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Medicare's Prospective Payment System for Hospitals:  
New Evidence on Transitions among Health Care Settings

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Medicare's Prospective Payment System for Hospitals:  
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Abstract (125 words)

Previous studies of Medicare's prospective payment system for hospitals (PPS), introduced in 1983, evaluated only its first few years, using data collected during the hospital stay to control for patients' health. We examine transitions among health care settings over a full decade following implementation of PPS, using survival models and a national longitudinal survey with independent information on health. We find that the rate of discharge from hospitals to nursing homes continued to rise as PPS matured, hospital readmissions from the community dropped after the early years, and risk of nursing home admission from the community soon after hospital discharge tripled. Evaluations of new payment systems for one type of provider need to be comprehensive in order to capture the full effects on other providers.

Keywords: Medicare; prospective payment

JEL code: I18

Introduction

In October 1983, the Medicare program of health insurance for the elderly and disabled introduced its prospective payment system (PPS) for hospitals. Until 1983 Medicare had reimbursed hospitals on the basis of costs. PPS instead pays a fixed rate based on the patient's diagnosis at admission. The new payment system led to shorter stays for Medicare patients as hospitals tried to keep costs below the fixed rates. Hospitals discharged more patients to nursing homes and discharged them earlier. The location of death shifted, with more deaths occurring in

nursing homes (Russell 1989b).

Our knowledge of these effects comes from studies that analyzed data for only the first few years of PPS. In addition, these studies relied on measures of health that were changed by the payment system itself, which may have biased their estimates of its effects. Under cost reimbursement coding did not affect payment. In contrast, under PPS hospitals benefit by coding the most serious diagnoses possible, because more serious diagnoses qualify for higher payment rates. Thus measures of health based on data collected during a hospital stay do not provide comparable information about the health of patients before and under PPS, and are not reliable controls for health in a study that seeks to measure changes induced by the new payment system..

In this paper we report a competing risks survival regression analysis of PPS using data for 1977-1992 from the NHANES I Epidemiologic Followup Study (NHEFS). NHEFS surveyed a large, nationally representative sample of U.S. adults, recorded health information at baseline, and prospectively collected data on hospital admissions, nursing home admissions, and deaths. Using data on adults aged 65 and over, including those who turned 65 during followup, we improve upon previous studies in several ways.

- NHEFS lets us examine new types of transitions among health care settings in addition to those examined by previous studies. We find that risk of admission to a nursing home from the community within the first two months after hospital discharge -- an outcome not available to previous studies -- more than tripled under PPS.
- NHEFS covers a longer period of time than previous studies, both before and after the introduction of PPS, providing a firmer basis for comparison and the ability to identify longer-term effects. Although earlier authors called for research over the longer term, we

are the first to conduct such an analysis.

- Using the extensive baseline health information collected in NHANES I, we control for differences in health without relying on information collected at hospital admission. This allows us to address the difficulties arising from the PPS-induced coding changes that troubled previous studies.

## Background

Prospective payment created incentives very different from those of the earlier cost-based system. To stay within the fixed rates, hospitals try to keep costs low by cutting services or substituting less expensive for more expensive services. They can also substitute care outside the hospital for hospital care, by discharging patients to other providers earlier than under cost reimbursement -- to nursing homes, long-term care hospitals, or the community where family or home health services agencies may provide care. Thus PPS can affect the cost and location of care across the full spectrum of providers, shifting care and costs to other parts of the formal and informal caregiving system.

Studies of the early years of PPS include the important series of articles by a team of researchers at the RAND Corporation and UCLA (Kahn et al. 1990; Kosecoff et al. 1990; Rogers et al. 1990). The team analyzed data for 14,012 Medicare patients in five states -- half hospitalized in 1981-1982, before PPS, half in 1985-1986 -- who were admitted for congestive heart failure, myocardial infarction, pneumonia, hip fracture, or stroke. They examined changes in admission, length of stay, readmission, and mortality, adjusting for sickness at admission with a scale developed from patients' hospital records for that admission. The study found that length of stay dropped from 14.4 days to 11.0 days, mortality in the hospital declined from 16.1% to

12.6%, and mortality 30 days after admission declined from 16.5% to 15.4% ( $P < 0.05$  in each case). There was no significant change in mortality 180 days after admission. Four percentage points more patients were discharged to nursing homes. Readmissions to hospital within a year were unchanged. The one adverse effect associated with PPS was that more patients were discharged from the hospital in unstable condition. Kahn et al. concluded that “because our post-PPS data are from 1985 and 1986, we recommend that clinical monitoring be maintained to ensure that changes in prospective payment do not negatively affect patient outcome.”

Cutler (1995) examined the effects of PPS in the six New England states, using longitudinal data on 40,000 Medicare admissions for 1981-88; Massachusetts was exempt from PPS until 1986 because of its state hospital rate-setting program. Cutler used a post-PPS dummy variable to proxy for PPS’s “marginal reimbursement effect,” his term for the fact that, in contrast to cost-based reimbursement, hospitals’ marginal costs are not reimbursed under PPS. Patients’ health status at admission was represented by age, sex, type of admission, and whether the stay was a readmission. He found that mortality was compressed under PPS, with more deaths occurring soon after discharge from the hospital but no increase in deaths at one year. He also noted an increase in readmissions, which he attributed to coding changes, and a decrease in deaths in the hospital. In conclusion he observed that PPS “has been in place for less than a decade and reimbursement was relatively generous for much of that period, [so] there has been little experience with prolonged reductions in prices.”

The most recent studies, also published in the late 1980s and early 1990s, generally corroborate earlier findings that hospital stays decreased under PPS, discharges to nursing homes increased, and a larger share of deaths occurred in nursing homes (Gerety et al. 1989; Kane et al. 1996; Kenny and Holahan 1991; Newhouse and Byrne 1988; Sager et al. 1987; Sager et al. 1988;

Sager et al. 1989). Except for Kane's study of 1988-89 data for three cities, which had no pre-PPS baseline, no studies analyzed data more recent than 1987.

Thus our knowledge of the effects of PPS comes from studies that analyzed its first few years and compared them to baseline periods limited to the years 1981-1983. While longer-term effects should be in the same direction – a tendency to save on resources during the hospital stay and to use substitutes for hospital care more often, and earlier in a patient's course of illness -- there are several reasons to expect that the magnitude of the effects might have changed, or new effects might have appeared. First, with experience hospital administrators and physicians learned what worked best under PPS for patients and for hospitals' financial health. Second, four states with their own rate-setting systems received waivers that initially exempted them from PPS. Three were brought under PPS after 1983 -- Massachusetts and New York in 1986, New Jersey in 1988; Maryland is still exempt. Third, and likely most important, PPS payment rates were set at less generous levels after the implementation period, putting even more pressure on hospitals to cut costs. The margin by which Medicare revenues exceeded costs declined from 13.4% in the first year of PPS to its low point – a *negative* 2.4% (costs exceeded revenues) – in 1991 (MedPAC 1999, chapter 3). Margins declined at the same time that rapid growth in HMO enrollment among the population under 65 limited hospitals' ability to shift Medicare costs to other payers. The trend reversed after 1991 and inpatient margins were above 15% by the mid-1990s.

## Methods

Our data come from the first National Health and Nutrition Examination Survey (NHANES I), which enrolled a nationally representative sample of adults aged 25-74 during the

years 1971-1975 and collected extensive information on their health through medical examinations and personal interviews. The NHANES I Epidemiologic Followup Study (NHEFS) tracked these adults through 1992, recording hospital admissions, nursing home admissions, and deaths. The National Center for Health Statistics (NCHS) conducted the first followup in 1982-84, locating about 95% of the original cohort, and additional followups in 1987 and 1992 (Cohen et al. 1987; Cox et al. 1992). Admissions were identified through personal interviews and matched with institutional records, which provided diagnosis codes and exact dates of admission and discharge. Deaths were traced through interviews with proxies (confirmed by death certificates) and the National Mortality Index. The long followup allowed us a longer baseline period than previous studies (1977-September 1983), as well as a longer period under PPS (September 1983-1992).

*Sample.* We selected all adults with complete information on the variables used in the analysis who were 65 or older on January 1, 1977; we added persons who turned 65 later as of the date of their 65<sup>th</sup> birthday. For each individual we created a timeline, noting dates of hospital and nursing home admission and discharge, and calculating time spent in each setting. Three types of spells (periods at risk of a transition to a different health care setting) were defined from the timeline: spells in the hospital; spells in a nursing home following hospital discharge; and spells in the community following hospital discharge. Spells that ended before January 1, 1977 were excluded in order to start the analysis after all NHANES I participants were enrolled and to avoid the undercount of hospital admissions that marked the first years of the NHEFS followup (Russell et al. 1997). We excluded the 115 spells in Maryland since Maryland has never been under PPS. The final sample consisted of 24,193 spells for 4,242 persons 65 and older in 45 states (Table 1).



In each setting, three types of transitions were possible: death or discharge/admission to one of the other health care settings. Thus we examined the following transitions (Figure 1):

- for hospital spells, death in hospital, transfer to a nursing home, or discharge to the community;
- for nursing home spells that followed a hospital stay, death in the nursing home, readmission to hospital, or discharge to the community;
- for community spells that followed a hospital stay, death in the community, readmission to a hospital, or admission to a nursing home.

A spell could also be censored, ending before any of these transitions occurred, because of loss to followup or the end of the survey period.

*Variables.* Our measure of health at admission is of particular importance to the analysis. Because of the monitoring system designed to prevent unnecessary hospital admissions, and the incentives to discharge patients early, elderly patients admitted to hospitals and nursing homes under PPS were sicker than before. If health is not fully accounted for, effects attributed to PPS may instead be due to differences in health. This problem is difficult to address because of the relation between payment method and health data collected during a hospital stay. As noted, unlike the system of cost reimbursement that preceded it, PPS provides incentives for hospitals to code the most serious diagnoses possible in order to qualify for higher payment rates. Thus data collected during an admission do not support an accurate comparison of the health of patients under the two systems.

NHEFS collected extensive information on each participant's health at baseline. Using this information, we developed a measure of health at admission that captures health in more detail than the simple demographics used by Cutler (1995), and avoids using information

recorded during the hospital stay as the RAND study did (Kahn et al., 1990). Our measure is the probability of survival *at the time of each hospital admission*, predicted from the person's age at admission and *baseline* (1971-1975) health information. This probability was derived from Weibull regressions, fitted to NHEFS data, which related survival after baseline to baseline age, sex, race, smoking, systolic blood pressure, overweight/underweight, laboratory test results, exercise, alcohol consumption, diet, and nine groups of chronic conditions (Russell and Valiyeva, 2003). These variables, identified through a review of the medical literature by two physicians, include all that were statistically significant in multiple studies (except for more recent measures of lipids, which were not measured in NHANES I). Risk factors strongly supported by the literature, e.g., smoking, blood pressure, were significant in the Weibull regressions. Regressions based on followup through 1987 accurately projected mortality during the final followup, 1988-1992. We used regressions based on followup through 1992 for this study.

We used the regressions to estimate each individual's survival probability at the date of each hospital admission, expressed as a percentage. Separate regressions were fitted for men 45-64 at baseline, women 45-64, men 65-74, and women 65-74 and the appropriate regression was used for each individual based on his/her age at baseline. A higher survival probability denotes better health. Since the estimate is based on information collected before the hospital stay, and independent of it, it is uncorrelated with the payment system. Table 2 shows, by type of spell, the means over spells of the demographic, health, and diagnostic variables.

We distinguished three time periods: (1) a pre-PPS baseline, 1977 - September 1983, during which hospitals were reimbursed on the basis of costs; (2) the implementation period, October 1983 - September 1986, during which hospitals were gradually phased into PPS, with

New York and Massachusetts included in 1986; and (3) full PPS, October 1986-1992, during which the system was fully phased in.

Two dummy variables define the PPS period. The first, called PPS in Tables 3-5, is the same as Cutler's "marginal reimbursement effect" (Cutler, 1995). It is coded 1 for spells that began between October 1983 and the end of 1992, 0 for spells that occurred earlier or in waiver states during the period of their waivers, and measures the effect of PPS over the entire PPS period. The second dummy, "Mature PPS" in the tables, is 1 for spells that began October 1986 or later and tests for a *change* in the effect of PPS once the implementation period was over.

Selection of NHANES I participants was based on a stratified sample design that identified 102 primary sampling units (PSUs, a county or group of contiguous counties) representative of the U.S. Because of confidentiality requirements, PSUs' identities are not available from the public-use tapes. As a result, although PSUs are similar in geographic scope to markets, we could not merge market measures at this level with the data on individuals. To control for differences in unmeasured characteristics among the 102 PSUs, particularly market characteristics, we included PSU fixed effects – a dummy variable for each PSU but one, with value 1 for that PSU and 0 for all other PSUs.

Each individual's state of residence, at each followup, was identified on the public-use tapes. We used this information to adjust the PSU designations for migration. The adjustment was approximate because we could only identify a move if the person moved out of the state (or states – some PSUs crossed state boundaries) in which the original PSU was located; in the few cases where individuals ultimately moved back to the same state we assumed that they returned to the original PSU. Spells that took place when individuals were not in their original PSUs, about 7% of each type of spell, were assigned a separate fixed effect. We made an additional

adjustment in the regressions for nursing home spells. Since there were only 1160 nursing home spells that followed a hospital stay, some PSUs had few such spells. We combined the 67 PSUs with 10 or fewer nursing home spells (375 spells in all) into a single fixed effect used only in the nursing home regressions.

*State-level variables.* As a potential supplement to the PSU fixed effects, the patient data were merged with a panel of state-level data for the years 1977-1992. The match was based on the individual's state of residence in the year a spell began. For individuals who moved between follow-up rounds, we made the standard assumption that the move occurred halfway between the two follow-ups (Trussell and Hammerslough 1983). For persons who died, we did not have the state of death and assumed that they died in the state shown for the last follow-up.

Following the hospital competition literature (Baker 2001), we collected the following state-level variables for the years 1977-1992 from the Area Resource File: percentage of population enrolled in HMOs; number of short-term general hospitals; average occupancy rate in short-term general hospitals; number of short-term hospitals per 1000 square miles of area (a proxy for travel distance); nursing home beds per 1000 short-term hospital beds (available for only 3 years); and percentage of population aged 65 or older. Missing values were interpolated. Multicollinearity was, however, a severe problem with the state-level variables. Condition numbers, calculated for all 6 variables and for subsets, were well above 20, indicating serious multicollinearity (Greene 2000), and none of the specifications that included them produced statistically significant results for the state-level variables or noteworthy changes in the other variables. Thus we do not present regressions with state-level variables.

*Statistical analyses.* Since PPS was expected to affect the length of a spell, we examined transitions among hospital, nursing home, community, and death using competing risks Cox

proportional hazard survival models. Our approach follows Cutler (1995), except that the semi-parametric Cox model makes no assumption about the shape of the baseline hazard function and is thus more robust than the Weibull he used (Allison, 1995).

Survival models show the risk of a transition (event) over the period (spell) at risk (Allison 1995). An individual is at risk until a transition occurs or until last observed. For example, during a hospital spell, an individual is at risk of death, discharge to a nursing home, or discharge to the community until one of those transitions occurs. To model these competing risks, we estimated a series of survival regressions, one for each type of transition; all other transitions were considered censored for that model. For instance, when we estimated the regression for death in the hospital, inpatient spells that ended in discharge to nursing homes or the community were treated as censored. For each type of transition, we estimated regressions using different censoring dates to explore the timing of PPS's effects. For death in the hospital, for example, we estimated separate regressions for death within 15 days and for the entire spell. Cutler's approach and ours share with multinomial logit the ability to examine transitions among multiple states (hospital, nursing home, community), but also takes account of the time in each state, an important margin for decisions under PPS.

For transition  $j$  of spell type  $s$ ,  $j=1, 2, 3$  and  $s=1, 2, 3$ , Cox's model specifies individual  $i$ 's instantaneous probability of risk, conditional on survival to  $t$  as

$$\lambda_{ijs}(t) = \lambda_{0,js}(t) \exp(X_i \beta),$$

where  $\lambda_{0,js}(t)$  is the baseline hazard, which does not require a parametric form, and  $X_i$  represents the covariates. Coefficients from a Cox model are estimates of the log-relative hazard of the transition. To obtain relative hazards (or hazard ratios, a form of relative risk), the

coefficients are exponentiated.

Because sample persons were chosen with unequal probabilities, we assigned the NCHS sample weight to each individual to obtain unbiased estimates. To estimate the regressions we used SAS-callable SUDAAN, release 9.1, which applies a robust variance estimator to adjust for the multistage, clustered data: multiple spells for (within) individuals, individuals within PSUs, and PSUs within states (Research Triangle Institute 2005). The original PSUs, unadjusted for migration, were used for this adjustment procedure.

In exploratory analyses, we estimated three models for each type of transition. In model 1 (not shown), the hazard function was specified to depend on patient characteristics (age at the beginning of the spell, female gender, health status, diagnostic category) and the two PPS dummies. Model 1 served as a benchmark for comparison with models 2 and 3; it showed that the results for the basic variables were robust to alternative ways of representing market characteristics. Model 2 added PSU fixed effects (Tables 3-5). In addition to PSU fixed effects, Model 3 explored ways of incorporating state-level variables; the problems with these variables have been noted. Results for Model 2 are reported here.

To examine how the effects of PPS varied with spell duration, each spell type was analyzed with alternative censoring rules. For hospital spells, we estimated regressions for spells censored at 15 and 31 days (not reported), and for full spells. Since the effects of PPS on post-hospital care were expected to appear soon after discharge from the hospital, regressions were estimated for nursing home and community spells censored at 31 and 61 days. Like the RAND study and Cutler (1995), we also estimated regressions for death within 180 and 365 days of hospital admission, and readmission within 180 days of hospital discharge.

## Results

Tables 3-5 show the estimated hazard ratios (risk ratios) from competing risks Cox regressions for transitions out of hospital spells, nursing home spells that followed a hospital stay, and community spells that followed a hospital stay. A hazard ratio (HR) greater than 1 indicates increased risk of the transition; a HR less than 1 indicates decreased risk. The regressions include all patient-level variables, the PPS dummies, and PSU fixed effects (Model 2).

### *Health status (Tables 3-5)*

Health status, an individual's predicted probability of survival at the time of the hospital admission based on age at admission and baseline (1971-1975) health characteristics, performs as expected. The findings are in the expected directions and significant at 95% or better, evidence that the measure successfully controls for health without relying on information recorded at admission. Healthier people (those with higher predicted survival probabilities) were less likely to die in the hospital or be discharged to a nursing home, and more likely to be discharged to the community (Table 3). They were less likely to be readmitted to a hospital from a nursing home, and more likely to be discharged to the community from a nursing home (Table 4). Finally, they were less likely to die in the community following a hospital stay, be readmitted to a hospital from the community, or be admitted to a nursing home from the community after a hospital stay (Table 5). The only outcome not affected by predicted survival probability was death in a nursing home.

Since survival probability at time of admission is continuous, and measured as a percentage, each hazard ratio shows the relative risk of the transition for a one percentage point increase in survival probability. For example, the hazard ratio of 0.984 for death within the first

15 days of a hospital stay (Table 3, column 1) implies that the risk of death declined 1.6% for each one percentage point increase in health status at admission.

*PPS: Hospital Spells (Table 3)*

Risk of death during a hospital stay increased 28% under PPS for full spells, although the effect was smaller and did not reach statistical significance within the first 15 days of a stay. This result appears to reflect a change in the timing of death; in regressions that examined mortality 30, 180, and 365 days after hospital admission (not shown), we did not find a PPS effect. The result differs from the RAND Study, which found a decline in in-hospital mortality for five diagnoses in their five states in 1985-1986. It is in general agreement with their findings of a small decline in mortality 30 days after admission, but no change 180 days after admission, and with Cutler, who found that mortality was compressed under PPS in the New England states in 1983-1988, with no change in mortality one year after admission.

The risk of discharge to a nursing home doubled under PPS and increased further after the transition period. This pattern reflects not only the shift in location found by other studies, with more patients discharged to nursing homes than before PPS, but also earlier discharges. The finding of a further increase in risk once PPS was fully implemented is new; other studies could not test for this possibility because of their shorter followup periods. When the two PPS coefficients are summed and exponentiated, the result shows that the risk of discharge to a nursing home within 15 days of admission more than tripled under mature PPS, compared with the pre-PPS period, and was almost triple for full stays.

Again reflecting hospitals' efforts to discharge patients quickly, shortening lengths of stay, the daily risk of discharge to the community increased about 20% for full stays. Risk was



highest during the first 15 days of a hospital stay: 29% higher than before PPS.

*PPS: Nursing Home Spells (Table 4)*

The regressions in Table 4 do not show statistically significant PPS effects for any of the three types of transitions – death, readmission to hospital, or discharge to the community -- within the first two months of transfer to a nursing home. Other studies found an increase in the risk of death in nursing homes. While the risk ratios in our regressions are greater than 1 for both PPS and mature PPS, neither achieves statistical significance at even the 10% level.

*PPS: Community Spells (Table 5)*

Risk of admission to a nursing home from the community rose sharply under PPS. It was 4 times its pre-PPS level in the first 31 days after a hospital stay and almost 3 times the pre-PPS level when the first 61 days are considered. The heightened risk remained after the implementation period, but did not increase further. Previous studies did not have data on this type of transition.

The risk of readmission to a hospital from the community did not rise. Indeed, risk within the first 61 days after discharge fell by almost 25% after the transition period. Regressions for readmission to a hospital within 180 or 365 days after hospital discharge, whether from a nursing home or from the community, confirmed that, on net, risk of readmission declined under PPS.

PPS had no significant effect on the risk of death in the community following discharge from the hospital.

## Conclusions

In their study of the expansion of prospective payment under the 1997 Balanced Budget Act, McCall et al. (2003: 296) observed that “Medicare providers are poised to alter use patterns substantially when financial incentives change.” The results presented here confirm the truth of that statement. Prospective payment brought an immediate response from hospitals, a response that continued to evolve as payment rates were tightened through the late 1980s until, by the early 1990s, hospitals were losing money on Medicare patients. We found, as earlier studies did, that patients were discharged earlier and were more likely to be discharged to a nursing home under PPS. With a much longer follow-up period (1983-1992) than previous studies, we were also able to show that the risk of discharge to a nursing home rose even more once PPS was fully implemented, for a total risk that was triple the pre-PPS level.

At the same time, nursing homes were receiving more patients who had recently been discharged to the community. The risk of admission to a nursing home from the community in the first two months after a hospital stay – a type of transition not examined by previous studies – more than tripled under PPS. This result is consistent with the RAND study’s finding that more patients in their five states were discharged from the hospital in unstable condition in 1985-1986 (Kahn et al, 1990). It is also consistent with the protests at the time that some patients were discharged before they were ready for the lower level of care available in the community, either from home health service agencies or from their families.

Risk of readmission to hospital, from a nursing home or from the community, did not increase under PPS. Indeed, once PPS was fully implemented, risk of readmission to hospital declined below pre-PPS levels, another new finding made possible by our longer follow-up period (the decline was not significant for spells in the nursing home). Regressions that

examined readmission over 180 and 365 days following admission confirmed that the net effect of PPS was a reduction in readmissions from either setting. The RAND Study found no change in readmission rates in their five states during the year after admission, while Cutler (1995) found an increase in readmissions in the New England states, which he attributed to coding changes.

Thus nursing homes, which continued to be paid costs as hospitals were moving to prospective payment, found themselves receiving more patients and patients who were in a different stage of their treatment or illness. Patients were discharged to nursing homes earlier in the course of their illness, they were sometimes discharged to the community before they or their families could cope with their care and were admitted to a nursing home within a few weeks, and hospitals resisted earlier practice patterns that would have had the patient readmitted to the hospital instead. Nursing homes became the locus of care for many patients who would not, before PPS, have received their services.

Our analysis of the longer-term effects of PPS for hospitals provides additional evidence of the restructuring of acute and postacute care that took place during the late 1980s, in which incentives directed at hospitals substantially reshaped the work not only of hospitals but also of providers of postacute care. McCall et al. (2003) showed that the extension of prospective payment to other providers after 1997 led quickly to further shifts in the location of care, particularly to a reduction in home health services and increases in care provided by long-term care and rehabilitation hospitals. These shifts, like the earlier ones that followed PPS for hospitals, cause problems for patients and their families as they try to negotiate the rapidly changing terms and conditions that come with rapid changes in patterns of care, and new configurations of providers, while still serving as the provider of last resort. Each change in the

payment system affects the continuity and outcomes of care for the elderly, and the burdens on their families, in new ways. In the last two decades patients and families have found themselves dealing with constant change.

Kahn et al. (1990) wrote of the need to continue monitoring outcomes under PPS beyond the first few years. Our results add evidence that the consequences of new payment systems cannot be assumed to be complete within just a few years of implementation. Evaluations need to take a comprehensive, long-term look at the health system. Changes in incentives for one provider reverberate throughout the system, changing the tasks faced by other providers and causing stresses and strains for patients and their families, who must learn how to deal with each new constraint on formal services, how to organize care across providers under changing conditions, and still provide the bulk of care in the community.

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Table 1: Number of spells and disposition, by type of spell and censoring date, persons aged 65 and older, 1977-1992 NHEFS

| Type of spell   | Disposition                | Disposition of spell<br>by time since admission (days) |               |               |               |
|---|----------------------------|--|---------------|---------------|---------------|
|   |                            | ≤15<br>days  | ≤31<br>days   | ≤61<br>days   | Full spell    |
| Inpatient hospital spells                               | Died                       | 647  | 793           | 857           | 882           |
|   | Discharged to nursing home | 854  | 1,068         | 1,128         | 1,160         |
|   | Discharged to community    | 9,081  | 10,181        | 10,429        | 10,490        |
|   | Censored                   | 1,961  | 501           | 129           | 11            |
|   | <b>Total</b>               | <b>12,543</b>  | <b>12,543</b> | <b>12,543</b> | <b>12,543</b> |
| Nursing home spells<br>that followed a hospital<br>stay | Died                       | --   | 104           | 146           | 310           |
|   | Readmitted to hospital     | --   | 135           | 214           | 532           |
|   | Discharged to community    | --   | 111           | 163           | 227           |
|   | Censored                   | --   | 810           | 637           | 91            |
|   | <b>Total</b>               | <b>--</b>  | <b>1,160</b>  | <b>1,160</b>  | <b>1,160</b>  |
| Community spells that<br>followed a hospital stay       | Died                       | --   | 156           | 208           | 687           |
|   | Readmitted to hospital     | --   | 1,539         | 2,285         | 8,150         |
|   | Admitted to nursing home   | --   | 75            | 102           | 323           |
|   | Censored                   | --   | 8,720         | 7,895         | 1330          |
|   | <b>Total</b>               | <b>--</b>  | <b>10,490</b> | <b>10,490</b> | <b>10,490</b> |



Table 2. Means of explanatory variables, by type of spell, persons aged 65 and older, 1977-1992 NHEFS

| Variable name/definition                           | Hospital spells | Nursing home spells | Community spells |
|--|-----------------|---------------------|------------------|
| Age at start of spell, in years                    | 74.0            | 78.6                | 73.6             |
| Female, %  | 53.9            | 65.2                | 53.0             |
| Health status (predicted survival, %) <sup>a</sup> | 69.6            | 55.9                | 70.8             |
| Primary diagnosis <sup>b</sup>                     |                 |                     |                  |
| Cardiovascular disease, %                          | 28.8            | 25.2                | 29.1             |
| Cancer, %  | 11.0            | 7.8                 | 11.0             |
| Other, %   | 60.2            | 67.0                | 59.9             |

Means are over spells.

a. Predicted survival probability, estimated from health characteristics measured at survey baseline (see text), is reported as a percentage. Higher percentages denote better health.

b. Based on ICD-9 codes. NCHS used ICD-9 for all stays, including those that occurred before 1980, when ICD-9 was introduced. Cardiovascular disease is the reference group in the regressions. Nursing home and community spells that followed a hospital stay were assigned the diagnostic group of the hospital stay.

Table 3. Transitions from inpatient hospital spells: Estimated hazard ratios from Cox regressions, persons aged 65 and older, 1977-1992 NHEFS

|                                | Death in hospital   |                     | Discharge to nursing home |                     | Discharge to community |                     |
|--------------------------------|---------------------|---------------------|---------------------------|---------------------|------------------------|---------------------|
|                                | 15 days             | Full spell          | 15 days                   | Full spell          | 15 days                | Full spell          |
| Age at start of spell          | 1.014<br>(0.90)     | 1.031**<br>(2.46)   | 1.058***<br>(3.44)        | 1.060***<br>(4.10)  | 0.990**<br>(-2.39)     | 0.992**<br>(-2.10)  |
| Female                         | 0.953<br>(-0.42)    | 0.841*<br>(-1.53)   | 1.893***<br>(4.82)        | 1.879***<br>(4.60)  | 0.935<br>(-1.49)       | 0.928<br>(-1.73)    |
| Health status <sup>a</sup>     | 0.984***<br>(-3.58) | 0.991**<br>(-2.22)  | 0.983***<br>(-3.00)       | 0.985***<br>(-2.90) | 1.009***<br>(6.59)     | 1.009***<br>(6.35)  |
| Primary diagnosis <sup>b</sup> |                     |                     |                           |                     |                        |                     |
| Cancer                         | 0.946<br>(-0.35)    | 1.328**<br>(2.08)   | 0.474***<br>(-2.85)       | 0.503***<br>(-2.97) | 0.818***<br>(-3.10)    | 0.821***<br>(-3.22) |
| Other diagnosis                | 0.541***<br>(-5.21) | 0.592***<br>(-4.65) | 1.214<br>(1.56)           | 1.181<br>(1.61)     | 1.036<br>(0.83)        | 1.033<br>(0.80)     |
| Time period <sup>c</sup>       |                     |                     |                           |                     |                        |                     |
| PPS, 1983-92                   | 1.147<br>(0.87)     | 1.283**<br>(2.02)   | 2.586***<br>(4.47)        | 2.025***<br>(4.22)  | 1.285***<br>(5.20)     | 1.215***<br>(4.13)  |
| Mature PPS, 1986-92            | 1.116<br>(0.77)     | 1.082<br>(0.71)     | 1.332*<br>(1.93)          | 1.500***<br>(2.81)  | 1.010<br>(0.19)        | 0.991<br>(-0.17)    |
| PSU fixed effects              | yes                 | yes                 | yes                       | yes                 | yes                    | yes                 |
| N spells<br>(# transitions)    | 12,543<br>(647)     | 12,543<br>(882)     | 12,543<br>(854)           | 12,543<br>(1,160)   | 12,543<br>(9,081)      | 12,543<br>(10,490)  |

t-statistics in parentheses: \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01

- a. Predicted survival probability, in percent.
- b. Reference category: cardiovascular disease
- c. Reference category: Pre-PPS, 1977-1982.

Table 4. Transitions from nursing home spells that follow a hospital stay: Estimated hazards ratios from Cox regressions, persons aged 65 and older, 1977-1992 NHEFS

|                                | Death in nursing home within |                    | Readmission to hospital within |                     | Discharge to community within |                    |
|--------------------------------|------------------------------|--------------------|--------------------------------|---------------------|-------------------------------|--------------------|
|                                | 31 days                      | 61 days            | 31 days                        | 61 days             | 31 days                       | 61 days            |
| Age at start of spell (yrs)    | 0.983<br>(-0.51)             | 0.992<br>(-0.28)   | 0.965<br>(-1.37)               | 0.955**<br>(-2.39)  | 1.064**<br>(2.66)             | 1.064**<br>(3.02)  |
| Female                         | 0.605<br>(-1.28)             | 0.675<br>(-1.39)   | 1.485<br>(1.19)                | 1.174<br>(0.75)     | 0.799<br>(-0.75)              | 0.620<br>(-1.78)   |
| Health status <sup>a</sup>     | 0.997<br>(-0.33)             | 0.996<br>(-0.44)   | 0.985*<br>(-2.04)              | 0.978***<br>(-3.41) | 1.043***<br>(5.12)            | 1.039***<br>(5.00) |
| Primary diagnosis <sup>b</sup> |                              |                    |                                |                     |                               |                    |
| Cancer                         | 4.516***<br>(4.40)           | 5.058***<br>(5.71) | 1.239<br>(0.56)                | 1.886**<br>(2.58)   | 0.611<br>(-0.50)              | 0.804<br>(-0.28)   |
| Other diagnosis                | 0.516**<br>(-2.02)           | 0.586**<br>(-2.01) | 0.709<br>(-1.46)               | 0.761<br>(-1.48)    | 2.120<br>(1.87)               | 2.310**<br>(2.24)  |
| Time period <sup>c</sup>       |                              |                    |                                |                     |                               |                    |
| PPS, 1983-92                   | 1.475<br>(0.83)              | 1.419<br>(0.85)    | 1.716<br>(1.28)                | 1.332<br>(0.86)     | 1.587<br>(0.99)               | 1.745<br>(1.46)    |
| Mature PPS, 1986-92            | 1.565<br>(1.40)              | 1.431<br>(1.35)    | 0.756<br>(-0.98)               | 0.994<br>(-0.03)    | 1.691<br>(1.42)               | 1.668<br>(1.64)    |
| PSU fixed effects <sup>d</sup> | yes                          | yes                | yes                            | yes                 | yes                           | yes                |
| N spells<br>(# transitions)    | 1,160<br>(104)               | 1,160<br>(146)     | 1,176<br>(135)                 | 1,160<br>(214)      | 1,160<br>(111)                | 1,160<br>(163)     |

t-statistics in parentheses: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

a. Predicted survival probability, in percent.

b. Reference category: cardiovascular disease

c. Reference category: Pre-PPS, 1977-1982.

d. PSUs with 10 or fewer spells are grouped as one fixed effect.

Table 5. Transitions from community spells that follow a hospital stay: Estimated hazards ratios from Cox regressions, persons aged 65 and older, 1977-1992 NHEFS

|                                | Death in community within |                     | Readmission to hospital within |                     | Admission to nursing home within |                    |
|--------------------------------|---------------------------|---------------------|--------------------------------|---------------------|----------------------------------|--------------------|
|                                | 31 days                   | 61 days             | 31 days                        | 61 days             | 31 days                          | 61 days            |
| Age at start of spell (yrs)    | 0.978<br>(-0.88)          | 0.987<br>(-0.67)    | 0.979***<br>(-2.75)            | 0.979***<br>(-3.02) | 1.041<br>(1.46)                  | 1.073**<br>(2.51)  |
| Female                         | 1.630***<br>(2.62)        | 1.477**<br>(2.02)   | 1.214*<br>(1.87)               | 1.263**<br>(2.67)   | 1.988*<br>(1.65)                 | 2.056**<br>(2.08)  |
| Health status <sup>a</sup>     | 0.965***<br>(-4.78)       | 0.970***<br>(-4.84) | 0.985***<br>(-5.34)            | 0.983***<br>(-6.91) | 0.980**<br>(-1.88)               | 0.983*<br>(-1.69)  |
| Primary diagnosis <sup>b</sup> |                           |                     |                                |                     |                                  |                    |
| Cancer                         | 2.313***<br>(2.90)        | 2.740***<br>(4.24)  | 1.567***<br>(4.02)             | 1.397***<br>(3.32)  | 1.264<br>(0.36)                  | 1.814<br>(1.13)    |
| Other diagnosis                | 0.851<br>(-0.54)          | 0.871<br>(-0.57)    | 0.746***<br>(-2.76)            | 0.745***<br>(-3.35) | 1.397<br>(0.83)                  | 1.439<br>(1.05)    |
| Time period <sup>c</sup>       |                           |                     |                                |                     |                                  |                    |
| PPS. 1983-92                   | 0.940<br>(-0.20)          | 0.816<br>(-0.70)    | 1.013<br>(0.11)                | 1.108<br>(1.04)     | 4.008**<br>(2.64)                | 3.083***<br>(2.76) |
| Mature PPS. 1986-92            | 1.412<br>(1.18)           | 1.473<br>(1.44)     | 0.856<br>(-1.49)               | 0.763***<br>(-3.14) | 0.670<br>(-0.98)                 | 0.787<br>(-0.69)   |
| PSU fixed effects              | yes                       | yes                 | yes                            | yes                 | yes                              | yes                |
| N spells<br>(# transitions)    | 10,490<br>(156)           | 10,490<br>(208)     | 10,490<br>(1,539)              | 10,490<br>(2,285)   | 10,490<br>(75)                   | 10,490<br>(102)    |

t-statistics in parentheses: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

- a. Predicted survival probability, in percent.
- b. Reference category: cardiovascular disease
- c. Reference category: Pre-PPS, 1977-1982.

Figure 1.

## Transitions among Health Care Settings

