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TECHNICAL REPORT

Preliminary Analyses of Changes in Coding and Case Mix Under the Inpatient Rehabilitation Facility Prospective Payment System

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EXECUTIVE SUMMARY

The Balanced Budget Act (BBA) of 1997 mandated use of a prospective payment system (PPS) to pay for Medicare patient stays at inpatient rehabilitation facilities (IRFs). The act also stated that changes in the payment amounts should accurately reflect changes in IRFs' patient case mix—that is, the true cost of treating patients—and not be influenced by changes in coding practices, since such coding changes could overstate IRF resource needs and not reflect actual changes in patient costs.

This report covers our analysis of IRF case mix during 2002, the first year of the IRF PPS, and compares it with case mix under the old system in 1999. The report analyzes the extent to which case mix changes were due to coding change versus real change in the resource needs of IRF patients.

BACKGROUND

The IRF PPS assigns a payment amount to each Medicare rehabilitation patient based on that patient's assignment to a Case Mix Group (CMG). At any given IRF, assignment to a CMG and tier (and thus payment amounts) for almost all cases are determined by four patient characteristics at admission: impairment, functional independence, comorbidities, and age. The amount of the payment for such a patient is calculated by taking the standard payment conversion factor ($12,525 in fiscal year 2004) and adjusting it by multiplying by a relative weight, which depends on the patient's CMG and tier. So, for example, an 80-year-old hip replacement patient with a motor score between 47 and 54 and no comorbidities is assigned a relative weight of 0.5511. Further payment adjustments are made based on the facility characteristics (area wage index, rural location, and share of low-income patients). Payments are reduced for short-stay transfers, defined as cases that are transferred to a hospital or nursing home before the expected length of stay in the patient's CMG.

There were three reasons why we expected that the relative weights and payment rates in the IRF PPS would need refining.

First, better data are available. The earlier sample over-represented freestanding facilities, and consequently under-represented distinct part units of hospitals.

Second, implementation of the IRF PPS was likely to cause important changes in coding. We expected more accuracy and consistency in coding across hospitals now, because of the educational programs that were implemented in 2001 and 2002 and because items that previously did not affect payment (such as comorbidities) are now important factors in determining payment. There were also changes in instructions for using some impairment codes and some measures of functional independence, so that the same patient may be correctly coded differently now than in 1999. Furthermore, there is now a significant incentive to code ambiguous cases in a way that provides the most payment.

It is worth emphasizing that coding can change significantly for a variety of reasons, and often without dishonesty or gaming. However, regardless of the reasons behind coding changes, CMS can use the BBA language to adjust future payments to eliminate the effect of coding changes because the resource requirements of the patients have not increased.

Third, the IRF PPS also provides an incentive to accept a costlier mix of cases. Under the old system (created in 1982 under the Tax Equity and Fiscal Responsibility Act or TEFRA), the same average payment rate applied to all patients and thus there was a strong incentive to admit less costly patients into any IRF where costs exceeded the TEFRA limit. Under the IRF PPS, hospitals will receive more compensation for patients who are more costly due to their impairment, lower function, and/or relevant comorbidities. Thus, many hospitals will have a greater incentive than they had under TEFRA to admit expensive patients. Higher payments that reflect an increase in severity of case mix are appropriate.

METHODS

The Case Mix Index (CMI) is the average relative weight used to pay for the case. In computing this average, short-stay transfers are counted as only a fraction of a case.

This analysis addresses two key questions: (1) How much did the CMI (and therefore payment per IRF case) change between 1999 and 2002? (2)

To what extent were changes due to changing patient resource needs and to what extent to changes in coding?

To address the first question, we derived aggregate totals using CMS bills and matched patient assessments from 1999 and 2002. To address the second question, we analyzed the determinants of the CMI. We analyzed weight per discharge (WPD) separately from changes in short stay transfers.

Because it was not possible to observe directly the coding of each patient, we used information from the patient's preceding acute care hospitalization to predict coding during the IRF hospitalization. We believe that the introduction of the IRF PPS had minimal effect on coding of acute care patients within acute care facilities. Thus changes over time in the acute care records should reflect real change in the rehabilitation population. Therefore, we partitioned changes in WPD into real change and coding change, using information from acute hospitalizations that preceded the rehabilitation admission.

We used two different approaches to estimating real and coding change using statistical models and acute care data. The first approach underestimates real change and overestimates coding change. The second approach overestimates real change and underestimates coding change. Thus we are confident that the truth lies somewhere between these two estimates.

First Set of Estimates

The first approach derived estimates based on the following two working hypotheses, illustrated in Figure S.1:

- Changes over time in characteristics recorded during the acute hospitalizations preceding inpatient rehabilitation are the result of real change in rehabilitation case mix.
- Changes over time in IRF coding of patients that had similar acute characteristics reflects coding change

If the acute care characteristics were perfect predictors of rehabilitation characteristics and acute care coding did not change, these two hypotheses would necessarily be true.

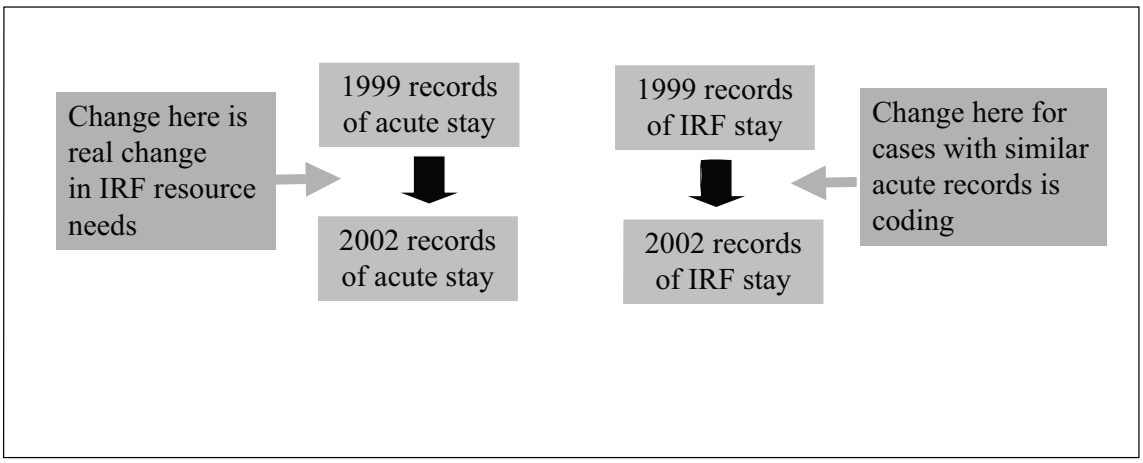

Figure S.1 Using Acute Care Records to Predict Real and Coding Changes in IRF Records

To illustrate the assumptions of this first set of estimates, suppose, for example, that IRFs recorded a greater number of patients on dialysis in 2002 than in 1999. If we find that more patients received dialysis during their acute care stay in 2002 than in 1999, then it is likely that IRFs were treating a greater number of patients with dialysis. Conversely, if the number of patients receiving dialysis in acute care did not change, but the IRFs reported dialysis for a greater percentage of the dialysis patients found in the acute care record, it is likely that the increase is due to coding changes, since it is unlikely that patients in rehabilitation are developing a need for dialysis that was not present during acute care.

We began with four models to predict each of the IRF stay characteristics that determine case weight: Rehabilitation Impairment Category (RIC), comorbidity tier, motor score (the measure of functional independence that most determines relative weight), and transfer status. Each of the first three models is based on characteristics found in the preceding acute stay. We predicted RIC based on the principal diagnosis of the acute stay and on major procedures performed during the stay (e.g., joint replacement, amputations, etc.). We predicted comorbidity tier based on all diagnoses during the acute stay and on a small set of procedure codes (e.g., hemodialysis, tracheostomy, etc.). We predicted motor score based on our predictions of RIC, predictions of tier, age, and a selected set of additional comorbidities. We predicted transfer

status from Medicare bills and nursing home assessments for the day of IRF discharge.

We then regressed weight per discharge in 1999 on all the variables that predict any of these rehabilitation characteristics:

- predicted RIC
- predicted tier
- age
- additional comorbidities found in acute care
- predicted transfer status

We then took the acute care characteristics of each 2002 discharge and predicted its weight using the coefficients from the 1999 regression. *If coding in 2002 of cases with each set of acute care characteristics was similar to coding in 1999 and if there were no patient selection within acute care groups*, then the difference between the model's prediction and the 1999 actual average weight per discharge is the increase in weight per discharge due to real case mix. This is our first estimate of real change. Further, the difference between the actual 2002 weight per discharge and the model's prediction is our first estimate of coding change because the sum of coding change and real change must add to the total change.

If the acute care characteristics were unbiased predictors of weight per discharge, this procedure would give us unbiased estimates of real and coding change. However, it is possible that hospitals might have selected patients during 2002 that had a higher weight from among all patients with the same acute care characteristics than were selected in 1999. If hospitals did in fact select in this way, this first set of estimates will underestimate real change and overestimate coding change. Thus the first estimate of real change is really only a lower bound on real change, while the estimate of coding change is an upper bound. The lower bound estimate of real change is the minimum amount of real change that occurred (the actual number could be higher) and the upper bound on coding is the maximum amount by which coding changed the CMI (the actual number could be lower).

Second Set of Estimates

Our second set of estimates of real and coding change accounts for possible patient selection by IRFs from among possible patients with

similar acute care characteristics. In this method, we attempted to model the results of a plausible selection process. When the observed data contradict what we see as a plausible selection process, we attribute that difference to coding change and thus get our second estimate of coding change and real change. In using this second approach we treat all change as real change except that which is not consistent with selection. Thus the biases in the estimate run in the opposite direction from those of the first set of estimates, and we therefore expect both real change and coding change to lie between the two estimates of real and coding change. Separate models were used for changes in RIC, tier comorbidities, and motor score.

DATA

We compared change in WPD between calendar year (CY) 2002 and the 1999 data that were used to develop the weights. The 1999 discharges in our analytic sample were bundled according to the interrupted stay rules, resulting in 247,461 cases that were used to calculate weights. Further information about this sample may be found in Carter et al. (2002).

We combined three sources of 2002 data on each IRF patient. First we used the IRF Patient Assessment Instrument (PAI). This provided impairment group code, a list of up to 10 comorbidities, and measures of functional independence at admission as well as demographic information, provider number, and admission, discharge, transfer, and return dates. Our second source of data was inpatient bills submitted to the Fiscal Intermediaries by the IRFs. These bills contain provider number, beneficiary number, age, admission date, and discharge date, which allow us to match most bills to an IRF PAI record. Our third source of data was other Medicare bills for IRF patients. For most analyses we used only the bill for the acute hospitalization that preceded admission to the IRF, provided it occurred in the month preceding rehabilitation admission. In both 1999 and 2002, 94 percent of IRF cases had a preceding acute care stay. For analyses of changes in transfers we used bills that covered the day of discharge. For completeness, we also use nursing home assessments (MDS records) for patients whose nursing home stay was not paid by Medicare.

RESULTS

Overall

Table S.1 shows the Case Mix Index and weight per discharge in each year. The CMI increased 4.55 percent, and the average WPD increased by 3.4 percent. The difference between these two rates of increase is due to an increase in short-stay transfers and to a decrease in the average LOS of short-stay transfers relative to the expected LOS in their CMG.

Table S.1

Change in Case Mix Index and Average Weight per Discharge between 1999 and 2002

Year	Case Mix Index	Weight per discharge
1999	1.0000	0.9413
2002	1.0455	0.9733
% increase	4.55%	3.40%

We find little evidence that the patients admitted to IRFs in 2002 had higher resource needs than the patients admitted in 1999. Despite the change in payment, most of the changes in case mix that we documented from the acute records imply a case mix with *lower* resource needs in 2002 than in 1999

The last line of Table S.2 shows our estimated bounds on real and coding change under the assumption that all real change would be reflected in changes in the acute care received prior to IRF admission. Based on the acute care records, we estimate that the resource needs of IRF patients, as measured by weight per discharge, declined by 3.45 percent between 1991 and 2002, and that coding change accounted for a 6.84 percent increase in WPD.

The first line of the table shows that most of the decline in real WPD occurred because of a change in the impairments of patients admitted to IRFs. Adding predicted tier, although it is highly statistically significant, has little effect on estimates of either real or coding change. Adding additional predictors of function at admission shows a further small decline in real case mix and the additional real increase in short-stay transfers further decreased WPD.

Table S.2

Lower Bound on Real Change in Weight per Discharge and Upper Bound on Coding Change in Weight per Discharge

Independent variables	Weight per discharge: Estimated real change	Weight per discharge: Estimated coding change	Percent change in WPD: Estimated real change	Percent change in WPD: Estimated coding change
Predicted RIC only	-0.0258	0.0578	-2.74%	6.14%
Predicted RIC and tier	-0.0258	0.0577	-2.74%	6.13%
Predicted RIC, age, tier, and other comorbidities related to function	-0.0282	0.0601	-3.00%	6.39%
Predicted RIC, age, tier, other comorbidities related to function, and transfer	-0.0325	0.0644	-3.45	6.84

The measured decline in case volume from the increase in short-stay transfers and decline in their relative LOS was almost entirely (95.5 percent) real change. Although coding of transfer status on the bills improved substantially between 1999 and 2002, the assessment data that we used to identify transfers in 1999 was just about as accurate as the 2002 bill data used for payment.

Below, we provide details of the changes in WPD, including our second set of estimates of coding change, which we believe are lower than actual coding change.

Impairment

Most of the decline in real weight per discharge occurred because of a change in the impairment of patients admitted to IRFs. Changes in predicted impairment were concentrated in two areas:

(1) a 16-percent decrease in the proportion of IRF patients who came following acute hospitalization for stroke (from 16.42 percent in 1999 to 13.76 percent in 2002). These patients had much higher than average weights in both years, so, all other things equal, this decrease will cause an decrease in WPD.

(2) a 22-percent increase in the proportion of IRF cases who came following a lower extremity joint replacement (from 18.65 percent in 1999 to 22.81 percent in 2002). These patients had much lower than average weights in both years, so, all other things equal, this increase

will cause a decrease in WPD. Changes in RIC assignment mirror this change in predicted impairment.

Although most of the change in assignment of RIC was true change, there was also coding change. Our predictions of RIC based on the principal diagnoses and major procedures in the preceding acute stay and our understanding of the rules were correct for about 5 percent more cases in 2002 than in 1999. We believe these corrections were due to improvements in IRF coding of impairment. For example, there was a noticeable decline between 1999 and 2002 in the percent of cases that had an acute principal diagnosis of hip fracture that were incorrectly assigned to the lower extremity joint replacement RIC 8. The net effect of all the RIC corrections was a lowering of weight per discharge by two-tenths of one percent. Table S.3 reports our direct estimates of coding change with the effect of the improved coding of RIC in the first line.

Table S.3

Percent Increase in WPD from Direct Estimates of Coding

Type of coding	Change in WPD	% change in WPD
Impairment improvement	-0.0019	-0.20%
Change in bladder, bowel items	0.0097	1.03%
Change in tier coding		
Tiers not related to cost	0.0011	0.12%
Increased tier coding	0.0088	0.93%
Total lower bound on coding	0.0177	1.88%

Functional Independence

The average motor score declined by 5.8 percent from 1999 to 2002. Lower motor score cases have less functional independence and a higher relative weight. Despite the coded increase in dysfunction, predictors of function at admission show a slight further decline in severity of case mix. An increase of 1 percent in the motor score was predicted from acute care characteristics, including predicted RIC.

The increase in apparent bowel and bladder dysfunction is noteworthy. The interpretation of responses to these items changed between 1999 and 2002. We believe that hospitals would not

differentially select these cases over other functional areas and that therefore, greater 'downcoding' of these two motor items reflects changes in the coding rules rather than an increase in real case mix. If the bowel and bladder items had declined only at the rate of other items, the total motor score decline would have been only 78.5 percent as large as observed. Thus we attribute 21.5 percent of the increase in WPD due to lower motor score to coding.

Comorbidity

There are indications of both real and coding change in comorbidities. Some indications of real change in comorbidity were consistent with a decrease in weight per discharge. For instance, there was a 9-percent decrease in the percentage of cases with an acute care record that indicates a tier 1 comorbidity (from 3.84 percent of cases to 3.55 percent of cases.).

The only sign of real change consistent with an increase in weight per discharge that we found was an increase in the number of cases whose acute care record shows a tier 3 comorbidity. This number increased by 3.5 percent from 20.09 to 20.77. However, because the weight of cases with a tier 3 comorbidity is so much smaller than the weight of cases with a tier 1 comorbidity, the total effect of tier conditions found in acute care is essentially 0.

A set of 10 tier diagnoses was found not to cause greater case cost. Increases in these diagnoses do not affect real resource use and thus should not affect future payments. However, these diagnoses increased much more than average, and therefore we count the effect of this increase on WPD as coding.

Although we cannot test the hypothesis that hospitals might have selected cases with active tier comorbidities from among those with and without indicators of tier comorbidities on their acute record, we believe that a reasonable selection process would have two properties. Increased selection of patients with tier comorbidities should occur at least proportionally from among those with tier comorbidities recorded in acute care as from among those whose acute care record does not record it. Second, hospitals would not discriminate against cases with a tier comorbidity on their acute record. Using these assumptions, we

estimate that coding was responsible for the majority of the effect of the increase in tier incidence on WPD.

Age

Age does not present a coding issue, since it can be assigned accurately. Weight per discharge is somewhat related to age, being slightly U-shaped, with the highest weights found among the oldest and youngest and the lowest weights being in the 65 to 74 age groups. We found that changes in the distribution of the age of IRF patients were quite modest and had little effect on weight per discharge. If we assume that weight per discharge within each age group were, in each year, at the average of the two years, then the weight per discharge would decline by three-hundredths of 1 percent due to the slight change in the age distribution.

IMPLICATIONS

Combining the last lines of Tables S.2 and S.3, we estimate that weight per discharge was between 1.9 percent and 6.8 percent higher in 2002 than in 1999 for reasons unrelated to resource use, largely coding changes. Since the change in the volume of cases due to short-stay transfers was essentially all real, coding increased the CMI by between 1.9 percent and 6.9 percent. Correspondingly, we estimate that the range of real change in the CMI was somewhere between a decline of -2.4 percent (if coding caused a 6.9 percent increase since 1999) and an increase of 2.6 percent (if coding caused only a 1.9 percent increase).

The conversion factor was not based on our case sample alone. CMS' Office of the Actuary projected TEFRA payments to obtain the budget neutral conversion factor. Part of the conversion factor calculation involved using a RIC prediction formula similar to the one used here. It was applied to the entire universe of 1999 IRF cases, and showed that, even in 1999, the population had a distribution of predicted RIC with lower weights than our sample. In response to this finding, CMI used a conversion factor that was 1 percent higher than the conversion factor that would have matched cost just within our sample. Thus, one-third of the approximately 3-percent decline in real case mix from impairment was already taken into account in setting the 2002 rates. This affects our lower and upper bounds on how real and coding change

affected payments. Thus, our final bounds on the causes of the increase in the CMI are:

- coding change between 1.9 percent and 5.9 percent
- real change between a 1.4-percent decline and a 2.4-percent increase

Given these findings, we recommend that CMS either reduce weights by at least 1.9 percent or reduce the conversion factor by at least 1.9 percent below what it otherwise would be in order to ensure that future payments reflect only real changes in resource needs.