
DRG 416: SEPTICEMIA



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Entitled "DRG 416: Septicemia," this inspection was conducted to analyze the characteristics of discharges paid as DRG 416. The report was prepared by BOTEC Analysis of Cambridge, MA under contract HHS-100-88-0019 and the Office of Analysis and Inspections, Health Care Branch. The following people participated in this project.

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DRG 416: SEPTICEMIA

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EXECUTIVE SUMMARY

BACKGROUND

Septicemia is a bacterial infection of the blood. Pathologically, the microorganisms multiply briskly in the rich medium, secrete toxins, and rapidly overwhelm the patient's defenses. Gram negative organisms pose particular medical dangers. The prolonged, complex hospital course carries a high relative weight. The National DRG Validation Study suggested a high rate of overpayments for diagnosis related group (DRG) 416. This inspection further quantifies the initial work.

FINDINGS

- Discharges billed as DRG 416 have a 40.5 percent rate of actually grouping to a different DRG. This rate significantly exceeds the 20.8 percent for all DRGs.
- The hospital overpaid itself in 91.9 percent of coding errors. This proportion significantly exceeds the 59.2 percent for all DRGs.
- These mis-assignments project to \$69 million in overpayments annually.
- One-half of the incorrectly paid discharges in this sample should have been billed to an alternative DRG within Major Diagnostic Category (MDC) 11 (kidney and urinary tract) or MDC 18 (infectious disease). Particularly common errors involved mis-assigning discharges grouping to fever of unknown origin (DRG 419) or urinary tract infection, site not specified (DRG 320).
- Patients received poor quality of care in 15.3 percent of hospitalizations. This rate significantly exceeds the 5.5 percent for all DRGs.

RECOMMENDATIONS

- The Health Care Financing Administration (HCFA) should direct the peer review organizations (PROs) to review prospectively all DRG 416 discharges for both coding accuracy and poor quality care. This action would recover \$69 million annually.

- The HCFA should direct the PROs to educate physicians and coders about the proper assignment of DRG 416, and about methods of distinguishing septicemia from fever of unknown origin and urinary tract infection, site not specified.

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INTRODUCTION

Background

On October 1, 1983, the Health Care Financing Administration (HCFA) began implementing a new system of payment for inpatient hospital services under the Medicare program. The new prospective payment system (PPS) replaced the cost-based reimbursement system. Congress mandated this change because of rapid growth in health care costs, particularly inpatient expenses under Medicare.

Under PPS, hospitals received a pre-established payment for each discharge, based upon the diagnosis related group (DRG) to which the discharge is assigned. The PPS classified discharges into clinically coherent groups which used similar amounts of hospital resources, based on variables such as diagnosis; evaluation and treatment procedures; and patient age, sex, and discharge status. Each of the 475 DRGs had an associated relative weight, which represented the average cost for hospital care provided to patients with diagnoses grouping to that DRG as a proportion of the cost of the average patient. The hospital received this payment, independent of the actual length of hospitalization or cost of treatment for the individual patient. With certain exceptions, the hospital retained any surplus from patients consuming less than the expected amount of resources, and suffered losses on those patients consuming more.

The shift from cost-based, retrospective reimbursement to prospective payment constituted one of the most dramatic changes in health care reimbursement since the creation of Medicare. A fixed payment per discharge induced hospitals to implement economies and reduce unnecessary services. The total payments to the hospitals provided the same financial resources for patient care. In effect, PPS reversed the financial incentives for hospitals. Where the cost-reimbursement system rewarded longer hospital stays and more costly treatments, PPS rewarded earlier discharges and less costly procedures.

PPS vulnerabilities

The advent of PPS created new opportunities for manipulation or "gaming" to increase hospital revenues from Medicare patients. To protect the integrity of PPS and maintain quality of care Congress established the peer review organizations (PROs) to monitor hospital activities.

The Office of the Inspector General (OIG) conducted the National DRG Validation Study to survey the general accuracy of DRG assignment and quality of care performed by hospitals under PPS. Its examination of over 7,000 medical records established that assignment errors resulted in \$300 million in overpayments to hospitals and that the majority of overpayments could be traced to assignment errors affecting a small number of DRGs. This report is one in a series examining assignment accuracy of one of the DRGs identified as having the highest impact on overpayments under PPS and the greatest potential for cost recovery.

PPS gaming takes two principal forms: optimization and creep. "Optimization" strategies adhere to coding rules, but maximize hospital reimbursements by selecting the most expensive among viable alternative principal diagnoses or adding more secondary diagnoses. The PPS permits optimization, which flows from the basic incentive structure of the PPS system.

"DRG creep" results from coding practices which do not conform to coding rules. Sources of DRG creep include:

- **Misspecification:** The attending physician writes an incorrect principal diagnosis (defined by the Uniform Hospital Discharge Data Set (UHDDS) as "that condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care"), secondary diagnoses, or procedures on the attestation sheet.
- **Miscoding:** The hospital assigns incorrect numeric codes to diseases or procedures correctly attested to by the attending physician.
- **Resequencing:** The hospital substitutes a secondary diagnosis for the correct principal diagnosis.

Auditing and review practices seek to curtail creep by identifying discharges in which coding rules are misapplied or ignored.

Claims processing

Under PPS, the hospital files a claim for Medicare reimbursement upon discharging the beneficiary. At the time of discharge, the attending physician attests to the principal diagnosis which caused the patient's admission to the hospital, secondary diagnoses, and procedures (diagnostic and therapeutic) provided. The hospital translates the narrative diagnoses of the physician's attestation statement into numeric codes based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), and prepares a claim. Fiscal intermediary (FI) organizations, working under contract with HCFA, enter the hospital's codes into the GROUPER computer program which assigns the appropriate DRG for reimbursement.

Hospital reimbursement is calculated by multiplying the "relative weight" of each DRG category by a standardized amount, as modified by certain hospital-specific factors. The relative weight of each DRG varies above or below the mean relative weight for all DRGs (approximately 1.0000) according to the average amount of hospital resources used by patients in that diagnostic group. The higher the relative weight, the greater the reimbursement. Mis-assignment of the ICD-9-CM categories, or erroneous assignment or sequencing of patient diagnoses, can thus have significant financial implications.

DRG 416

This study examines erroneous assignment and gaming in a single DRG: 416, "septicemia age ≥ 18 ." In septicemia or "blood poisoning," bacteria infect the bloodstream. A variety of pathogens can invade the blood. They can enter through skin wounds, gastrointestinal tract, intravenous catheters, intravenous drug abuse, or other portals. The microorganisms reproduce rapidly in the rich culture medium. Most septicemias carry a grave prognosis. DRG 416 does not include blood infections that derive from anatomic defects of the heart valves (endocarditis: DRGs 135-7) or vessel walls (thrombophlebitis: DRGs 130 and 131).

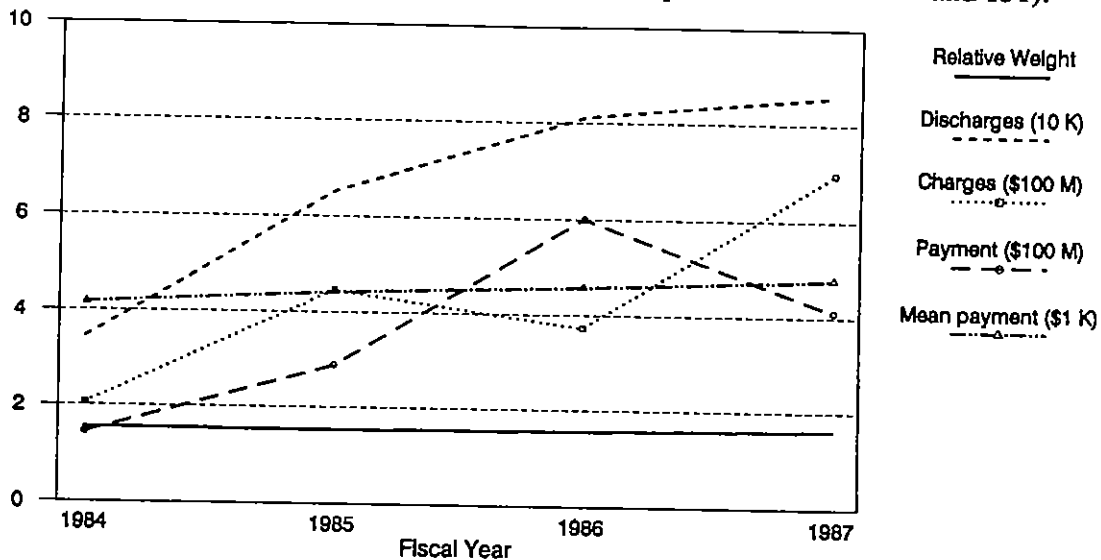


Figure 1: DRG 416 -- Septicemia

The invading bacteria may secrete toxins that cause the clinical symptoms of septicemia: fever, chills, skin eruptions, and gastrointestinal abnormalities. Diagnosis depends upon multiple blood cultures, but these tests may repeatedly fail to identify a causal organism. Therapy involves fluid support and parenteral antibiotics. Use of steroids remains controversial. Common complications include metastatic infection to the joints, brain, and abscesses; and septic shock.

A variety of other diseases have similar symptoms. In particular, uncontrolled urinary tract infections can induce systemic symptoms such as fever. However, a urine analysis or culture will reliably identify the location of the infection. A continuous fever for three weeks with daily temperatures exceeding 101 degrees Fahrenheit and which remains undiagnosed after 1 week of intensive hospital workup comprises a "fever of unknown origin" or FUO. Septic patients would not normally linger for so long a period (i.e., survive) without the underlying cause declaring itself. Proper diagnostic testing should distinguish urinary tract infections and FUOs from septicemia.

The incidence of DRG 416 and charges for it have risen steadily since the inception of PPS. Their rates of increase outpaced the general escalation in PPS costs.

Methodology

This study used a stratified two-stage sampling design based on hospitals to select medical records for review. The first stage used simple random sampling without replacement to select up to 80 hospitals in each of three bed-size strata: less than 100 beds (small), 100 to 299 beds (medium), and 300 or more beds (large). The second stage of the design employed systematic random sampling to select 25 DRG 416 bills from each strata for Medicare discharges between October 1, 1984 and March 31, 1985.

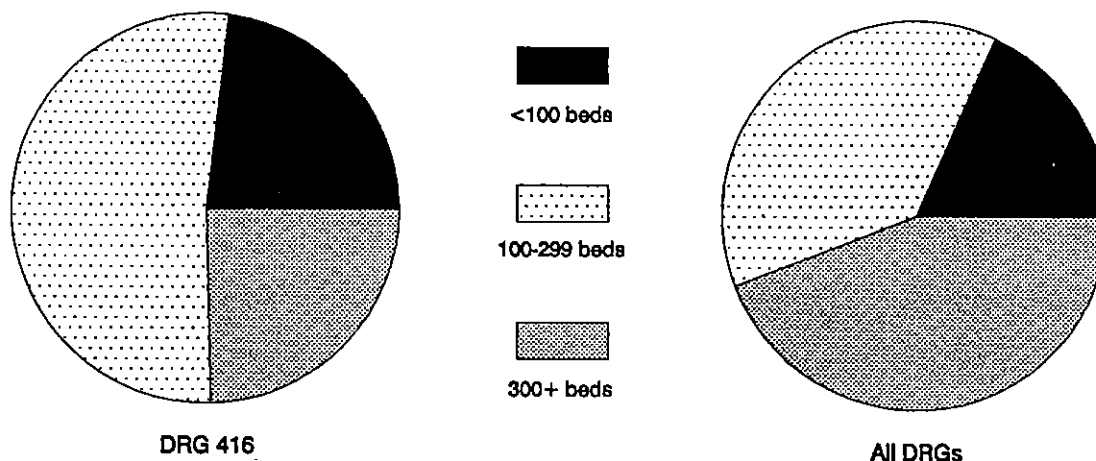


Figure 2: Sampling frame

The OIG contracted with the Health Data Institute (HDI) of Lexington, Massachusetts to reabstract the medical records. Upon receipt, the contractor "blinded" the ICD-9-CM codes by covering them, and assigned an identification number to each record. An Accredited Record Technician or Registered Record Administrator proficient in ICD-9-CM coding reviewed the entire record to substantiate the principal diagnosis, other diagnoses, and procedures indicated by the attending physician in the narrative attestation form. Any records which did not support the assigned DRG classification were referred to physician reviewers. The physician reviewers designated the correct Uniform Hospital Discharge Data Set principal diagnosis, and additional diagnoses and/or procedures which were substantiated by the patient records. The GROPER computer program processed the reabstracted ICD-9-CM codes to determine correct DRGs. A full discussion of the methodology and findings of the contractor record review is available in the final report of the National DRG Validation Study (available from OIG Public Affairs).

DRG 416 was chosen for this inspection because of its high error rate and relative weight (1.5343). The OIG contracted with BOTEC Analysis of Cambridge, MA to examine data for DRG 416 in greater detail, to identify sources of coding errors, and to make recommendations for recovery of overpayments.

FINDINGS

Sample

In FY 1985, 65,237 of the 8.3 million prospective payment discharges (0.8 percent) grouped to DRG 416. The National DRG Validation Study estimates that the majority came from medium size hospitals, with the remainder split evenly between the other strata. In the first half of FY 1985, the 239 hospitals selected in stage one of the sample design (the sampling frame) billed for 222,396 discharges of which 1,493 came from DRG 416 (0.7 percent). The first stage of the sample design therefore over-represents large hospitals.

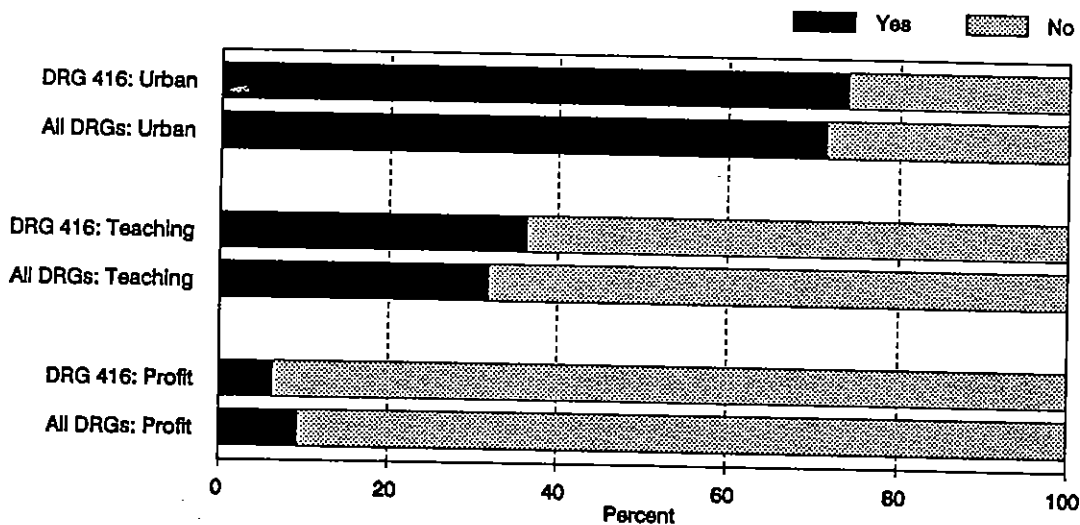


Figure 3: Hospital demography

Additionally, the two-stage sample design permits calculation of separate results for Medicare beneficiaries (the probability of something happening to a person) and hospitals (the odds of an event at a particular hospital). The appendices, table, and charts therefore report individual totals weighted by both discharges and hospitals.

The sample design intentionally distributes its discharges evenly between small, medium, and large hospitals (Chi-square 0.03, df 1, $P < 0.75$). Like the National DRG Validation Study, the majority of DRG 416 discharges came from urban (Mantel-Haenszel chi-square 0.02, df 1, $P < 0.9$), nonteaching (Mantel-Haenszel chi-square 0.08, df 1, $P < 0.75$), and nonprofit (Mantel-Haenszel chi-square 0.1, df 1, $P < 0.9$) hospitals.

Weighted by discharge, patients assigned DRG 416 averaged 79.3 years of age, almost 6 years older than National DRG Validation Study discharges (T-test 2.22, df 72, $P < 0.05$). The former sample's higher proportion of males did not attain statistical significance (Mantel-Haenszel chi-square 0.57, df 1, $P < 0.5$). Discharges billed as DRG 416 had an average length of stay 2.3 days longer than National DRG Validation Study discharges. Payment for patients discharged as DRG 416 averaged nearly \$1,200 more per patient than the average reported in

the National DRG Validation Study. Discharges assigned to DRG 416 died nearly five times as often as the average for all DRGs as reported in the National DRG Validation Study. The high mortality rate reflects the grave prognosis associated with septicemia.

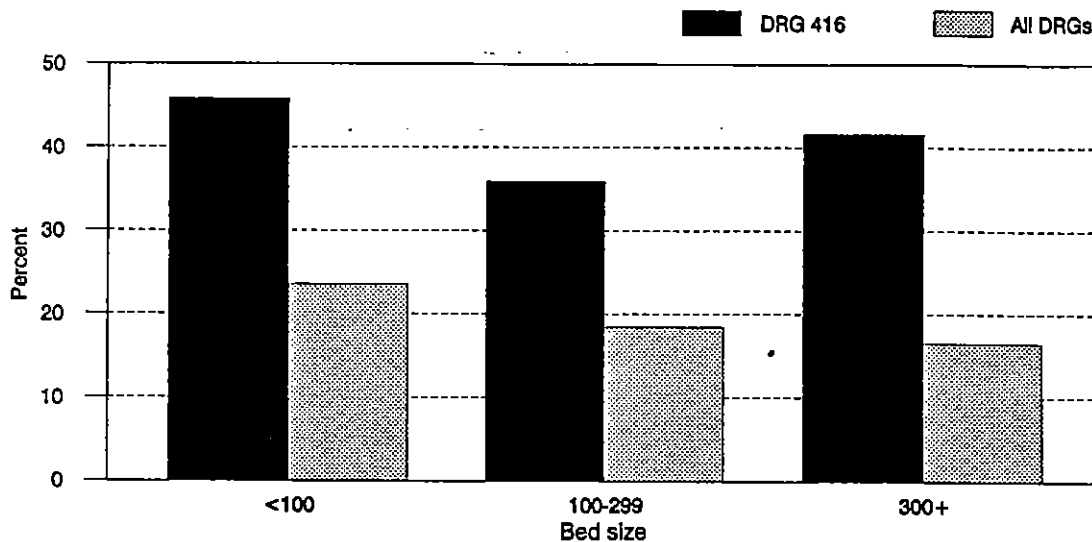


Figure 4: Assignment errors

Coding mis-assignments

Overall, 40.5 percent of discharges paid as DRG 416 changed to a different DRG after abstraction. This rate of errors is more than twice that reported in the National DRG Validation Study (Mantel-Haenszel chi-square 20.54, df 1, $P < 0.001$). Weighted by discharge, DRG 416 errors occurred more frequently in rural, nonteaching, and nonprofit hospitals. When compared to the National DRG Validation Study, assignment errors occurred more frequently in all hospital types except for-profit hospitals. In each bed size category, the rate of errors in DRG 416 roughly doubles that in each category for the National DRG Validation Study. Within the sample, errors were more likely in small and large hospitals than in mid-sized hospitals (Chi-square 0.49, df 2, $P < 0.5$).

Patient demographics, weighted by discharge, indicate that DRG 416 discharges assigned incorrectly were older, more likely male, and enjoyed a lower mortality rate than discharges assigned correctly. The latter finding contrasts the grave prognosis of septicemia with the better outcomes expected for less serious diseases miscoded into DRG 416. Length of stay and average reimbursement did not differ significantly between correctly and incorrectly assigned discharges.

Direction of errors

Weighted by discharge, 91.9 percent of errors in DRG 416 resulted in overpayments to the hospitals. This rate significantly exceeds the 59.7 percent overpayments in the National DRG Validation Study (Mantel-Haenszel chi-square 18.9, df 1, $P < 0.001$). Examined by hospital

demography, in all categories but for-profit institutions, the rate of overpayment measured higher for DRG 416 discharges than in the National DRG Validation Study. The 91.9 percent overpayment rate for DRG 416 when combined with the 40.5 percent error rate for DRG 416 yielded an effective overpayment rate of 36.9 percent, more than three times that of the National DRG Validation Study (11.1 percent). The proportion of overpayments for DRG 416 was highest among large hospitals (100.0 percent) and lowest among mid-sized hospitals (77.8 percent) (Chi-square 1.32, df 2, $P < 0.75$).

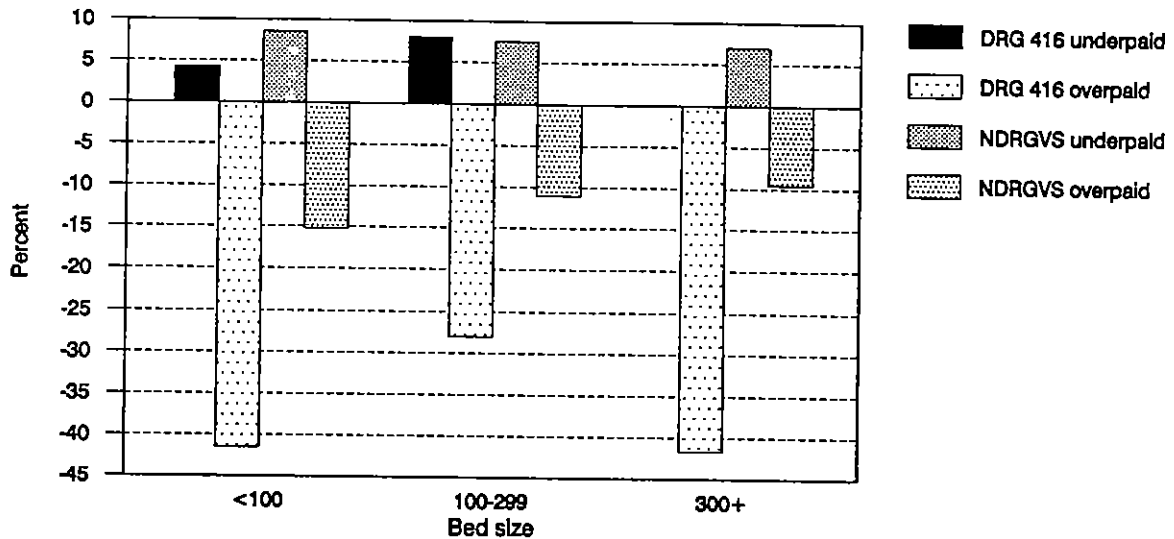


Figure 5: Direction of errors

Errors resulting in overpayments to hospitals (discharge weighted) occurred at the highest rate in urban (96.2 percent), nonteaching (88.5 percent), and nonprofit (93.2 percent) hospitals. The restricted size of the underpayment subsample limits comparison of patient demographics.

Department responsible for error

The vast majority (93.2 percent) of errors in DRG 416 discharges occurred when the medical records department incorrectly coded the discharge as DRG 416 and the hospital billed it accordingly. Only two of 30 errors resulted when medical records departments correctly selected a different diagnosis, but the hospital administration incorrectly billed it as DRG 416 anyway. This rate closely approximated the 91.2 percent of the National DRG Validation Study. Coding department errors caused the majority of errors in all sampling strata.

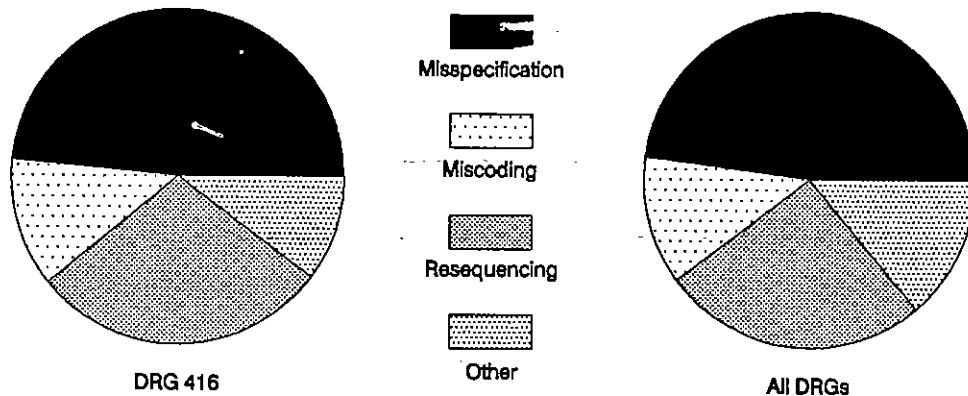


Figure 6: Reasons for errors

Reasons for errors

Mis-specification errors by the attending physician, in writing down the wrong diagnosis or procedure, caused 14 of the 30 assignment errors in DRG 416. When examined using an exclusive analysis (identifying the first error to occur chronologically), physicians mis-specified the principal diagnosis in 46.7 percent of discharges. Resequencing of the principal and secondary diagnoses by the hospital accounted for one-third of the errors in the DRG 416 sample. These proportions largely paralleled the results of the National DRG Validation Study.

Financial effects

Appendix F-1 shows the average and aggregate change in relative weight for DRG 416 discharges following reabstraction. After reabstraction, the average relative weight for DRG 416 discharges changed 13.2 percent (discharge weighted) from 1.5343 to 1.3033. For the 73 discharges in this sample, this aggregated to a total decrease in relative weight of 16.8630 (15.0 percent unweighted).

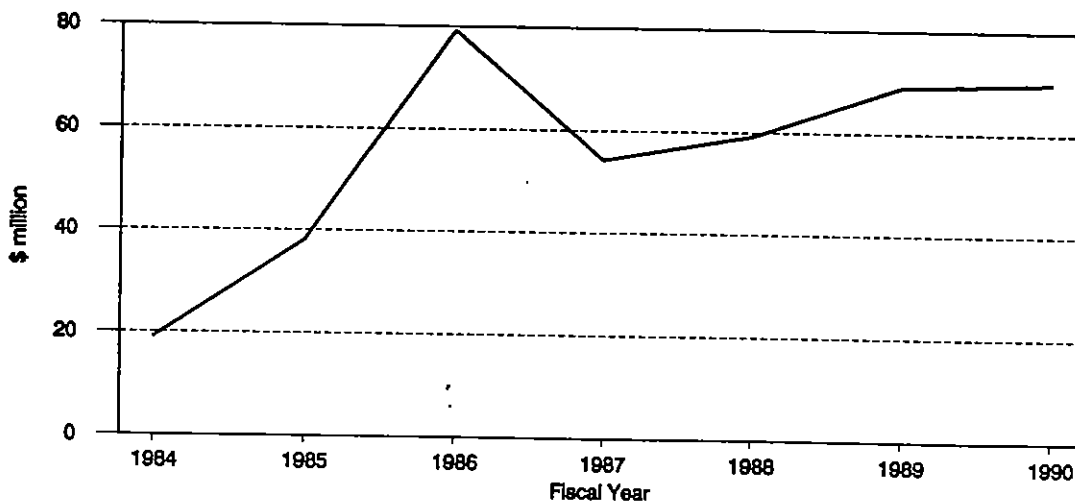


Figure 7: Projected overpayments

Extrapolated to the entire Medicare population, if the net rate of overpayment remained constant, mis-assignment of DRG 416 caused \$38.1 million in overpayments during the study year. The projected erroneous payments increase steadily to \$69.9 million annually.

Correct DRGs

DRG 416 falls into Major Diagnostic Category (MDC) 18: infectious diseases. Appendix G-1 reveals that the majority of discharges incorrectly assigned to DRG 416 came from only two MDCs.

- MDC 18: Infectious diseases
- MDC 11: Kidney and urinary tract disease

Reviewers reassigned 26.7 percent of the discharges to MDC 18 (but to DRGs other than 416) and 23.3 percent of the discharges to MDC 11.

In addition, five of the eight discharges reassigned to MDC 18 came from DRG 419 (fever of unknown origin) and five of the seven reassigned to MDC 11 came from DRG 320 (kidney and urinary tract infections, age 70 and/or complicating conditions). Both of these DRGs have substantially lower relative weights for the purpose of reimbursement (DRG 419: 0.8583, DRG 320: 0.8039). Within each of these two DRGs, all changes derive from a single ICD-9-CM code. In DRG 419, all five discharges reassigned to ICD code 780.6 (pyrexia of unknown origin). In DRG 320, all five discharges reassigned to ICD 599.0 (urinary tract infection, site not specified). The vagueness of these codes suggests inadequate diagnostic workup, in addition to physician misunderstanding of the ICD-9-CM taxonomy. The remainder of incorrect DRG assignments spread among eight MDCs.

Clinical review

In this sample, patients assigned to DRG 416 exhibited no cases of unnecessary admissions. However, discharges paid as DRG 416 recorded 13 cases with quality of care problems. Small hospitals had the highest incidence of cases (25.0 percent), totaling almost three times the average number reported in the National DRG Validation Study. Only one case of premature discharge occurred.

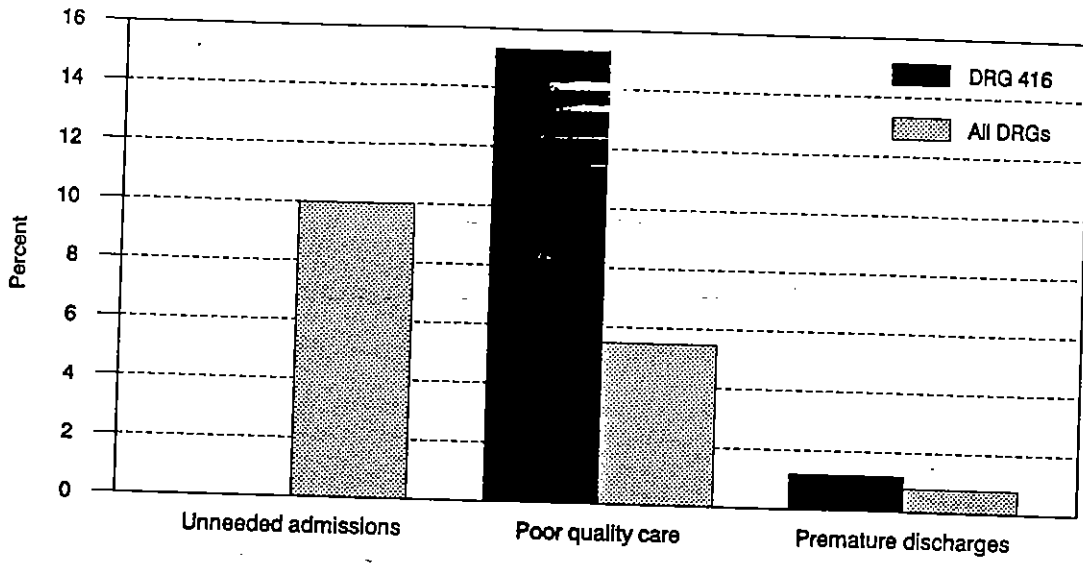


Figure 8: Clinical incidents

RECOMMENDATIONS

- The HCFA should direct the PROs to review DRG 416 discharges for both coding accuracy and poor quality care.
- The HCFA should direct the PROs to educate physicians and coders about the proper assignment of DRG 416, and about methods of distinguishing septicemia from fever of unknown origin and urinary tract infection, site not specified.

The HCFA requested more information about the first recommendation and agreed with the second recommendation. The OIG modified the draft of this inspection to accommodate the HCFA's comments and continues to believe that full implementation of its recommendations could save \$69.9 million annually.

Appendix A-1: DRG 416 discharges from all PPS hospitals

Fiscal Year	1984	1985	1986	1987
Relative weight	1.5504	1.5343	1.5708	1.6182
Number of discharges	34,605	65,273	81,374	85,929
Total charges (\$000)	205,955	446,283	373,582	697,250
Total reimbursement (\$000)	144,328	288,988	601,396	411,624
Average reimbursement (\$)	4,171	4,427	4,591	4,790

Appendix A-2: DRG 416 sampling frame

	Bed size			Total
	<100	100-299	300+	
Medicare population	15,184	34,033	16,056	65,273
Sampling frame	140	417	936	1,493
Sampled	24	25	24	73
Sampling fraction (%)	17.1	6.0	2.6	4.9

Appendix A-3: DRG 416 hospital demography

Number [Percent]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Urban	6 [25.0]	16 [64.0]	22 [91.7]	44	[60.3]	[74.0]	[48.3]
Rural	18 [75.0]	9 [36.0]	2 [8.3]	29	[39.7]	[26.0]	[51.8]
Teaching	0 [0.0]	7 [28.0]	12 [50.0]	19	[26.0]	[36.4]	[17.0]
Nonteaching	24 [100]	18 [72.0]	12 [50.0]	54	[74.0]	[63.6]	[83.0]
Profit	5 [20.8]	1 [4.0]	1 [4.2]	7	[9.6]	[6.4]	[12.7]
Nonprofit	19 [79.2]	24 [96.0]	23 [95.8]	66	[90.4]	[93.6]	[87.3]
Total	24 [100]	25 [100]	24 [100]	73	[100]	[100]	[100]

Appendix A-4: DRG 416 hospital demography comparison

Percent distribution		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Urban	DRG 416	25.0	64.0	91.7	60.3	74.0	48.3
	NDRGVS	19.9	70.2	94.0	62.0	71.5	48.0
Rural	DRG 416	75.0	36.0	8.3	39.7	26.0	51.8
	NDRGVS	80.1	29.8	6.0	38.0	28.5	52.0
Teaching	DRG 416	0.0	28.0	50.0	26.0	36.4	17.0
	NDRGVS	2.6	18.8	55.2	25.9	31.9	16.2
Non-teaching	DRG 416	100.0	72.0	50.0	74.0	63.6	83.0
	NDRGVS	97.4	81.2	44.8	74.1	68.2	83.8
Profit	DRG 416	20.8	4.0	4.2	9.6	6.4	12.7
	NDRGVS	9.2	17.5	2.5	9.8	9.4	10.9
Nonprofit	DRG 416	79.2	96.0	95.8	90.4	93.6	87.3
	NDRGVS	90.8	82.5	97.5	90.2	90.6	89.2

Appendix A-5: DRG 416 patient demography

	Bed size			Weighted average		
	<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	77.2	77.4	80.8	78.5	79.3	77.8
Sex (% male)	41.7	44.0	62.5	49.3	54.0	45.7
LOS (days)	7.2	11.7	9.3	9.4	9.8	9.0
Payment (\$)	3045	4384	4636	4027	4340	3732
Mortality (%)	33.3	28.0	29.2	30.1	29.4	30.9

Appendix A-6: DRG 416 patient demography comparison

		Bed size			Weighted average		
		<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	DRG 416	77.2	77.4	80.8	78.5	79.3	77.8
	NDRGVS	76.2	74.0	72.2	74.1	73.6	74.9
Sex (% male)	DRG 416	41.7	44.0	62.5	49.3	54.0	45.7
	NDRGVS	43.3	45.4	48.1	45.7	46.2	44.8
LOS (days)	DRG 416	7.2	11.7	9.3	9.4	9.8	9.0
	NDRGVS	5.9	7.4	8.3	7.2	7.5	6.8
Payment (\$)	DRG 416	3045	4384	4636	4027	4340	3733
	NDRGVS	1849	2923	3807	2860	3115	2508
Mortality (%)	DRG 416	33.3	28.0	29.2	30.1	29.4	30.9
	NDRGVS	5.6	6.2	7.0	6.3	6.4	6.0

Appendix B-1: DRG 416 assignment errors

Number [Rate]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Urban	2 [25.0]	8 [50.0]	8 [36.4]	18	[40.9]	[39.0]	[35.0]
Rural	9 [50.0]	1 [11.1]	2 [100.0]	12	[41.4]	[65.8]	[45.2]
Teaching	---	3 [42.9]	4 [33.3]	7	[36.8]	[39.8]	[39.8]
Nonteaching	11 [45.8]	6 [33.3]	6 [50.0]	23	[42.6]	[44.3]	[42.4]
Profit	2 [40.0]	0 [0.0]	0 [0.0]	2	[28.6]	[5.5]	[20.6]
Nonprofit	9 [47.4]	9 [37.5]	10 [43.5]	28	[42.4]	[42.2]	[43.6]
Total	11 [45.8]	9 [36.0]	10 [41.7]	30	[41.1]	[40.5]	[42.0]

Appendix B-2: DRG 416 assignment errors comparison

Rate		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Urban	DRG 416	25.0	50.0	36.4	40.9	39.0	35.0
	NDRGVS	22.5	19.3	16.2	18.0	17.6	20.4
Rural	DRG 416	50.0	11.1	100.0	41.4	65.8	45.2
	NDRGVS	23.9	16.6	22.5	21.9	20.9	21.3
Teaching	DRG 416	---	42.9	33.3	36.8	39.8	39.8
	NDRGVS	20.0	20.9	15.8	17.4	17.2	19.6
Non-teaching	DRG 416	45.8	33.3	50.0	42.6	44.3	42.4
	NDRGVS	3.7	17.9	17.6	20.2	19.2	20.9
Profit	DRG 416	40.0	0.0	0.0	28.6	5.5	20.6
	NDRGVS	23.8	18.9	18.3	20.3	19.7	21.3
Nonprofit	DRG 416	47.4	37.5	43.5	42.4	42.2	43.6
	NDRGVS	23.6	18.4	16.5	19.4	18.5	20.8
Total	DRG 416	45.8	36.0	41.7	41.1	40.5	42.0
	NDRGVS	23.6	18.5	16.6	19.5	18.6	20.8

Appendix B-3: DRG 416 assignment errors by patient demography

	<100	Bed size			Weighted average		
		100-299	300+	Sample	Discharge	Hospital	
Age (years)	Correct	74.6	75.7	79.8	76.7	77.8	75.8
	Incorrect	80.4	80.6	82.1	81.0	81.4	80.7
Sex (% male)	Correct	23.1	43.8	64.3	44.2	52.3	36.4
	Incorrect	63.6	44.4	60.0	56.6	55.7	56.8
LOS (days)	Correct	7.6	9.6	10.1	9.2	9.6	8.7
	Incorrect	6.7	15.4	8.1	9.8	10.2	9.8
Payment (\$)	Correct	2915	4267	4779	4025	4366	3650
	Incorrect	3200	4592	4436	4029	4315	3849
Mortality (%)	Correct	23.1	31.3	35.7	30.2	32.7	27.8
	Incorrect	45.5	22.2	20.0	30.0	24.2	33.9

Appendix C-1: DRG 416 direction of error

Number of overpayments [Percent of errors]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Urban	2 [100.0]	7 [87.5]	8 [100]	17	[94.4]	[96.2]	[95.9]
Rural	8 [88.9]	0 [0.0]	2 [100]	10	[83.3]	[67.7]	[61.7]
Teaching	---	3 [100.0]	4 [100]	7	[100.0]	[100.0]	[100.0]
Nonteaching	10 [90.9]	4 [66.7]	6 [100]	20	[87.0]	[88.5]	[84.5]
Profit	1 [50.0]	---	---	1	[50.0]	[50.0]	50.0]
Nonprofit	9 [100.0]	7 [77.8]	10 [100]	26	[92.9]	[93.2]	[92.8]
Total	10 [90.9]	7 [77.8]	10 [100]	27	[90.0]	[91.9]	[88.0]

Appendix C-2: DRG 416 direction of error comparison

Percent overpayments		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Urban	DRG 416	100.0	87.5	100.0	94.4	96.2	95.0
	NDRGVS	53.9	60.4	57.0	58.0	57.6	56.5
Rural	DRG 416	88.9	0.0	100.0	83.3	67.7	61.7
	NDRGVS	66.5	57.6	65.6	64.7	63.2	63.4
Teaching	DRG 416	---	100.0	100.0	100	100	100
	NDRGVS	66.7	59.6	56.6	57.9	58.9	62.8
Non-teaching	DRG 416	90.9	66.7	100.0	87.0	88.5	84.5
	NDRGVS	64.1	59.7	59.0	61.7	59.9	61.9
Profit	DRG 416	50.0	---	---	50.0	50.0	50.0
	NDRGVS	68.0	55.7	63.6	60.7	61.8	63.3
Nonprofit	DRG 416	100.0	77.8	100.0	92.9	93.2	92.8
	NDRGVS	63.7	60.5	57.6	60.9	59.3	61.7
Total	DRG 416	90.9	77.8	100.0	90.0	91.9	88.0
	NDRGVS	64.1	59.6	57.7	60.8	59.2	61.6

Appendix C-3: DRG 416 direction of error by patient demography

		Bed size			Weighted average		
		<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	Overpay	80.7	78.6	82.1	80.7	80.8	80.2
	Underpay	77.0	87.5	---	84.0	80.2	81.1
Sex (% male)	Overpay	70.0	42.9	60.0	59.3	56.1	59.6
	Underpay	0.0	50.0	---	33.3	15.5	19.4
LOS (days)	Overpay	7.3	11.0	8.1	8.6	8.9	8.6
	Underpay	1.0	31.0	---	21.0	10.6	13.0
Payment (\$)	Overpay	3272	4693	4436	4071	4356	3919
	Underpay	2481	4238	---	3652	3024	3161
Mortality (%)	Overpay	40.0	26.7	20.0	28.9	28.2	32.5
	Underpay	100	0.0	---	50.0	69.1	61.3

Appendix D-1: DRG 416 hospital department making error

Coding department errors [Percent of errors]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Urban	2 [100.0]	8 [100.0]	7 [87.5]	17	[94.4]	[93.1]	[98.0]
Rural	8 [88.9]	1 [100.0]	2 [100.0]	11	[91.7]	[98.5]	[94.3]
Teaching	0 [0.0]	3 [100.0]	3 [75.0]	6	[85.7]	[72.4]	[44.5]
Nonteaching	10 [90.0]	6 [100.0]	6 [100.0]	22	[95.6]	[98.6]	[94.8]
Profit	1 [50.0]	---	---	1	[50.0]	[50.0]	[50.0]
Nonprofit	9 [100.0]	9 [100.0]	9 [90.0]	27	[96.4]	[94.5]	[98.4]
Total	10 [90.9]	9 [100.0]	9 [90.0]	28	[93.3]	[93.2]	[93.7]

Balance of errors made by hospital billing department

Appendix D-2: DRG 416 hospital department making error comparison

Percent of coding department errors		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Urban	DRG 416	100.0	100.0	87.5	94.4	93.1	98.0
	NDRGVS	89.2	88.8	90.6	89.7	89.9	89.3
Rural	DRG 416	88.9	100.0	100.0	91.7	98.5	94.3
	NDRGVS	94.5	95.8	90.6	94.5	92.7	94.3
Teaching	DRG 416	---	100.0	75.0	85.7	92.0	91.9
	NDRGVS	91.7	92.6	89.2	90.3	90.6	91.6
Non-teaching	DRG 416	90.0	100.0	100.0	95.6	98.6	94.8
	NDRGVS	93.5	90.2	92.3	92.2	91.8	92.2
Profit	DRG 416	50.0	---	---	50.0	50.0	50.0
	NDRGVS	86.0	92.4	81.8	89.3	85.6	87.4
Nonprofit	DRG 416	100.0	100.0	90.0	96.4	94.5	98.4
	NDRGVS	94.3	90.3	90.9	92.1	91.2	92.5
Total	DRG 416	90.9	100.0	90.0	93.3	93.2	93.7
	NDRGVS	93.5	90.7	90.6	91.7	91.2	92.1

**Appendix D-3: DRG 416 hospital department making error by patient
demography**

		Bed size			Weighted averages		
		<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	Coding	80.7	80.6	82.9	81.4	81.9	81.0
	Billing	77.0	---	75.0	76.0	76.0	76.5
Sex (% male)	Coding	70.0	44.4	66.7	60.7	60.3	61.1
	Billing	0.0	---	0.0	0.0	0.0	0.0
LOS (days)	Coding	7.3	15.4	8.3	10.3	10.4	10.1
	Billing	1.0	---	6.0	3.5	3.6	2.2
Payment (\$)	Coding	3272	4592	4503	4092	4362	3897
	Billing	2481	---	3834	3158	3176	2798
Mortality (%)	Coding	40.0	22.2	22.2	28.6	24.6	31.4
	Billing	100.0	---	0.0	50.0	48.6	76.6

Appendix E-1: DRG 416 reasons for errors

	Bed size			Total	[Percent]
	<100	100-299	300+		
Mis-specification	4	5	5	14	[46.7]
Miscoding	1	1	2	4	[13.3]
Resequencing	5	2	3	10	[33.3]
Other	1	1	0	2	[6.7]
Total	11	9	10	30	[100.0]

Appendix E-2: DRG 416 reasons for errors by hospital demography

	Mis-specification	Miscoding	Resequencing	Other	Total
Number of discharges [Percent distribution]					
<100 beds	4 [36.4]	1 [9.1]	5 [45.5]	1 [9.1]	11 [100.0]
100-299 beds	5 [55.6]	2 [22.2]	2 [22.2]	0 [0.0]	9 [100.0]
300+ beds	5 [50.0]	1 [10.0]	3 [30.0]	1 [10.0]	10 [100.0]
Urban	8 [44.4]	4 [22.2]	5 [22.8]	1 [5.6]	18 [100.0]
Rural	6 [50.0]	0 [0.0]	5 [41.7]	1 [8.3]	12 [100.0]
Teaching	4 [57.1]	2 [28.6]	0 [0.0]	1 [1.4]	7 [100.0]
Nonteaching	10 [43.5]	2 [8.7]	10 [43.5]	1 [4.3]	23 [100.0]
Profit	0 [0.0]	0 [0.0]	1 [50.0]	1 [50.0]	2 [100.0]
Nonprofit	14 [50.0]	4 [14.3]	9 [32.1]	1 [3.6]	28 [100.0]
Total	14 [46.7]	4 [13.3]	10 [33.3]	2 [6.7]	30 [100.0]

Appendix E-3: DRG 416 reasons for errors comparison

Percent distribution		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Mis-specification	DRG 416	36.4	55.6	50.0	46.7	49.9	44.8
	NDRGVS	49.8	44.9	49.4	48.1	48.1	48.1
Miscoding	DRG 416	9.1	11.1	20.0	13.4	12.8	11.5
	NDRGVS	10.4	14.3	11.4	11.9	12.2	11.8
Resequencing	DRG 416	45.5	22.2	30.0	33.3	29.7	35.5
	NDRGVS	31.0	24.9	24.3	27.1	25.4	28.0
Other	DRG 416	9.1	11.1	10.0	10.1	10.4	9.9
	NDRGVS	6.7	15.9	14.9	12.8	14.1	11.0

Appendix E-4: DRG 416 reasons for errors by patient demography

	Mis-specification	Miscoding	Resequencing	Other
Age (years)	81.3	78.2	82.7	76.0
Sex (% male)	50.0	75.0	70.0	0.0
LOS (days)	9.4	8.8	12.1	3.5
Payment (\$)	4009	4765	3939	3158
Mortality (%)	28.6	25.0	30.0	50.0

Appendix F-1: DRG 416 corrected relative weights

	Bed size			Average- Total
	<100	100-299	300+	
<u>Average</u>				
Paid	1.5343	1.5343	1.5343	1.5343
Correct	1.2482	1.3963	1.2614	1.3033
Difference	0.2861	0.1380	0.2729	0.2310
[Rate]	[18.7]	[9.0]	[17.8]	[13.2]
<u>Total</u>				
Paid	36.8232	38.3575	36.8232	112.0039
Correct	29.9568	34.9075	30.2736	95.1409
Difference	6.8864	3.4500	6.5496	16.8630

*. Discharge weighted.

Appendix F-2: DRG 416 corrected reimbursement

\$	Bed size			Average- Total
	<100	100-299	300+	
<u>Average</u>				
Paid	3853	4221	4482	4186
Correct	3135	3841	3685	3556
Difference	719	380	797	630
[Rate]	[18.7]	[9.0]	[17.8]	[13.4]
<u>Total</u>				
Paid	92,481	105,520	107,554	305,556
Correct	70,811	77,184	71,333	219,890
Difference	21,671	28,336	36,222	85,666
[Rate]	[23.4]	[26.9]	[33.7]	[27.8]

*. Discharge weighted.

Appendix F-3: DRG 416 projected annual cost of errors

Fiscal Year	Reimbursement (\$ million)	Overpayment (\$ million)
1984	144.3	19.1
1985	289.0	38.1
1986	601.4	79.4
1987	411.6	54.3
1988 est.	448.7	59.2
1989 est.	523.0	69.0
1990 est.	597.3	69.9

Overpayment is calculated as 13.2 percent of reimbursement.
Estimates based on linear regression.

Appendix G-1: Correct MDCs for DRG 416 errors

	Bed size			Total	[Percent]
	<100	100-299	300+		
01: Nervous System	1	1	0	2	[6.7]
04: Respiratory	1	2	1	4	[13.3]
05: Circulatory	0	1	1	2	[6.7]
06: Digestive	0	0	1	1	[3.3]
08: Musculoskeletal	1	0	0	1	[3.3]
09: Skin and Breast	1	1	0	2	[6.7]
10: Endocrine and Metabolic	1	1	0	2	[6.7]
11: Kidney and Urinary Tract	4	2	1	7	[23.3]
18: Infectious Diseases	2	0	6	8	[26.7]
21: Injury, Poisoning & Drugs	0	1	0	1	[3.3]
Total		11	9	10	[300.0]

Appendix G-2: Correct DRGs for DRG 416 errors

Number of discharges	Bed size			Total	[Percent]
	<100	100-299	300+		
79 Respiratory infection	0	2	0	2	[6.7]
89 Simple pneumonia	1	0	1	2	[6.7]
296 Nutritional	1	1	0	2	[6.7]
320 Urinary tract infection	2	2	1	5	[16.7]
331 Other kidney disorders	2	0	0	2	[6.7]
418 Postoperative	1	0	1	2	[6.7]
419 Fever of unknown origin	0	0	5	5	[16.7]
Other	4	4	2	10	[33.3]
Total	11	9	10	30	[100.0]

Appendix H-1: DRG 416 clinical review

Number [Rate]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Unnecessary admissions	0 [0.0]	0 [0.0]	0 [0.0]	0	[0.0]	[0.0]	[0.0]
Poor quality of care	6 [25.0]	4 [16.0]	3 [12.5]	13	[17.8]	[9.8]	[11.2]
Premature discharge	0 [0.0]	1 [4.0]	0 [0.0]	1	[1.4]	[15.3]	[20.1]

Appendix H-2: DRG 416 clinical review comparison

Rate		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Unnecessary admissions	DRG 79	0.0	0.0	0.0	0.0	0.0	0.0
	NDRGVS	12.6	10.1	8.9	10.5	10.0	11.3
Poor quality of care	DRG 79	25.0	16.0	12.5	17.8	15.3	20.1
	NDRGVS	11.4	5.1	3.5	6.6	5.5	8.1
Premature discharge	DRG 79	0.0	4.0	0.0	1.4	1.2	1.3
	NDRGVS	2.1	0.8	0.4	1.1	0.8	1.4