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DOES HOW MUCH AND HOW YOU PAY MATTER? EVIDENCE FROM THE INPATIENT REHABILITATION FACILITY PROSPECTIVE PAYMENT SYSTEM

Neeraj Sood
Melinda Beeuwkes Buntin
Jose J. Escarce

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ABSTRACT

We use the implementation of a new prospective payment system (PPS) for inpatient rehabilitation facilities (IRFs) to investigate the effect of changes in marginal and average reimbursement on costs. The results show that the IRF PPS led to a significant decline in costs and length of stay. Changes in marginal reimbursement associated with the move from a cost based system to a PPS led to a 7 to 11% reduction in costs. The elasticity of costs with respect average reimbursement ranged from 0.26 to 0.34. Finally, the IRF PPS had little or no impact on costs in other sites of care, mortality, or the rate of return to community residence.

Neeraj Sood
The RAND Corporation
1776 Main Street
Santa Monica, CA 90407
and NBER
neeraj_sood@rand.org

Jose J. Escarce
RAND
1700 Main Street
M-28
Santa Monica, CA 90401
escarce@rand.org

Melinda Beeuwkes Buntin
RAND
1776 Main Street
Santa Monica CA 90407
buntin@rand.org

INTRODUCTION

Between 1988 and 1997, post-acute care was the fastest growing category of Medicare spending with an average annual growth rate of 25% (MedPAC, 2003). The Balanced Budget Act of 1997 and subsequent Balanced Budget Refinement Act of 1999 attempted to control the rising spending and costs by shifting payments to providers from a cost basis to prospective payment systems (PPSs). However, the switch to a prospective payment system has two potential, and possibly competing, effects on costs. First, the switch to prospective payment reduces *marginal* reimbursement for additional services thereby creating incentives to reduce costs. Second, and perhaps a less appreciated fact, is that a switch to prospective payment could also affect the *average* reimbursement that a facility receives. An increase in average reimbursement levels could in principle lead to an increase in costs (Hogkin and McGuire, 1994). Therefore, it is uncertain whether a switch to prospective payment that reduces marginal reimbursement but increases average reimbursement would result in cost savings

Under a prospective payment system that leads to cost savings, the approach chosen by providers to reduce costs could have implications for health outcomes. In particular, cost savings that are achieved by reducing the amount of beneficial care provided might increase the risk of adverse health outcomes (Cutler, 1995; Shen, 2003). Prospective payment-induced reductions in beneficial care could also have spillover effects for providers in other settings; for example, patients who are discharged "too early" due to prospective payment and suffer adverse health outcomes might end up obtaining additional care from providers in other settings. On the other hand, providers that respond to prospective payment by providing care more efficiently could generate savings without affecting health outcomes and costs of care in other settings.

In this study, we examine the impact of the inpatient rehabilitation facility prospective payment system (IRF PPS) on the costs of care and length of stay in inpatient rehabilitation facilities (IRFs). The IRF PPS changed payments in two fundamental ways. First, it switched the payments from a cost-based system to a prospective payment system. Second, although the IRF PPS was intended to be budget neutral, we find evidence that in practice it significantly increased the average reimbursement received by IRFs. To disentangle the impact of changes in marginal and average reimbursement, we take advantage of the timing of the IRF PPS and of the fact that different IRFs experienced widely divergent degrees of changes in average reimbursement under the new payment system, depending on the payment levels they received in the pre-PPS period. We also examine whether the IRF PPS had spillover effects on the use of other post-acute and acute care providers, and whether it affected health outcomes including return to community residence and mortality after an IRF stay.

We find that the implementation of the IRF PPS was associated with a decline in resource use (both costs and length of stay) for patients receiving inpatient rehabilitation following a stroke, hip fracture, or lower extremity joint replacement. We also find strong evidence that both marginal and average reimbursement matter. Finally, we find no evidence of spillover effects on providers in other settings or adverse health outcomes for patients.

The rest of the paper proceeds as follows. First we describe the key features of the IRF PPS. Next, we briefly discuss the anticipated effects of changes in marginal and average reimbursement associated with the IRF PPS. We then describe our data and empirical strategy. The last two sections present the results and conclusions.

THE IRF PPS

Prior to the implementation of the IRF PPS, IRFs were paid on a cost basis up to a per patient limit that varied substantially across facilities and was based on each facility's historical costs (Chan et al., 1997). The facility-specific limits were determined by calculating average costs per patient during each IRF's base year of operation: facilities opening after this rule went into effect had incentives to inflate their costs during their initial period of operation and thus had higher payment limits than older facilities. Various attempts were made to bound the payment limits, for example by imposing caps, but facilities were still able to petition to have these caps waived (CMS, 2002). Accordingly, there was wide variation in payment limits: as we describe below, in 2001 approximately a third of IRFs had payment limits below $13,000 per patient while the top third had limits above $17,000. The cap in the final year of TEFRA was set at just under $22,000, and 16 IRFs successfully made a case to have payment adjustments made that exceeded this cap.

Under the IRF PPS, IRFs receive a prospective payment for each patient. Patients are assigned to a CMG based on their rehabilitation impairment (e.g., stroke, hip fracture, joint replacement, etc.), comorbidities, functional status and length of stay, and each CMG has a payment weight based on the expected resource use for patients in that category. The payment for a patient depends on the patient's CMG and on facility characteristics such as rural location and percentage of low-income patients (CMS, 2001; Carter et al., 2004). A national conversion factor is used to obtain the dollar amount of the payment. There is also an outlier payment system, but it is designed to affect only three percent of payments.

Beginning in January 2002, all IRFs were required to start administering the IRF Patient Assessment Instrument (IRF PAI), which is used to assess functional status for the purpose of CMG assignment. However, each IRF actually transitioned to the IRF PPS at the beginning of its fiscal year, which could occur any time during the 2002 calendar year. Thus some IRFs had more time to anticipate and plan for the transition to the IRF PPS. In summary, all facilities expected a virtual elimination of marginal reimbursement following the implementation of the IRF PPS in January 2002. However, the effects of the IRF PPS on average reimbursement varied across facilities. Facilities with low pre-PPS annual payment limits expected the highest increase in average reimbursement and facilities with high pre-PPS annual payment limits expected little or no change in average reimbursement.

EXPECTED IMPACT OF THE IRF PPS

Changes in both marginal and average reimbursement could have significant effects on provider behavior. Hodgkin and McGuire (1994) develop a model of how hospitals' intensity of treatment responds to changes in average and marginal reimbursement. Increasing intensity of treatment (akin to increases in quality of care) attracts new patients to the hospital but also increases the marginal costs of providing care. They consider two types of hospitals -- a pure profit-maximizer and a hospital that derives utility from both profits and intensity of care. They show that whether or not a hospital is a pure profit-maximizer, it responds to increase in marginal and average payment by increasing the intensity of care. The intuition is that increasing average reimbursement increases intensity because hospitals want to attract and admit profitable new patients. Similarly, increasing marginal reimbursement makes increases in intensity less costly as hospitals recover some of the costs with increased payments. Ellis and McGuire (1996) show that in addition to changing the intensity of treatment hospitals might also change the severity or type of patients they see (selection effect). The changes in treatment intensity could also affect patient outcomes and have spillover effects on providers who provide similar services. For example, patients discharged "too early" due to payment change at a particular provider might be at higher risk of suffering adverse health outcomes and also might end up obtaining care from providers in other settings who provide similar services. Again, however, providers could respond to prospective payment by providing care more efficiently and thus not affect health outcomes or costs of care in other settings.

Several papers have estimated the impact of changes in reimbursement such as the switch to acute care PPS in 1983 on hospital costs and selection (See Frank and McGuire, 2000 for a review). However, the health economics literature on the impact of PPS on patient outcomes is more limited (some prominent exceptions are Staiger and Gaumer, 1992; Cutler, 1995; Shen, 2003). Finally, we know of no study that evaluated the spillover effects of payment system changes on providers in other settings.

This study adds to this literature by disentangling the impact of changes in average and marginal reimbursement for inpatient rehabilitation care. We evaluate the impact of changes in average and marginal payments on intensity of care (costs and length of stay per episode), patient characteristics, patient outcomes (mortality and return to community residence) and spillover effects for acute care and other post acute care providers. Based on the above literature we hypothesize that the impact of the implementation of the IRF PPS would depend on how the IRF PPS affected the average and marginal reimbursement for each facility. The decrease in marginal reimbursement after the implementation of the IRF PPS would tend to reduce costs of IRF care and also might increase adverse health outcomes and the amount of services consumed after IRF care. This change in IRF costs, outcomes and amount of post IRF care services would be mitigated by an increase in average reimbursement. In other words, the decreases in IRF costs and increase in adverse health outcomes and post-IRF costs would be greatest for IRFs that experienced the <u>least</u> increase in average reimbursement under the IRF PPS and smallest for IRFs that experienced the <u>greatest</u> increase in average reimbursement.

METHODS

Data and Study Sample

We examined episodes of IRF care for three groups of Medicare patients discharged from acute care hospitals between January 1, 2001 and June 30, 2003 and admitted to IRFs within 30 days of their acute care discharge: stroke patients; hip fracture patients; and lower extremity joint replacement patients. These 3 impairments account for roughly half of admissions to IRFs and represent the 3 largest groups of patients using inpatient rehabilitation.

We used a 100% sample of Medicare acute care hospital claims for the study period to identify stroke patients as those with a principal diagnosis of intracerebral hemorrhage (diagnosis code 431.xx), occlusion and stenosis of precerebral arteries with infarction (433.x1), occlusion of cerebral arteries with infarction (434.x1), or acute but ill-defined cerebrovascular disease (436.xx). We identified hip fracture patients using principal diagnoses of fractures of the neck of the femur (820.xx). Hip fracture patients whose fractures could be due to bone metastases or who suffered major trauma to a site other than a lower extremity were excluded. We identified lower extremity joint replacement patients using the diagnosis related groups for joint replacement procedures, but excluding patients classified above as hip fracture patients and those with reattachment procedures (procedure codes 84.26, 84.27 and 84.28.)

We then linked a 100% sample of Medicare cost report, enrollment and claims data for acute care hospitals, IRFs, skilled nursing facilities and home health care so we could identify patients who used inpatient rehabilitation; construct episodes of IRF care (see below); and assess costs, length of stay, and Medicare payments for services used in acute and post-acute care settings during an episode.[1] We also linked these data with the Minimum Data Set (MDS) data on the universe of nursing home stays to ascertain whether each study patient was in a custodial nursing home before or at the end of the IRF episode.

We excluded a small fraction of patients from our analyses. Patients who died in the acute care hospital or within 30 days of hospital discharge were dropped since their use of post-acute care was effectively truncated. We also dropped patients admitted to IRFs that did not treat any patients in the pre-PPS period (i.e., 2001), patients who were residents of nursing homes prior to their acute admission since they would not be expected to return to community residence, and patients for whom Medicare was not the primary payer for their acute care stay since we likely lacked complete information on their use of care.

The final analysis sample consisted of 108,692 patients with episodes of IRF care following a stroke; 92,142 following a hip fracture; and 229,705 following a lower extremity

[1] Records were linked across these administrative databases using the patients' unique scrambled social security number and provider ID numbers.

joint replacement. These patients were admitted to 1,145 different IRFs; 38% of these IRFs transitioned to the IRF PPS in the first quarter of 2002, 9% in the second quarter, 37% in the third quarter, and 16% in the fourth quarter.

Episodes of IRF Care and Study Outcomes

For each patient in the study sample, we constructed an episode of IRF care that began with admission to an IRF facility and ended 60 days after admission to IRF. (The results were qualitatively similar with episodes of 90 days.) We obtained the costs of the initial IRF stay in each episode as follows. First, we used claims data to determine the charges incurred in each department within the IRF. Next, we estimated the costs incurred by multiplying the charges for each department by the cost-to-charge ratio for the department, obtained from Medicare cost reports and then summed the departmental costs to obtain total costs. We also used claims data to obtain the length of the initial IRF stay in each episode. Details of the cost calculation are available in Carter et al. (2002).

We also calculated Medicare payments for each IRF stay. For stays in 2001 (the pre-PPS period), we calculated payments by multiplying the cost of the episode by a facility-specific payment-to-cost ratio, estimated using data on costs and Medicare payments from the cost reports. Payments for stays under the IRF PPS were determined by using the IRF PPS rules to simulate payments. Specifically, we classified each IRF patient into a CMG based on their impairment group and functional status reported at admission to the IRF, used the payment weight for each CMG and the published conversion factor to calculate the base payment, multiplied the base payment by a facility-level adjustment based on the characteristics of the IRF, and adjusted payments for unusual cases including short stay transfers and outliers (Carter et al., 2002).

For each 60-day IRF episode, we used claims to calculate Medicare payments for care received in other settings including readmissions to acute care hospitals, SNFs, long-term care hospitals, and home health care.

Finally, we used the Medicare and MDS data to identify each patient's clinical outcome at the end of the IRF episode, i.e., 60 days after admission to IRF. We classified patients into two categories: (1) returning to the community (i.e., alive and receiving no institutional care) or (2) dead or institutionalized (i.e. staying in an acute care hospital or post-acute care facility (IRF, SNF, or long-term care hospital), staying in a custodial nursing home, or dead).

Empirical Methods

For all analyses, we defined the pre-PPS period as the four calendar quarters from January 1, 2001 through December 31, 2001 and the post-PPS period as the 10 quarters from January 1, 2002 through June 30, 2003. In several analyses, we also classified IRFs into one of three mutually exclusive categories, with a roughly equal number of facilities in each category, based on their annual payment limit in pre-PPS period: payment limit less than $13,000; payment limit between $13,000 and $16,999; and payment limit greater than or equal to $17,000. Facilities in the lowest pre-PPS payment category experienced the highest increase in average reimbursement as a result of the PPS.

We conducted descriptive analyses to compare costs, length of stay and payments for IRF care in the pre-PPS and post-PPS periods. We also estimated two different sets of multivariate regression models to examine changes in the level and rate of growth of costs and length of stay between the pre-PPS and post-PPS periods. The multivariate analyses allow us to examine the drivers of changes in costs and length of stay while controlling for patient and IRF characteristics. To account for the skewed distributions of costs and length of stay, we logarithmically transformed these variables for the analyses. We conducted separate analyses for each tracer condition (hip fracture, joint replacement and stroke).

In the first set of regression models, we examined the percentage change in average IRF costs (or length of stay) between the pre-PPS and post-PPS period controlling for patient and IRF characteristics and a pre-existing quarterly time trend. Thus, in these models the key independent variable was an indicator variable for the post-PPS period, and the coefficient on this variable measures the percentage change in costs (or length of stay) between the pre-PPS and post-PPS period.[2] Using the three categories of facilities that we defined based on pre-PPS payment limits (see above), we tested whether decreases in costs and length of stay following implementation of the IRF PPS were greatest for IRFs that experienced the lowest increase in average reimbursement under the PPS and smallest for IRFs that experienced the highest increase in average reimbursement.

In the second set of regression models, we use instrumental variables (IV) estimation to disentangle the impact of changes in average and marginal reimbursement on costs. We estimate the following IV model using two-stage least squares.

$$Log(AveragePayment) = \alpha + \delta_{PPS} * PPS + \delta_{pre} * paylimit * PPS + \delta * X + \theta_f + \eta \quad (1)$$

[2] The analysis described above measured the impact of the IRF PPS on cost (or length of stay) by allowing for a break in the level of costs in the first quarter of 2002. We tested the robustness of our results by estimating models that assessed changes in growth rates and levels at two time points: (1) the first quarter of 2002, when all IRFs began administering the IRF PAI and could anticipate transitioning to the IRF PPS, and (2) the beginning of the fiscal year for each facility, when the IRF PPS was actually in effect. The results of this more complex model were similar to the results from the simpler model reported in the paper. In particular, consistent with the results reported in the paper, we found statistically significant declines in the levels and growth of costs for patients in all 3 study impairments. Moreover, most of the decrease in costs was "anticipatory" in that it occurred in the first quarter of 2002. This "anticipatory" decline is costs is also confirmed by Figures 1 and 2 which show a substantial and immediate dip in the level of costs and length of stay in first quarter of 2002. Complete results from this more complex specification are omitted in the interest of brevity.

$$Y = \alpha + \beta_{PPS} * PPS + \beta_{avg} * Log(\widehat{AveragePayment}) + \beta * X + \lambda_f + \varepsilon \qquad (2)$$

where, *AveragePayment* measures average reimbursement; *PPS* is an indicator variable indicating whether the data are from the post-PPS period; *paylimit* is the pre-PPS payment limit; X is a vector of covariates that includes a linear time trend and patient characteristics (described in detail later); and *Y* is the outcome of interest (log costs). θ_f and λ_f are facility fixed effects; they control for any systematic differences across IRFs including their pre-PPS payment limits and other facility-specific characteristics.

Several points are noteworthy. First, following the implementation of the IRF PPS all facilities experienced an arguably exogenous and identical change in marginal reimbursement; specifically, marginal reimbursement was driven down to zero as all facilities were paid prospectively following the IRF PPS. Therefore, β_{PPS} identifies the causal effect of reducing marginal reimbursement to zero. In addition, following the IRF PPS all facilities also experienced a change in average reimbursement. However, the magnitude of the change in average reimbursement was not identical across facilities; rather, it depended on the pre-PPS payment limit. Thus, $paylimit * PPS$ is a valid instrument for average payment as it is driven by exogenous changes in average reimbursement introduced by the IRF PPS and it is a strong predictor of average reimbursement (as we'll show in the results). Therefore, β_{avg} measures the elasticity of costs or length of stay with respect to average reimbursement. Finally, note that the above model includes facility level fixed effects and a rich set of demographic and patient characteristics that we describe next.

The individual or patient level covariates in the regression models included the patient's age, gender, race, and location of residence (categorized as a metropolitan county, a county adjacent to a metropolitan area, or county not adjacent to a metropolitan area). The models also included a large set of clinical variables tailored to our stroke, hip fracture, and joint replacement patients intended to control for the severity of each patient at discharge from the acute care hospital. The clinical variables included the following 13 chronic comorbidities: primary cancer with poor prognosis, metastatic cancer, chronic pulmonary disease, coronary artery disease, congestive heart failure, peripheral vascular disease, severe chronic liver disease, diabetes mellitus with and without end-organ damage, chronic renal failure, nutritional deficiencies, dementia, and functional impairment (Iezzoni et al., 1994; Buntin et al., 2005)

The clinical variables also included 21 types of complications that were likely to have arisen during the acute stay, be important for a Medicare population, and have a continued effect after acute care discharge: pulmonary compromise; post-operative gastrointestinal hemorrhage; cellulitis or decubitus ulcer; septicemia; pneumonia; mechanical complications due to a device; implant, or graft; shock or cardiorespiratory arrest in the hospital; post-operative acute myocardial infarction (AMI); post-operative cardiac abnormalities other than AMI; post-operative derangement; coma; procedure-related perforation or laceration; venous thrombosis and pulmonary embolism; wound infection; acute renal failure; delirium; sentinel events; iatrogenic complications; stroke (for joint replacement and hip fracture patients only); hip fracture (for stroke patients only); and other miscellaneous complications (Iezzoni et al., 1994; Buntin et al., 2005).

We also created several condition-specific clinical variables. For hip fracture and joint replacement patients, we created indicators of the type of surgical procedure the patient received. Hip fracture patients were classified as having no surgery, internal fixation, a partial or total hip replacement, and/or a revision of a previous joint replacement. We also classified the location of the fracture. For joint replacement patients, we created indicators for hip or knee replacement, and for whether the patient received multiple replacements. For stroke patients, we created indicators for hemorrhagic stroke and for variants of ischemic stroke.

Finally, the regression models included an indicator for each IRF (i.e., a facility "fixed effect") to control for both measured and unmeasured facility characteristics.

RESULTS

Descriptive Data

There was a substantial increase in average payments to IRFs, ranging from 18% for joint replacement patients to 23% for stroke patients, following implementation of the IRF PPS ($p<.01$) (Table 1). However, there was variation in the magnitude of increase in average payments in the pre-PPS period: IRFs with the lowest pre-PPS payment limits experienced the highest increases in average payments under the IRF PPS, whereas IRFs with the highest limits experienced the lowest increase in payments. This difference in the change in average payments was statistically significant ($p <0.01$) and is consistent with the notion that IRFs with the highest payment limits experienced the most financial pressure under the IRF PPS.

Table 2 compares mean costs and length of stay for IRF admissions in the pre-PPS and post-PPS periods. There was a small but statistically significant increase in costs for joint replacement and hip fracture patients ($p<.01$). Mean length of stay for the initial IRF stay decreased by 5% to 6% for patients with all 3 study impairments (p<.01).[3] Finally, the data show that mean Medicare payments for acute or post acute care after the initial IRF admission increased by 6% to 9% across the 3 study impairments. There was no statistically significant change in rates of return to residing in the community 60 days after the initial IRF admission.

Table 3 shows a remarkable similarity in the patient population before and after the IRF PPS. The distribution of IRF patients according to age, gender, race, Medicaid status, and location of residence did not change significantly after the IRF PPS was implemented. Moreover, the changes in the clinical variables were minor and did not exhibit any pattern suggesting a significant change in the severity or complexity of IRF patients.[4]

Mean IRF Costs and Length of Stay Before and After the IRF PPS

Figures 1 and 2 show trends in mean costs and length of stay for the period January 1, 2001 through June 30, 2003. The trends in the raw data are striking. As shown in Figures 1 and 2, mean IRF costs and length of stay per patient were rising rapidly in the pre-PPS period in all IRFs and for all 3 study impairments. However, there was a substantial and immediate decline in the level of costs and length of stay beginning in the first quarter of 2002 following the IRF PPS. It also shows that facilities with "low" (< $13,000) pre-PPS payment limits

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[3] The sharp decrease in length of stay but negligible increase in costs is most likely explained by rising input prices. We estimate that input prices actually increased by 4.8% between the pre-PPS and post-PPS period: we calculated the input price increase by using CMS's quarterly moving averages from Q1:2001 through Q2:2003 for the market basket inputs used by inpatient rehabilitation facilities. Since the actual increase in payments was lower than 4.8%, and length of stay declined, this suggests that real resource use per discharge declined following the implementation of the IRF PPS – a finding also confirmed by multivariate results.

[4] We also observed a remarkable similarity in patient population before and after IRF PPS even when facilities were classified according to their pre-PPS payment limit: payment limit less than $13,000; payment limit between $13,000 and $16,999; and payment limit greater than or equal to $17,000.

experienced a smaller decline in costs and length of stay compared to facilities with "high" (>$17,000) pre-PPS payment limits.

Table 4 shows the results from the first set of regressions. The results show the percentage change in IRF costs and lengths of stay after the implementation of the IRF PPS, adjusted for a pre-existing time trend (constant growth rate), changes in patient characteristics and changes in characteristics of IRFs, by the pre-PPS payment limit categories. Notably, IRFs with the lowest pre-PPS limits experienced the smallest decrease in costs for the initial IRF stay under the IRF PPS. Thus, the mean costs of treating stroke, hip fracture, and joint replacement patients fell by 6.2% (p<.01), 2.7% (p<.01), and 2.6% (p<.01), respectively, in IRFs with payment limits less than $13,000 after the IRF PPS was implemented. By contrast, the costs of treating stroke, hip fracture, and joint replacement patients fell by 9% (p<0.01), 6.8% (p<0.01), and 6.3% (p< 0.01), respectively, in IRFs with the highest pre-PPS limits. For all 3 study conditions, the change in costs experienced by IRFs with the highest payment limit was significantly different (p<.05) from the change in costs experienced by IRFs with the lowest payment limit.

The bottom panel of Table 4 presents results from our multivariate analysis of length of stay. The results are consistent with the cost results and show that length of stay declined following the implementation of the IRF PPS. The results also confirm our previous finding of a positive association between changes in payments and costs. Consistent with results for costs we find that facilities in the lowest payment category (that experienced the highest increase in payments) experienced the smallest decrease in length of stay. In IRFs with the lowest payment limits the mean length of stay for stroke, hip fracture, and joint replacement patients fell by 8% (p<.01), 4.5% (p<.01), and 3.2% (p<.01), respectively, after the IRF PPS was implemented. However, the drop in mean length of stay was even greater in IRFs with the highest payment limits: 9.8% for stroke ($p<.01$), 7.5% for hip fracture ($p<.01$), and 5.6% for joint replacement ($p<.01$).

In summary, the findings from both the raw data and the costs and length of stay regressions strongly suggest that resource use declined following the implementation of the IRF PPS and the decline in resource use was lesser in facilities that experienced the highest increase in average reimbursement. In other words, the results suggest that both marginal and average reimbursements matter—the elimination of marginal reimbursement (marginal reimbursement is zero under the IRF PPS) led to a decline in costs and length of stay, however, this decline in resource use was mitigated by the increase in average reimbursement following the IRF PPS.

Table 5 shows the results from the instrumental variable (IV) regressions that disentangle the impact of changes in average and marginal reimbursement on costs per discharge. The coefficient on the PPS variable measures the causal effect of reducing marginal reimbursement to zero. The coefficient on Log(Avg. Payment) measures the elasticity of costs with respect to average reimbursement or payment. In addition, we report the first stage F-Statistic for $paylimit * PPS$.

The first stage F-statistics reported in Table 5 shows that our instrument is very strong predictor of changes in average reimbursement. In other words, these results confirm that the magnitude of the change in average reimbursement following IRF PPS was not identical across facilities and depended critically on the pre-PPS payment limit. Thus, $paylimit * PPS$ is a valid instrument for average payment as it is driven by exogenous changes in average reimbursement introduced by the IRF PPS and it is a strong predictor of average reimbursement.

The results in Table 5 show that cost per discharge for stroke, hip fracture, and joint replacement patients fell by 11% ($p<.01$), 8% ($p<.01$), and 7% ($p<.01$), respectively, due to the decrease in marginal reimbursement following IRF PPS. The table also shows that costs also respond to changes in average reimbursement – a 100% increase in average reimbursement for stroke, hip fracture, and joint replacement patients would increase costs by 26%($p<.01$), 34%($p<.01$), and 28%($p<.01$), respectively.

Spillover Effects and Outcomes

Mean Medicare payments for acute and post-acute care services received after IRF discharge increased by 5 to 7 percent after the IRF PPS was implemented for all 3 study impairments (Table 6). However, there was no clear relationship between IRFs' annual payment limits in the pre-PPS period and cost spillovers to other providers. For all 3 study conditions the change in mean Medicare payments following IRF PPS was not statistically different between facilities with high (> 17,000) and low (< 13,000) pre-PPS annual payment limits. These results were conformed in the multivariate analysis that controlled for a pre-existing time trend, patient characteristics and facility fixed effects (results not shown in table). In addition, there was no meaningful change in the use of post-IRF care as measured numbers of days in an acute care or post acute care facility following the initial IRF admission. Thus, the small increase in post IRF payments following the implementation of the IRF PPS most likely reflects Medicare's annual increases in payment rates (to account for input price inflation) rather than changes in resource use.

Table 6 also shows that the changes in costs and length of stay following the implementation of the IRF PPS had little or no impact on the rate of return to community 60 days after the initial IRF admission. We also found no changes in mortality rates following IRF PPS and no evidence of differential impact on outcomes based on a facilities pre-PPS payment limit. Finally, the results from multivariate analyses of outcomes were consistent with results in Table 6 (results not presented).

CONCLUSIONS

We used the implementation of a new prospective payment system for inpatient rehabilitation facilities to investigate the effect of changes in marginal and average reimbursement on costs and length of stay. The results show that the IRF PPS led to a significant decline in costs and length of stay. Changes in marginal reimbursement associated with the move from a cost based system to a PPS led to a 7 to 11% reduction in costs across the three conditions that we studied. The elasticity of costs with respect average reimbursement ranged from 0.26 to 0.34.

The evidence for a causal effect of the IRF PPS on these outcomes is two-fold. First, we observed sizable declines in the levels and growth rates of costs and length of stay directly coinciding with the beginning of the transition to the new payment system in January 2002. Second, the decreases in costs and length of stay were greatest for IRFs that experienced the smallest increase in average reimbursement under the IRF PPS, and lowest for IRFs that experienced the most increase in average reimbursement. This is consistent with more pronounced responses among facilities experiencing the strongest incentives to curb resource use. In addition, we did not find evidence of a change in the types of patients receiving inpatient rehabilitation following the implementation of the IRF PPS—a finding supported by another study using more detailed clinical data and measures of functional status (Carter and Paddock, 2004).

The reductions in resources devoted to IRF patients raise questions about spillover effects on other providers and outcomes. However, we found that implementation of the IRF PPS did not coincide with a change in resource use at other acute and post-acute care providers during the 60 days following a patient's admission to an IRF. Moreover, in contrast to the findings for IRF costs and length of stay, we found no evidence that changes in Medicare payments to other acute and post acute care providers were related to the degree of financial pressure faced by IRFs. Finally, we found that the changes in resource use following the implementation of the IRF PPS had little or no impact on patient outcomes as measured by mortality rates and rates of return to residence in the community 60 days following IRF admission. The implication of these findings is that, when given incentives to do so, IRFs were able to improve their efficiency, producing similar outcomes for similar patients but using fewer resources and days of care.

It is important in evaluating these findings to understand the limitations and context of this study. First, this study examines IRF costs, length of stay, and outcomes for a year-and-a-half following the implementation of the IRF PPS. The data show a marked decline in costs following the implementation of the IRF PPS but continued growth thereafter, albeit at slower rates. It will be important to monitor long-term trends as more data become available. We also acknowledge that more sensitive measures of functional status or quality of life might have captured changes in outcomes, but such data are not nationally available.

Our findings do, however, clearly demonstrate that IRFs responded to both changes in average and marginal reimbursement associated with the IRF PPS by reducing their costs and length of stay consistent with the level of financial pressure they faced. Fortunately these changes do not appear to have had adverse consequences in terms of poor health outcomes or increased costs in other facilities.

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Figure 1: Mean IRF Costs by Annual Payment Limit and Quarter of Discharge from IRF

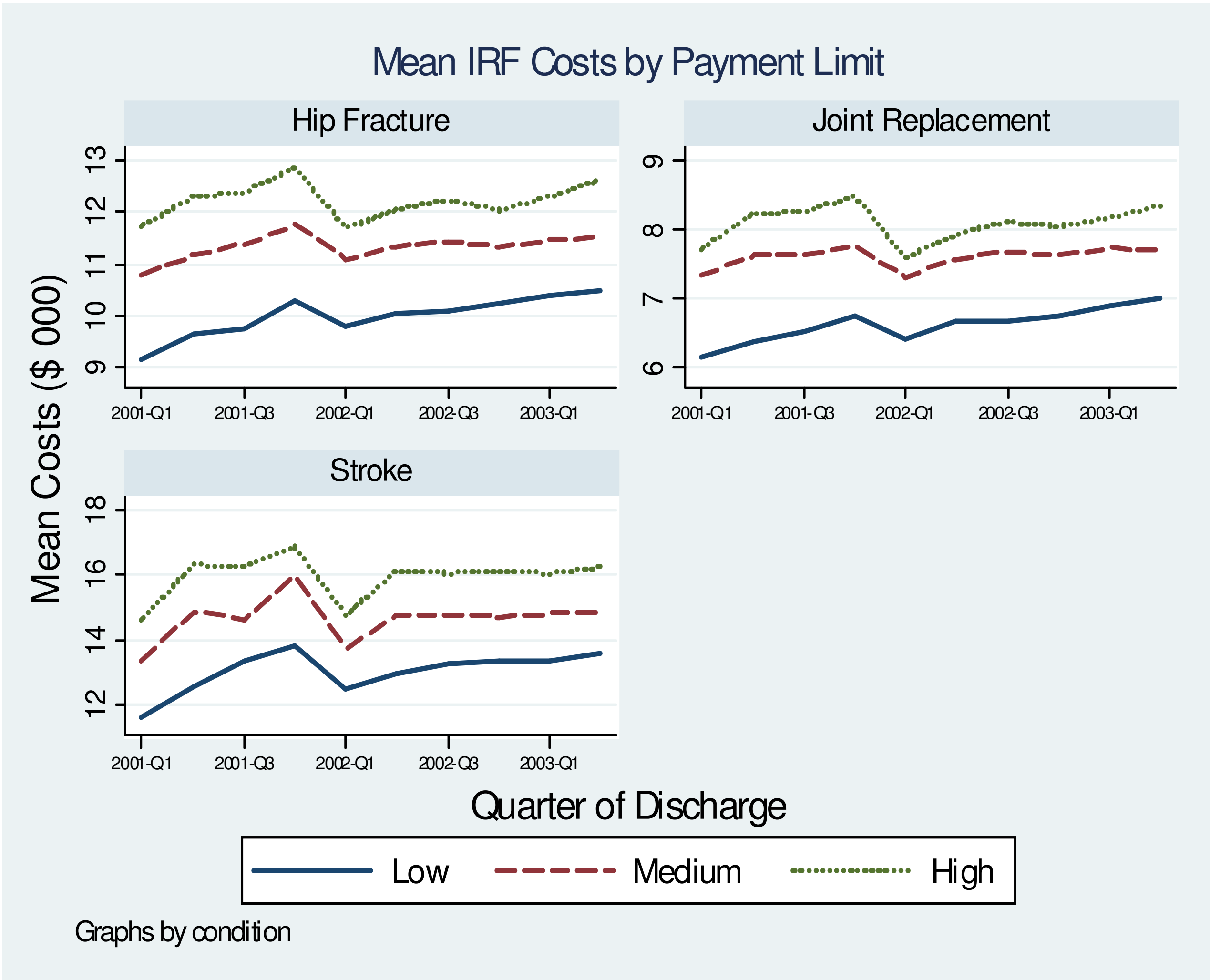

Figure 2: Mean IRF Length of Stay (LOS) by Annual Payment Limit and Quarter of Discharge from IRF

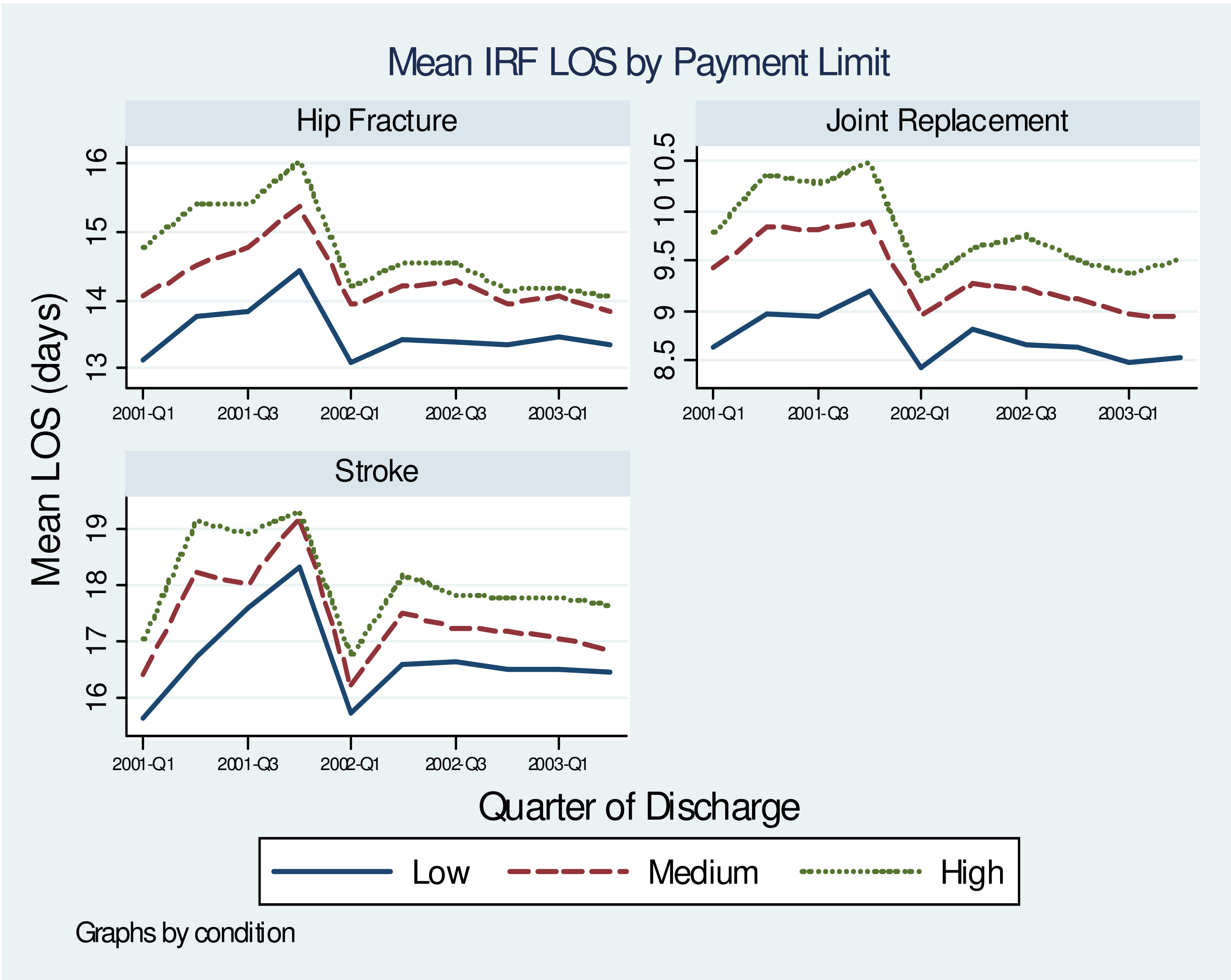

Table 1. IRF Payments by Tracer Condition and Facility Type

	Facilities with 2001 Payment Limit of:															
	< $13,000				$13,000 - $17,000				> $17,000				All Facilities			
	Pre-PPS	IRF PPS	% Change		Pre-PPS	IRF PPS	% Change		Pre-PPS	IRF PPS	% Change		Pre-PPS	IRF PPS	% Change	
IRF Payments($)																
Joint Replacement	$6465	$8294	28%	*	$7778	$8843	14%	*	$8368	$9266	11%	*	$7435	$8764	18%	*§
Hip Fracture	$9700	$12951	34%	*	$11517	$13578	18%	*	$12557	$14143	13%	*	$11172	$13530	21%	*§
Stroke	$12775	$17094	34%	*	$14887	$17562	18%	*	$16327	$19441	19%	*	$14665	$18048	23%	*§

*Difference between pre-PPS and IRF PPS is significant at P < .01

§ percentage change in costs or LOS for IRFs with high pre-PPS limit is statistically different from IRFs with low pre-PPS limit P < .01

Table 2. IRF Costs, Length of Stay and Post IRF Outcomes during the Pre-PPS and IRF PPS Payment Periods

	Condition Type											
	Joint Replacement				Hip Fracture				Stroke			
	Pre-PPS	IRF PPS	% Change		Pre-PPS	IRF PPS	% Change		Pre-PPS	IRF PPS	% Change	
Costs and LOS												
IRF Costs ($)	7322	7418	1.3%	*	11030	11207	1.6%	*	14534	14592	0.4%	
Length of Stay for Initial Episode (days)	9.6	9.0	-5.7%	*	14.6	13.9	-4.9%	*	17.9	17.1	-4.7%	*
Outcomes												
Total Payments for Post-IRF Care ($)	2852	3021	5.9%	*	5935	6357	7.1%	*	6288	6825	8.6%	*
Alive In Community 60 days after IRF admission (%)	96.8	97.0	0.2%		81.3	81.3	-0.1%		74.6	74.7	0.2%	

*Difference between pre-PPS and IRF PPS is significant at P < .01

Table 3. Patient Characteristics by Condition Type during the Pre-PPS and IRF PPS Payment Periods

	Condition Type					
	Joint Replacement		Hip Fracture		Stroke	
	Pre-PPS	IRF PPS	Pre-PPS	IRF PPS	Pre-PPS	IRF PPS
Demographics						
Age (years)	73.7	73.5	80.2	80.1	76.0	76.1
Female (%)	70.7	70.1	75.7	75.5	56.6	56.5
Hispanic (%)	1.3	1.3	1.4	1.4	1.5	1.7
African-American (%)	8.0	8.1	4.1	4.0	14.2	14.4
White (%)	88.5	88.3	92.3	92.3	80.9	80.3
Receiving Medicaid Benefits (%)	11.5	11.9	14.7	15.2	19.8	19.9
MSA (%)	77.4	77.9	77.4	77.5	76.6	77.7
MSA adjacent (%)	13.3	12.6	12.9	12.5	13.5	12.9
non-MSA (%)	9.2	9.4	9.7	9.9	9.9	9.4
Health Status*						
Comorbid conditions (n)	0.54	0.56	0.91	0.94	1.42	1.42
Complications (n)	0.15	0.16	0.20	0.21	0.15	0.16
Any comorbid conditions (%)	40.2	42.0	58.5	59.8	80.9	81.0
Any complications (%)	11.8	12.3	15.2	16.3	11.6	12.5
Condition Specific Factors*						
Partial	1.5	1.3	-	-	-	-
Revision	5.7	5.0	-	-	-	-
Total revision	30.3	30.0	-	-	-	-
Hip replacement	37.5	36.2	-	-	-	-
Knee replacement	62.6	63.8	-	-	-	-
Bilateral procedure	6.3	6.1	-	-	-	-
Petrochanteric fracture	-	-	46.5	46.1	-	-
Partial	-	-	36.8	37.7	-	-
Revision	-	-	0.2	0.2	-	-
Total replacement	-	-	3.9	3.9	-	-
Hemorrhagic stroke (%)	-	-	-	-	9.6	9.6
Basilar artery infraction (%)	-	-	-	-	0.4	0.5
Carotid, vertebral, or multiple artery (%)	-	-	-	-	6.0	5.8

Table 3. Patient Characteristics by Condition Type during the Pre-PPS and IRF PPS Payment Periods (cont.)

*Health status and condition specific factors are based on information coded in the preceding acute care claim**.**

Table 4: Percentage Change in Costs and Length of Stay following IRF PPS by condition and facility type.

	Facilities with 2001 Pre-PPS Limit of:					
	< $13,000		$13,000 - $17,000		> $17,000	
Costs						
Joint Replacement	-2.6%	***	-4.4%	***	-6.3%	***§
Hip Fracture	-2.7%	***	-5.3%	***	-6.8%	***§
Stroke	-6.2%	***	-8.7%	***	-9.0%	***§
Length of Stay						
Joint Replacement	-3.2%	***	-4.7%	***	-5.6%	***§
Hip Fracture	-4.5%	***	-6.0%	***	-7.5%	***§
Stroke	-8.0%	***	-10.5%	***	-9.8%	***#

(*, **, ***) Difference between pre-PPS and IRF PPS is significant at P < (.10, .05, .01)
§ percentage change in costs or LOS for IRFs with high pre-PPS limit is statistically different from IRFs with low pre-PPS limit at P < .05
# percentage change in costs or LOS for IRFs with high pre-PPS limit is statistically different from IRFs with low pre-PPS limit at P < .10

Table 5: Effects of Marginal and Average Reimbursement on Costs

	Conditions		
	Joint Replacement	Hip Fracture	Stroke
Log(Costs)			
PPS	-0.07 ***	-0.08 ***	-0.11 ***
Log(Avg. Payment)	0.28 ***	0.34 ***	0.26 ***
First Stage F-statistic	877.34 ***	453.26 ***	202.49 ***

(*, **, ***) significant at P < (.10, .05, .01)

Table 6. Changes in Outcomes and Medicare Payments for Other Acute and Post-acute Care Services

	Facilities with Pre-PPS Limit of:											
	< $13,000				$13,000 - $17,000				> $17,000			
Values in Dollars ($)	Pre-PPS	IRF PPS	% Change		Pre-PPS	IRF PPS	% Change		Pre-PPS	IRF PPS	% Change	
Joint Replacement												
Total Payments for Post IRF Care	2735	2916	6.6%	*	2817	2990	6.1%	*	3035	3177	4.7%	*
Alive In Community 60 days after IRF admission (%)	97.0	97.0	0.1%		96.9	96.9	0.0%		96.7	96.8	0.1%	
Hip Fracture												
Total Payments for Post IRF Care	5774	6204	7.5%	*	6063	6328	4.4%	*	6004	6556	9.2%	*
Alive In Community 60 days after IRF admission (%)	81.8	81.7	-0.2%		80.4	80.4	-0.1%		81.5	81.6	0.1%	
Stroke												
Total Payments for Post IRF Care	5898	6487	10.0%	*	6337	6911	9.1%	*	6628	7077	6.8%	*
Alive In Community 60 days after IRF admission (%)	75.2	75.3	0.1%		73.4	73.6	0.3%		75.1	75.3	0.2%	

*Difference between pre-PPS and IRF PPS is significant at $P < .01$