During the 20th century, mortality rates have generally declined. This has been not only because of improvements in health care but because of improvements in standards of living and advances

[3]Total days of care is the product of the discharge rate and the average length of stay. As such, it is an indicator of total hospital use.

in public health measures (water purification, better sanitation, vaccines, etc.). Currently, PPS seems to be the major payment reform occurring in the U.S. health care system. However, there are other societal changes over which the health care system has little or no control. One example is the acquired immune deficiency syndrome (AIDS) epidemic. New cases of AIDS have doubled each of the last few years. Given this rate of increase and the fact that AIDS is considered fatal, it will not be many years before overall mortality rates will be affected by AIDS deaths (although probably not for the aged). A second example is lung cancer among women. The first year in which deaths resulting from lung cancer exceeded deaths resulting from breast cancer among women was 1985. This was in large part because of the increase in smoking among women that began back in the 1950's. Even if the rate of smoking among women were to decrease immediately, the lagged effects of a 30-year increase in smoking will push up lung cancer deaths among women for the next few decades. The health care system (including the payment methods) will have little effect on this type of mortality.

Three measures of mortality follow. The first is population mortality. This is usually expressed as deaths per 100,000 population. It is a measure of total deaths, irrespective of place of death or hospitalization experience. An advantage of this measure is that it is based on the total population at risk and is not directly affected by variations in utilization rates or practice patterns, both of which can affect hospital mortality, irrespective of levels of quality. It also has the advantage of picking up any effect PPS might have on mortality for those persons not admitted to hospitals. On the other hand, it has the disadvantage of including mortality unrelated to the provision of health care.

The second measure is post-admission mortality. This is usually expressed as post-admission deaths per 1,000 hospitalizations. For the purposes of this analysis, a 6-week post-admission period was used to capture mortality rates. This measure is used in preference to the more commonly used discharge mortality rate because of a bias in discharge mortality rate caused by variations in lengths of stay. To some extent, differences in discharge mortality rates are caused by practice patterns that result in patients dying in hospitals in some areas and patients dying in long-term care institutions or at home in other areas. Thus, variations in discharge mortality are in part the result of where people die as well as the fact of death itself. Mortality at a fixed interval from date of admission avoids biases caused by regional patterns of length of stay and possible constraints on the placement of patients to alternative settings because of variations in the supply of skilled nursing facilities, intermediate care facilities, or home health care.[4]

[4]Using a fixed interval from admission is a special case of the more general actuarial life table methodology. Picking a fixed point to measure mortality is a somewhat arbitrary decision. Life table analyses are preferable in that they enable one to examine the entire distribution of time until death.

Post-admission mortality, nonetheless, is not a measure that can be interpreted in a fully straightforward manner. It can be influenced by the volume of services. As shown in Tables 1 and 2, the number of admissions per 1,000 population declined with the advent of PPS. If the reductions come at the expense of relatively nonsevere cases (e.g., the shift of lens extractions and other procedures to the outpatient setting), then the overall case severity of the remaining hospitalizations will increase and with it, mortality. To counteract this potential bias of post-admission mortality, another measure of mortality is used that is a hybrid of the population base and the post-admission death rates. It is the number of post-admission deaths per 1,000 population. The numerator is the same as in the post-admission mortality measure (that is, the number of deaths occurring within a fixed length of time from admission), but the denominator is the total population, not just the hospitalized population. The advantage of this measure is that it helps control for changes in case mix. As will be shown, this measure shows a different pattern than does the post-admission rate based on hospitalized patients only.

Data from the National Center for Health Statistics were used to track population mortality among the aged for the years 1968 through 1983. The yearly rates were age adjusted to the age distribution of Medicare beneficiaries in 1980. The expected 1984 mortality rate for the U.S. aged population was calculated using a linear time trend model. The dependent variable (the year-by-year mortality) was expressed as a log function, so that the trend would appear as a rate of change. The independent variable, time, was divided into two separate time trends (Draper and Smith, 1966). The two trends intersect in 1976. Essentially this model allows one to use all 15 years of mortality data and at the same time provide estimates of two rates of change, one prior to 1976 and one since 1976. This allows full use of the data and allows for an apparent leveling of the downward trend in mortality.

The results of this analysis are shown in Table 4. The regression model fits the data very well, with an R-squared value of .96. The estimated rate of change coefficient for the 1968-to-1976 time period was -2.3 percent; and for the 1976-to-1983 time period, the coefficient was -1.2 percent. Thus, it is estimated that since 1976 mortality rates have been improving less rapidly than previously. Also shown in Table 4 are the actual mortality rates for each of the years 1968 through 1984, as well as the predicted rates from the model and an estimated confidence interval of plus and minus two standard deviations from the predicted rate. If an actual value lies outside the confidence intervals, then one would be 95-percent certain that that value was off the trend line.

In 1984, the predicted mortality rate for aged persons was 5,017 deaths per 100,000. The actual rate was 5,100, or 1.7 percent higher than predicted by the model. However, as shown by the confidence intervals, the 5,100 was clearly within the bounds of

Table 4

Estimated and actual mortality rates per 100,000 aged population: United States, 1968-84

Year	Actual mortality rate per 100,000	Low estimate (−2 standard deviations)	Predicted mortality rate per 100,000	High estimate (+2 standard deviations)
1968	6,637	6,385	6,625	6,873
1969	6,449	6,239	6,473	6,715
1970	6,152	6,095	6,324	6,561
1971	6,141	5,955	6,179	6,411
1972	6,171	5,819	6,037	6,263
1973	6,101	5,685	5,898	6,120
1974	5,857	5,555	5,763	5,979
1975	5,550	5,427	5,631	5,842
1976	5,527	5,303	5,502	5,708
1977	5,357	5,242	5,439	5,643
1978	5,336	5,182	5,376	5,578
1979	5,170	5,123	5,315	5,514
1980	5,367	5,064	5,254	5,451
1981	5,186	5,006	5,194	5,389
1982	5,101	4,949	5,134	5,327
1983	5,130	4,892	5,076	5,266
1984	5,100	4,836	5,017	5,206

NOTE: Data are age adjusted to the 1980 age distribution of aged Medicare beneficiaries.

SOURCE: National Center for Health Statistics: Annual summary of births, marriages, divorces, and deaths: United States, 1984. *Monthly Vital Statistics Report.* Vol. 33, No. 13. DHHS Pub. No. (PHS) 85-1120. Public Health Service. Hyattsville, Md., Sept. 26, 1985.

Table 5

Number of deaths per 1,000 hospitalizations (first admissions only) occurring within 6 weeks of an admission, and annual percent change by area: 1980-84

Area	CY 1980	CY 1981	CY 1982	CY 1983	FY 1984	Annual percent change 1980-83	Annual percent change 1983-84
	Deaths per 1,000 hospitalizations						
PPS States	80.0	74.9	72.4	74.0	76.1	−2.5	3.7
Waiver States	89.3	85.1	82.3	81.9	81.7	−2.8	−0.3
	Deaths per 1,000 beneficiaries						
PPS States	29.2	28.5	29.7	30.3	29.3	1.2	−4.1
Waiver States	27.5	27.0	29.1	29.2	29.1	2.1	−0.7

NOTES: CY is calendar year; FY is fiscal year; PPS is prospective payment system.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the Office of Statistics and Data Management.

year-to-year variations experienced in previous years. The upper end of the 95-percent confidence interval in 1984 was 5,206. Thus, the actual mortality rate was not statistically different from the previous trend of declining mortality.

The difficulty in projecting expected mortality rates can be further illustrated by a closer examination of the trends in Table 4. Looking over an even shorter time frame (1979 through 1983), it appears that mortality rates may have almost stopped declining. From 1979 through 1983, there was only a .2-percent average decline in mortality. The model was rerun using 1979 as the year in which a change took place in the long-term trend in mortality (not shown). The model fit very well (R^2 was .96), and the predicted mortality in 1984 was 5,114, somewhat higher than what actually occurred.

The major point to be made from these various examinations of the data is that the mortality rate in 1984 was well within historical trends for mortality among the aged. Tracking mortality in future years against a projected rate will become more and more suspect, however. As the projected figures get farther and farther away from 1983, the validity of the projection declines. For instance, how would one interpret the mortality rates if they continue to exhibit the rate of change shown between 1979 and 1983? Was the 1979-to-1983 trend a real leveling off of the historical trend, or was it a short-term aberration in the longer trend that goes back at least to 1968? There is no simple answer to this question. In essence, the assessment of the PPS impact on population mortality rates will have to be taken within the context of other measures of quality such as post-admission mortality and rehospitalization rates.

Post-admission mortality rates for aged Medicare beneficiaries are shown in Table 5. In PPS States, a decline in post-admission deaths per 1,000 hospitalizations in 1981 and 1982 was followed by increases in 1983 and 1984. Overall, there was an average annual decrease in this measure between 1980 and 1983 of 2.5 percent. The increase in 1984 was 3.7 percent. In waiver States the pre-PPS decline was 2.8 percent per year, with a very small decrease of .03 percent in 1984. The second part of Table 5 (post-admission deaths per 1,000 beneficiaries) shows the impact of the decline in admission rates in 1984. In 1984, mortality declined by 4.1 percent in the PPS

States to 29.3 per 1,000 beneficiaries and declined by 0.7 percent in the waiver States to 29.1 per 1,000. The banks of data in Table 5, taken together, support the hypothesis that declining admission rates are associated with increasing case severity. Although the mortality rate increased in 1984 (per 1,000 hospitalizations), the number of deaths within 6 weeks of a hospitalization actually decreased.

Summary

The assessment of quality of health care in the United States has received increased attention in recent years, primarily because of the implementation of PPS. The research agenda on quality of care, developed within ORD, has evolved since the implementation of PPS to deal with additional quality issues as they have arisen. Currently, there are a variety of intramural and extramural efforts dealing with issues of access to inpatient care, the quality of inpatient care, and access to post-hospital care.

Early results from utilization and mortality statistics do not suggest that the implementation of PPS is associated with problems of access to inpatient care or with increases in mortality. Future research will refine these initial analyses as well as provide information on the trends in access to post-hospital care services, further refinements on changes in inpatient severity levels, and more detailed analyses of any changes in the actual processes of care in the inpatient setting.

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