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**DRG 121: CIRCULATORY DISORDERS  
WITH ACUTE MYOCARDIAL  
INFARCTION AND CARDIOVASCULAR  
COMPLICATIONS**

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**OFFICE OF INSPECTOR GENERAL**  
**OFFICE OF ANALYSIS AND INSPECTIONS**

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AUGUST 1989

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**DRG 121: CIRCULATORY  
DISORDERS WITH ACUTE  
MYOCARDIAL INFARCTION AND  
CARDIOVASCULAR COMPLICATIONS**

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### **Contract**

HHS-100-88-0019

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## EXECUTIVE SUMMARY

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### BACKGROUND

Under the prospective payment system, the diagnosis related group (DRG) 121 represents heart attacks with complications. Preliminary data from the National DRG Validation Study suggested that discharges incorrectly billed as DRG 121 comprise a disproportionate share of the Medicare overpayments attributable to disease coding errors.

### FINDINGS

- Of discharges billed as DRG 121, 17.7 percent should have grouped to a different DRG. This error rate approximates that for all DRGs, as measured in the National DRG Validation Study.
- Of these errors, 89.3 percent overpaid the hospital. This rate significantly exceeds the 59.6 percent for all DRGs.
- Reasons for errors include physicians mis-specification of a narrative diagnosis, "other," and resequencing in that order. Miscoding caused no DRG mis-assignments.

### RECOMMENDATIONS

- The Health Care Financing Administration (HCFA) should direct the peer review organizations (PROs) to review DRG 121 bills for coding accuracy.
- The HCFA should direct the PROs to educate physicians and hospitals about the diagnoses that properly group to DRG 121.

The HCFA disagrees with the first recommendation and agrees with the second. The Office of Inspector General modified the draft of this report to accommodate the HCFA comments, but continues to believe that implementation of these recommendations could recover \$42.2 million annually.

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## INTRODUCTION

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### **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. One of the first consequences of the new payment system was a drop in average length of hospital stay for Medicare patients.

### **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 (NDRGVS) to survey the general accuracy of DRG assignment and quality of care performed by hospitals under PPS. Its examination of 7000 medical records and 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.

The 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:

- **Mis-specification:** 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 illegal 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 121

This inspection examines erroneous assignment in DRG 121, Circulatory Disorders with Myocardial Infarction and Cardiovascular Complications. In order to group to DRG 121, a bill must have codes for both (1) a myocardial infarction and (2) a cardiovascular complication. Either diagnosis may appear as the principal diagnosis or as a secondary diagnosis. The order in which they appear doesn't matter.

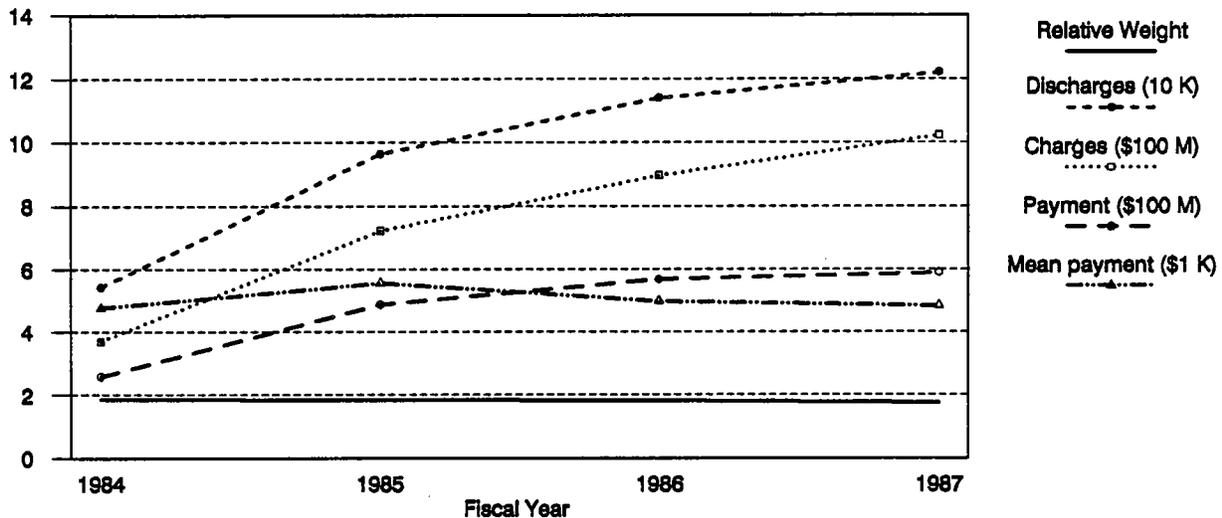


Figure 1: DRG 121

The number of DRG 121 bills and their dollar reimbursement has risen steadily throughout the history of the prospective payment system. Decreases in the relative weight from 1.8648 to 1.7687 have not offset these increases. The DRG 121 bills constitute 1.2 percent of discharges, but 1.8 percent of reimbursement. [Appendix A-1]

### 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 up to 25 DRG 121 bills from each strata for Medicare discharges between October 1, 1984 and March 31, 1985. [Appendix A-2]

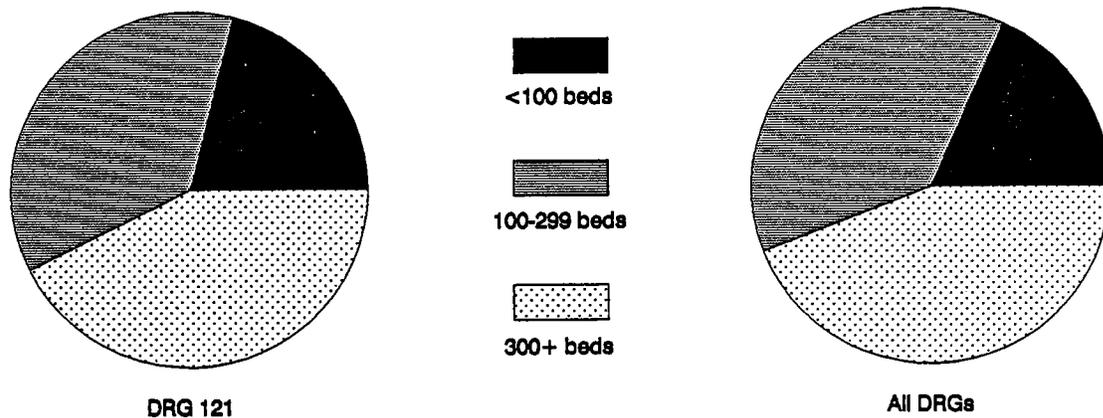


Figure 2: Sampling frame

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 UHDDS principal diagnosis, and additional diagnoses and/or procedures which were substantiated by the patient records. The GROUPER 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). The OIG contracted with BOTEC Analysis of Cambridge, MA to examine this data to identify sources of assignment errors and formulate recommendations for recovery of overpayments.

## FINDINGS

### Sample characteristics

In Fiscal Year (FY) 1985, 96,443 of the 8.3 million prospective payment discharges (1.2 percent) grouped to DRG 121. The National DRG Validation Study estimates that larger hospitals submitted more DRG 121 bills, but that smaller hospitals had a higher proportion of their bills group to DRG 121. 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 2,591 came from DRG 121 (1.2 percent). The stratification into bed-size classes illustrates the higher volume of larger hospitals and the higher sampling fraction of smaller hospitals.

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). Therefore the appendices, tables, and charts report individual totals by both discharges and hospitals.

Of the discharges assigned to DRG 121, 21.1 percent came from small hospitals (<100 beds), 36.2 percent from mid-sized hospitals (100-299 beds), and 42.7 percent from large hospitals (300+ beds). This distribution parallels the proportions for all Medicare discharges with slightly more discharges from small hospitals and slightly fewer from large hospitals. For this inspection, DRG 121 discharges were chosen randomly from equal number of hospitals from each stratum, thereby intentionally oversampling small hospitals and producing sampling fractions of 13.3 percent from small hospitals, 3.3 percent from mid-sized hospitals, and 1.5 from large hospitals.

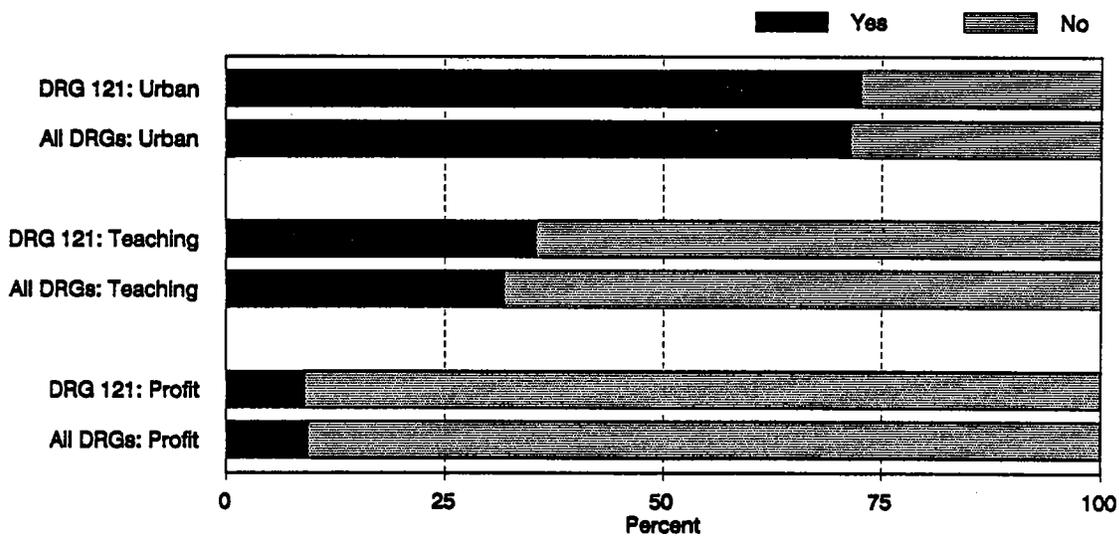


Figure 3: Hospital demography

The majority of DRG 121 discharges, weighted by discharge, came from urban, nonteaching, and nonprofit hospitals. [Appendix A-3] These findings did not significantly differ from those in the National DRG Validation Study. [Appendix A-4]

DRG 121 National DRG All Medicare Validation Study			
Age (years)	74.1	73.6	not available
Sex (%male)	54.1	46.2	42.2
LOS (days)	10.4	7.5	7.8
Payment (\$)	4894	3115	2985 urban 2381 rural
Mortality	3.7	6.4	not available

Table 1: Patient characteristics

The DRG 121 discharges (discharge-weighted) averaged almost three days longer length of stay in the hospital than either discharges in the National DRG Validation Study or all Medicare discharges. [Appendix A-5] The former discharges were more also more likely to be male (Mantel-Haenszel chi-square 2.52, df 1,  $P < 0.25$ ). DRG 121 discharges also averaged over \$1,700 more in payment than discharges in the National DRG Validation Study and over \$2,000 more than discharges for the Medicare population as a whole. [Appendix A-6]

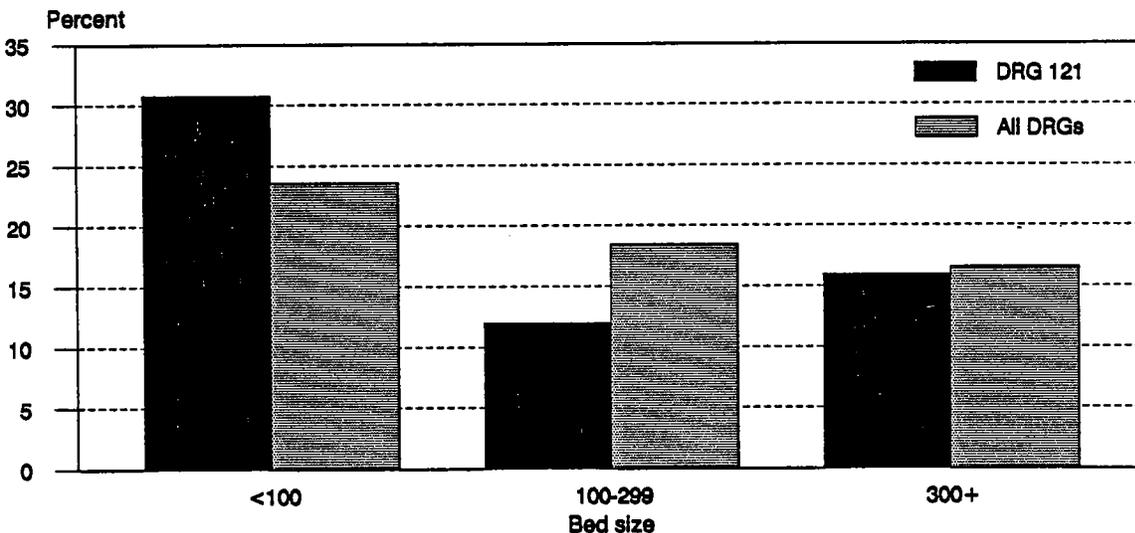


Figure 4: Coding mis-assignments

### DRG assignment errors

Overall, 17.7 percent of discharges paid as DRG 121 changed to a different DRG after reabstraction. This rate did not significantly differ than the average for all DRGs in the National DRG Validation Study (Mantel-Haenszel chi-square 0.13, df 1,  $P < 0.75$ ). Small hospitals had a 30.8 percent error rate, 53.3 percent of the sample's errors. Mid-sized and large hospitals had error rates of 16.0 and 18.0 percent respectively. These findings parallel the proportions of the National DRG Validation Study in which small hospitals also contributed the largest share of assignment errors. [Appendix B-1]

Analyzed by hospital demography, the proportion of errors was largest among urban, non-teaching, and nonprofit hospitals. Analysis of hospital demography in the National DRG Validation Study indicated that across all DRGs, hospital characteristics were not associated with significant differences in assignment accuracy when controlling for bed size. [Appendix B-2]

Patients incorrectly assigned to DRG 121 were younger (75.5 years to 67.2 years), and experienced shorter lengths of stay in the hospital (10.6 days to 9.0 days) than those correctly assigned. In addition, incorrectly assigned discharges paid, on average, over \$400 more than those correctly assigned. All patients in the sample discharged as expired had been incorrectly assigned. [Appendix B-3]

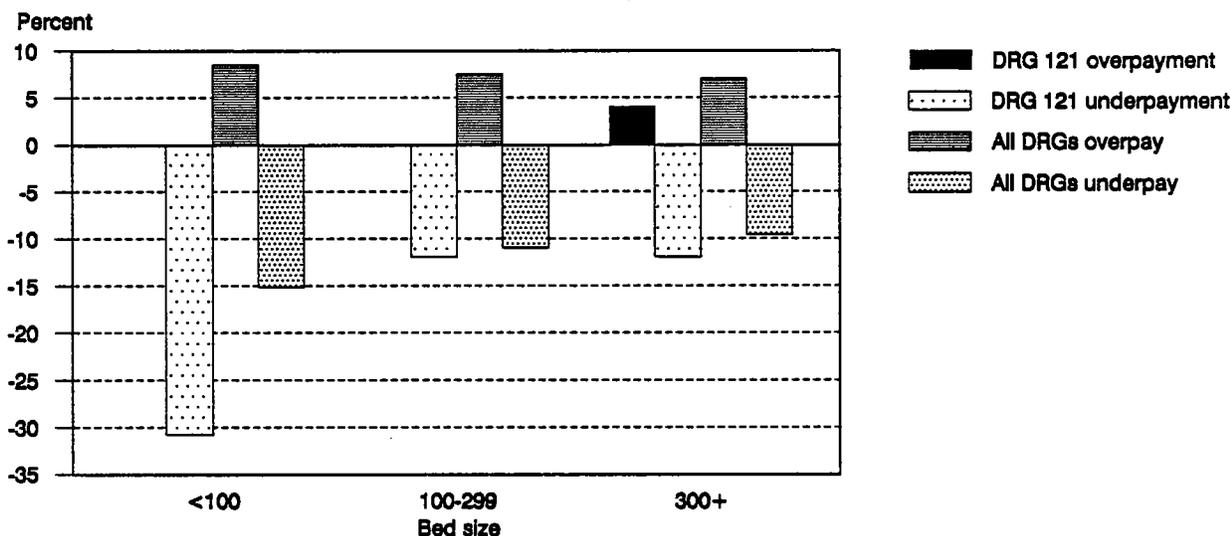


Figure 5: Direction of errors

### Direction of errors

Weighted by discharge, 89.3 percent of errors in the DRG 121 sample resulted in overpayments to hospitals. [Appendix C-1] This rate significantly exceeded the 59.6 percent of overpayments reported in the National DRG Validation Study (Mantel-Haenszel chi-square 5.21, df 1,  $P < 0.025$ ). [Appendix C-2] Weighted by discharge, however, the rate of overpayment exceeded that of the National DRG Validation Study only in urban and nonprofit hospitals. When combined with the rate of error for DRG 121 (17.7 percent), the effective rate of overpayment for DRG 121 was 15.8 percent, compared to an effective overpayment rate of 11.1 percent for the National DRG Validation Study.

### Source of errors

In this sample, 9 of the 15 assignment errors occurred when the medical records department incorrectly accepted and coded discharges as DRG 121 and billed accordingly. [Appendix D-1] Six errors, resulted when the medical records department correctly selected codes that did not group to DRG 121, but the hospital billed the discharge as DRG 121 anyway. This 51.8 per-

cent of errors (discharge weighted) due to billing errors greatly exceeds the 8.8 percent for the National DRG Validation Study. [Appendix D-2]

Discharges billed incorrectly had a lower average age (71.4 years to 64.7 years) and lengths of stay almost twice that of discharges with coding errors (11.0 days to 6.5 days). Discharges with billing errors averaged nearly \$1,000 more than discharges with coding errors. Billing errors also included all of the cases reported expired. [Appendix D-3]

### Reasons for assignment errors

Of the 15 errors in the DRG 121 sample, all but one resulted from either mis-specification errors by attending physicians or "other" errors. When examined using an exclusive analysis that selects identifying the first error to occur chronologically, physicians mis-specified a diagnosis in 53.3 percent of the mis-assignments. Aside from one resequencing error, the rest of the errors in this sample (40.0 percent) were categorized as "other" errors. [Appendix E-1]

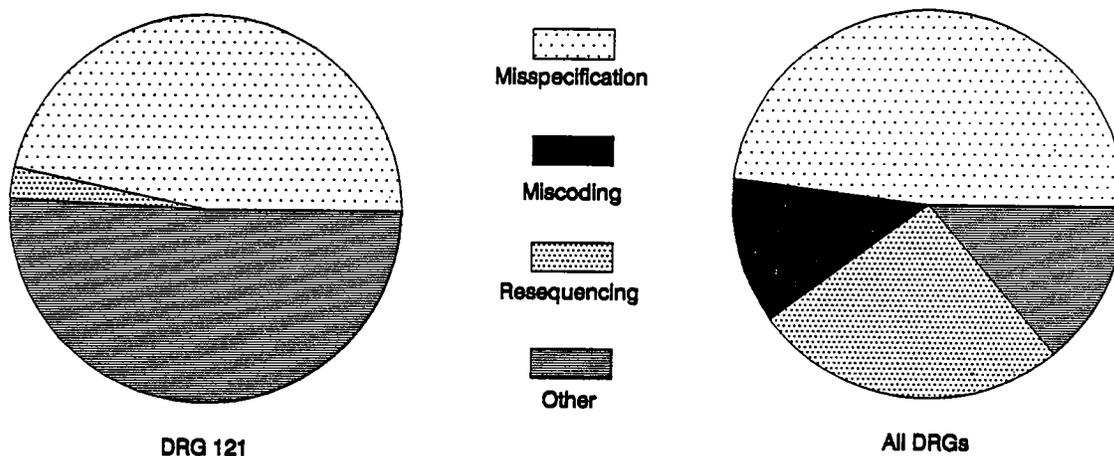


Figure 6: Reasons for coding

The majority of mis-specification errors by physicians occurred in small hospitals. [Appendix E-2] Mis-specification errors were also more likely in nonteaching and nonprofit hospitals. The bulk of "other" errors occurred in urban, nonteaching, and nonprofit hospitals. The discharge weighted 50.8 percent distribution of "other" errors exceeded the 13.8 percent for the National DRG Validation Study. [Appendix E-3]

Patients with "other" errors were younger (66.3 years to 74.3), had a longer average length of stay (9.5 days to 8.1 days) and a higher average payment (\$5486 to \$3843) than discharges with mis-specification errors. [Appendix E-4]

## Financial effects

After reabstraction, the average relative weight for DRG 121 discharges in this sample dropped from 1.8454 to 1.7298. For the 76 discharges in this sample, this amounted to an aggregate drop in relative weight of 8.7833 (4.4 percent weighted by discharges). [Appendix F-1]

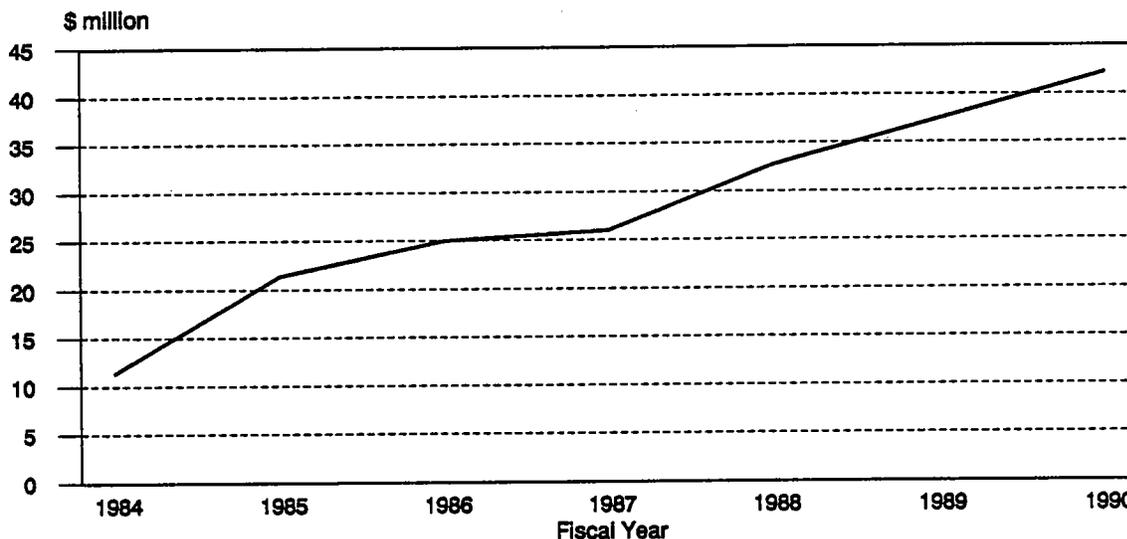


Figure 7: Overpayments

Based on the standardized amount for reimbursement in FY 1985 (\$2985 urban and \$2381 rural), the average change in relative weight for discharges assigned to DRG 121 resulted in mean overpayments to hospitals of \$601 (small hospitals), \$218 (mid-sized hospitals), and \$83 (large hospitals) on each discharge. Two-thirds of these overpayments came from small hospitals. [Appendix F-2]

Extrapolated to the entire Medicare population, if the rate of errors and urban/rural discharges remains constant, mis-assignment of DRG 121 results in \$42.2 million annually. Extrapolating by bed size, mid-sized and large hospitals together would account for over three-quarters of the overpayments. [Appendix F-3]

## Correct DRG assignments

All the discharges incorrectly assigned to DRG 121 came from Major Diagnostic Category (MDC) 05, the circulatory system. The DRG 121 also falls into this MDC. The DRG 121 is unique in that the attestation must contain both a principal diagnosis of acute myocardial infarction and a cardiovascular complication among its diagnoses, but not in a particular order. Reabstraction confirmed myocardial infarction, but not a cardiovascular complication, in 33.3 percent of assignment errors. [Appendix G-1]

These discharges recoded to DRG 122 (relative weight 1.3509). In 20.0 percent of errors, the patient died, reassigning the bill to DRG 123 (relative weight 1.1242). In another 33.3 percent

of errors the patient not actually suffer a heart attack, but had angina or a cardiac arrhythmia. [Appendix G-2]

In addition, the ICD-9-CM codes for ischemic heart disease can group to DRG 121 if the patient subsequently suffers a heart attack within 8 weeks of discharge. However, only one erroneous bill carried such a code, suggesting that such events occur only rarely.

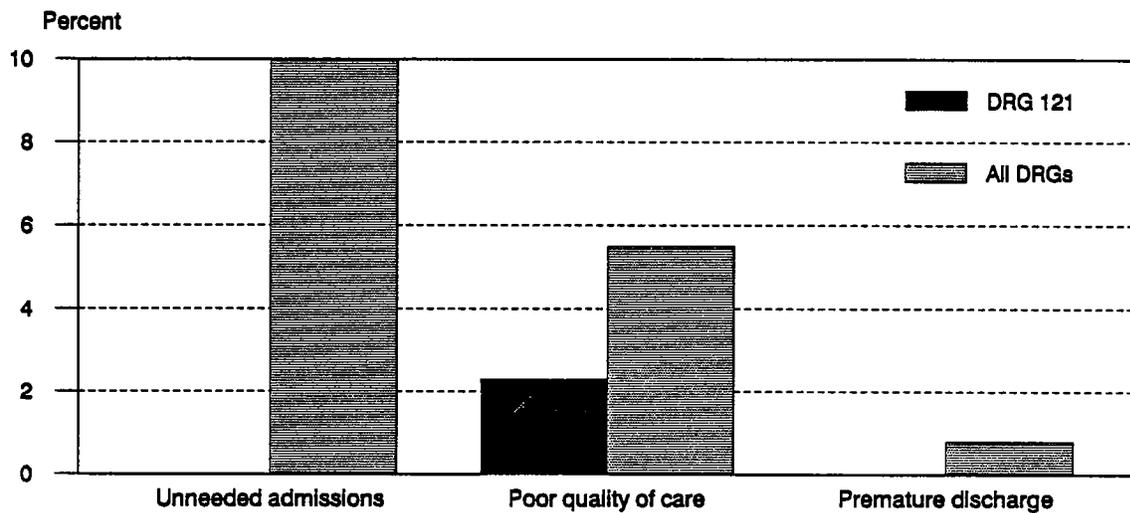


Figure 8: Clinical incidents

### Clinical review results

The DRG 121 had 2.3 percent rate of poor quality care. [Appendix H-1] This rate is less than half that in the National DRG Validation Study. [Appendix H-2] It found no premature discharges or unnecessary admissions.

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## RECOMMENDATIONS

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- The Health Care Financing Administration should direct the peer review organizations to review DRG 121 bills for coding accuracy.
- The HCFA should direct the PROs to educate physicians and hospitals about the diagnoses that properly group to DRG 121.

The HCFA disagrees with the first recommendation and agrees with the second. The Office of Inspector General modified the draft of this report to accommodate the HCFA comments, but continues to believe that implementation of these recommendations could recover \$42.2 million annually.

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### Appendix A-1: DRG 121 discharges from all PPS hospitals

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Fiscal Year	1984	1985	1986	1987
Relative weight	1.8648	1.8454	1.8145	1.7687
Number of discharges	54,365	96,443	113,963	122,068
Total charges (\$ million)	370.2	722.5	896.3	1,022.6
Total reimbursement (\$ million)	259.0	487.6	567.8	590.4
Average reimbursement (\$)	4,764	5,567	4,982	4,836

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### Appendix A-2: DRG 121 sampling frame

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Number	Bed size			Total
	<100	100-299	300+	
Medicare population	20,350	34,912	41,181	96,443
Sampling frame	196	762	1,633	2,591
Sample	26	25	25	76
Sampling fraction (%)	13.3	3.3	1.5	2.9

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### Appendix A-3: DRG 121 hospital demography

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Number [Percent]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Urban	7 [26.9]	18 [72.0]	24 [96.0]	49	[64.5]	[72.7]	[52.5]
Rural	19 [73.1]	7 [28.0]	1 [4.0]	27	[35.5]	[27.3]	[47.5]
Teaching	2 [7.7]	1 [4.0]	19 [76.0]	22	[28.9]	[35.5]	[17.3]
Nonteaching	24 [92.3]	24 [96.0]	6 [24.0]	54	[71.1]	[64.5]	[81.7]
Profit	4 [15.4]	4 [16.0]	0 [0.0]	8	[10.5]	[9.0]	[13.2]
Nonprofit	22 [84.6]	21 [84.0]	25 [100]	68	[89.5]	[91.0]	[86.8]
Total	26 [100]	25 [100]	25 [100]	76	[100]	[100]	[100]

## Appendix A-4: DRG 121 hospital demography comparison

Percent		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Urban	DRG 121	26.9	72.0	96.0	64.5	72.7	52.5
	NDRGVS	19.9	70.2	94.0	62.0	71.5	48.0
Rural	DRG 121	73.1	28.0	4.0	35.5	27.3	47.5
	NDRGVS	80.1	29.8	6.0	38.0	28.5	52.0
Teaching	DRG 121	7.7	4.0	76.0	28.9	35.5	17.3
	NDRGVS	2.6	18.8	55.2	25.9	31.9	16.2
Non-teaching	DRG 121	92.3	96.0	24.0	71.1	64.5	82.7
	NDRGVS	97.4	81.2	44.8	74.1	68.2	83.8
Profit	DRG 121	15.4	16.0	0.0	10.5	9.0	13.2
	NDRGVS	9.2	17.5	2.5	9.8	9.4	10.9
Non-profit	DRG 121	84.6	84.0	100.0	89.5	91.0	86.8
	NDRGVS	90.8	82.5	97.5	90.2	90.6	89.2

## Appendix A-5: DRG 121 patient demography

	Bed size			Weighted average		
	<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	78.3	71.0	74.7	74.7	74.1	75.4
Sex (% male)	53.9	52.0	56.0	54.0	54.1	53.6
LOS (days)	8.0	10.4	11.6	10.0	10.4	9.4
Payment (\$)	3696	4417	5891	4655	4894	4278
Mortality (%)	3.9	8.0	0.0	4.0	3.7	4.6

## Appendix A-6: DRG 121 patient demography comparison

		Bed size			Weighted average		
		<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	DRG 121	78.3	71.0	74.7	74.7	74.1	75.4
	NDRGVS	76.2	74.0	72.2	74.1	73.6	74.9
Sex (% male)	DRG 121	53.9	52.0	56.0	54.0	73.7	74.9
	NDRGVS	43.3	45.4	48.1	45.7	46.2	44.8
LOS (days)	DRG 121	8.0	10.4	11.6	10.0	10.4	9.4
	NDRGVS	5.9	7.4	8.3	7.2	7.5	6.8
Payment (\$)	DRG 121	3696	4417	5891	4668	4894	4278
	NDRGVS	1849	2923	3807	2860	3074	2508
Mortality (%)	DRG 121	3.9	8.0	0.0	4.0	3.7	4.6
	NDRGVS	5.6	6.2	7.0	6.3	6.4	6.0

## Appendix B-1: DRG 121 assignment errors

Number [Percent]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Urban	1 [14.3]	3 [16.7]	4 [16.7]	8	[16.3]	[16.2]	[15.5]
Rural	7 [36.8]	0 [0.0]	0 [0.0]	7	[25.9]	[7.8]	[19.0]
Teaching	0 [0.0]	0 [0.0]	4 [21.1]	4	[18.2]	[9.0]	[3.3]
Nonteaching	8 [33.3]	3 [12.5]	0 [0.0]	11	[20.4]	[11.6]	[21.3]
Profit	1 [25.0]	0 [0.0]	--	1	[12.5]	[5.3]	[12.9]
Nonprofit	7 [31.8]	3 [14.3]	4 [16.0]	14	[20.6]	[18.7]	[23.6]
Total	8 [30.8]	3 [12.0]	4 [16.0]	15	[19.7]	[17.7]	[22.3]

## Appendix B-2: DRG 121 assignment errors comparison

Percent		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Urban	DRG 121	14.3	16.7	16.7	16.3	16.2	15.5
	NDRGVS	22.5	19.3	16.2	18.0	17.6	20.4
Rural	DRG 121	36.8	0.0	0.0	25.9	7.8	19.0
	NDRGVS	23.9	16.6	22.5	21.9	20.9	21.3
Teaching	DRG 121	0.0	0.0	21.1	12.5	9.0	3.3
	NDRGVS	20.0	20.9	15.8	17.4	17.2	19.6
Non-teaching	DRG 121	33.3	12.5	0.0	20.4	11.6	21.3
	NDRGVS	23.7	17.9	17.6	20.2	19.2	20.9
Profit	DRG 121	25.0	0.0	--	12.5	5.3	12.9
	NDRGVS	23.8	18.9	18.3	20.3	19.7	21.3
Non-profit	DRG 121	31.8	14.3	16.0	20.6	18.8	23.6
	NDRGVS	23.6	18.4	16.5	19.4	18.5	20.8
Total	DRG 121	30.8	12.0	16.0	19.7	17.7	22.3
	NDRGVS	23.6	18.5	16.6	19.5	18.6	20.8

## Appendix B-3: DRG 121 assignment errors by patient demography

		Bed size			Weighted average		
		<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	Correct	80.0	72.3	75.9	75.7	75.5	76.8
	Incorrect	75.2	61.0	68.5	70.7	67.2	69.5
Sex (% male)	Correct	55.6	54.6	52.4	54.1	53.9	54.8
	Incorrect	50.0	33.3	75.0	53.3	54.6	48.5
LOS (days)	Correct	8.1	10.9	11.6	10.3	10.6	9.6
	Incorrect	7.6	7.0	11.4	8.5	9.0	8.0
Payment (\$)	Correct	3876	4331	5778	4695	4853	4325
	Incorrect	3290	5049	6483	4494	5290	4368
Mortality (%)	Correct	0.0	0.0	0.0	0.0	0.0	0.0
	Incorrect	12.5	66.7	0.0	20.0	26.8	28.2

### Appendix C-1: DRG 121 direction of error

Number of overpayments [Percent of errors]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Urban	1 [100.0]	3 [100.0]	3 [75.0]	7	[87.5]	[89.3]	[96.5]
Rural	7 [100.0]	----	- ---	7	[100]	[21.1]	[51.6]
Teaching	----	----	3 [75.0]	3	[75.0]	[32.0]	[11.9]
Nonteaching	8 [100.0]	3 [100.0]	----	11	[100]	[57.3]	[84.2]
Profit	1 [100.0]	----	----	1	[100]	[21.1]	[51.6]
Nonprofit	7 [100.0]	3 [100.0]	3 [75.0]	13	[92.9]	[89.3]	[96.1]
Total	8 [100.0]	3 [100.0]	3 [75.0]	14	[93.3]	[89.3]	[96.1]

### Appendix C-2: DRG 121 of direction of error comparison

Percent of errors		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Urban	DRG 121	100	100	75.0	87.5	89.3	96.1
	NDRGVS	53.9	60.4	57.0	58.0	57.6	56.5
Rural	DRG 121	--	--	75.0	75.0	21.1	51.6
	NDRGVS	66.5	57.6	65.6	64.7	62.9	63.4
Teaching	DRG 121	--	--	75.0	75.0	32.0	11.9
	NDRGVS	66.7	59.6	56.6	57.9	59.8	62.8
Non-teaching	DRG 121	100	100	--	100	57.3	84.2
	NDRGVS	64.1	59.7	59.0	61.7	60.3	61.9
Profit	DRG 121	100	--	--	100	21.1	51.6
	NDRGVS	68.0	55.7	63.6	60.7	61.7	63.3
Non-profit	DRG 121	100	100	75.0	92.9	89.3	96.1
	NDRGVS	63.7	60.5	57.6	60.9	59.9	61.6
Total	DRG 121	100	100	75.0	93.3	89.3	96.1
	NDRGVS	64.1	59.6	57.7	60.8	59.7	61.6

## Appendix C-3: DRG 121 direction of error by patient demography

		Bed size			Weighted average		
		<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	Overpaid	75.5	61.0	69.7	71.1	67.8	69.9
	Underpaid	--	--	65.0	65.0	27.8	10.3
Sex (% male)	Overpaid	50.0	33.3	66.7	50.0	51.1	47.2
	Underpaid	--	--	100.0	100.0	42.7	15.8
LOS (days)	Overpaid	7.6	7.0	8.0	7.6	7.6	7.5
	Underpaid	--	--	21.0	21.0	9.0	3.3
Payment (\$)	Overpaid	3290	5049	5304	4098	4787	4182
	Underpaid	--	--	10020	10020	4279	1583
Mortality (%)	Overpaid	not available					
	Underpaid						

## Appendix D-1: DRG 121 hospital department making error

Coding department errors [Percent of errors]	Bed size			Total	Weighted percentage		
	<100	100-299	300+		Sample	Discharge	Hospital
Urban	1 [100]	1 [33.3]	2 [50.0]	4	[50.0]	[54.5]	[70.4]
Rural	5 [71.4]	---	---	5	[71.4]	[15.1]	[36.8]
Teaching	---	---	2 [50.0]	2	[50.0]	[21.4]	[7.9]
Nonteaching	6 [75.0]	1 [33.3]	---	7	[63.6]	[27.9]	[49.6]
Profit	1 [100]	---	---	1	[100]	[21.1]	[51.6]
Nonprofit	5 [74.1]	1 [33.3]	2 [50.0]	8	[57.1]	[49.0]	[57.0]
Total	6 [75.0]	1 [33.3]	2 [50.0]	9	[60.0]	[49.2]	[57.5]

Balance of errors made by billing department.

## Appendix D-2: DRG 121 hospital department making error comparison

Percent coding department errors		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Urban	DRG 121	100	33.3	50.0	50.0	54.5	70.4
	NDRGVS	89.2	88.8	90.6	89.7	89.7	89.3
Rural	DRG 121	71.4	---	---	71.4	15.1	36.9
	NDRGVS	94.5	95.8	90.6	94.5	93.3	94.3
Teaching	DRG 121	---	---	50.0	50.0	21.4	7.9
	NDRGVS	91.7	92.6	89.2	90.3	91.0	91.6
Non-teaching	DRG 121	75.0	33.3	---	63.6	27.9	49.6
	NDRGVS	93.5	90.2	92.3	92.2	91.8	92.2
Profit	DRG 121	100	---	---	100	21.1	51.6
	NDRGVS	86.0	92.4	81.8	89.3	86.5	87.4
Non-profit	DRG 121	74.1	33.3	50.0	57.1	49.0	57.0
	NDRGVS	94.3	90.3	90.9	92.1	91.4	92.5
Total	DRG 121	75.0	33.3	50.0	60.0	49.2	57.5
	NDRGVS	93.5	90.7	90.6	91.7	91.2	92.1

## Appendix D-3: DRG 121 hospital department making error by patient demography

		Bed size			Weighted average		
		<100	100-299	300+	Sample	Discharge	Hospital
Age (years)	Coding	75.2	69.0	71.5	73.7	71.4	72.6
	Billing	76.5	57.0	65.5	66.3	64.7	68.4
Sex (% male)	Coding	66.7	0.0	50.0	55.6	35.4	42.3
	Billing	0.0	50.0	100	50.0	60.8	32.1
LOS (days)	Coding	9.0	8.0	4.0	7.8	6.5	7.9
	Billing	3.5	6.5	18.5	9.5	11.0	6.9
Payment (\$)	Coding	3074	5534	5254	3832	4895	4220
	Billing	3940	4807	7713	5486	5865	4819
Mortality (%)	Coding	0.0	0.0	0.0	0.0	0.0	0.0
	Billing	50.0	100	0.0	50.0	46.8	58.4

## Appendix E-1: DRG 121 reasons for errors

Number	Bed size			Total	[Percent]
	<100	100-299	300+		
<b>Mis-specification</b>					
Principal diagnosis	2	0	1	3	[20.0]
Secondary diagnosis	3	1	1	5	[33.3]
Miscoding	0	0	0	0	[0.0]
Resequencing	1	0	0	1	[6.7]
<b>Other</b>					
Admitting diagnosis used	1	0	0	1	[6.7]
No hospital codes	0	0	1	1	[6.7]
Multiple attestations	0	0	1	1	[6.7]
Other	1	2	0	3	[20.0]
<b>Total</b>	<b>8</b>	<b>3</b>	<b>4</b>	<b>15</b>	<b>[100.0]</b>

## Appendix E-2: DRG 121 reasons for errors by hospital demography

Number [Percent]	Mis-specification	Resequencing	Other
<100 beds	5 [62.5]	1 [12.5]	2 [25.0]
100-299 beds	1 [33.3]	0 [0.0]	2 [66.7]
300+ beds	2 [50.0]	0 [0.0]	2 [50.0]
Urban	4 [50.0]	0 [0.0]	4 [50.0]
Rural	4 [57.1]	1 [14.3]	2 [28.6]
Teaching	2 [50.0]	0 [0.0]	2 [50.0]
Nonteaching	6 [54.5]	1 [9.1]	4 [36.4]
Profit	1 [100]	0 [0.0]	0 [0.0]
Nonprofit	7 [50.0]	1 [7.1]	6 [42.9]
<b>Total</b>	<b>8 [53.3]</b>	<b>1 [6.7]</b>	<b>6 [40.0]</b>

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### Appendix E-3: DRG 121 reasons for errors comparison

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Percent		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Mis-specification	DRG 121	33.3	6.7	13.3	53.3	46.6	51.0
	NDRGVS	3.8	4.2	2.8	48.1	47.9	48.1
Resequencing	DRG 121	12.5	0.0	0.0	6.7	2.6	6.5
	NDRGVS	31.0	24.9	24.3	27.1	25.9	28.0
Other	DRG 121	25.0	66.7	50.0	40.0	50.8	42.5
	NDRGVS	6.7	15.9	14.9	12.8	13.5	11.0

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### Appendix E-4: DRG 121 reasons for DRG assignment errors by patient demography

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	Narrative	Resequencing	Other
Age (years)	74.3	69.0	66.3
Sex (% male)	50.0	100	50.0
LOS (days)	8.1	5.0	9.5
Payment (\$)	3843	3734	5486
Mortality (%)	0.0	0.0	50.0

## Appendix F-1: DRG 121 corrected relative weights

Relative weight	Bed size			Average-Total
	<100	100-299	300+	
<u>Average</u>				
Paid	1.8454	1.8454	1.8454	1.8454
Correct	1.6092	1.7679	1.8172	1.7298
Difference	0.2362	0.0775	0.0282	0.1156
<u>Total</u>				
Paid	47.9800	46.1350	46.1350	140.2500
Corrected	41.8392	44.1975	45.4300	131.4667
Difference	6.1408	1.9375	0.7050	8.7833
[Percent]	[12.8]	[4.2]	[1.5]	[4.4]

\* Discharge weighted.

## Appendix F-2: DRG 121 corrected reimbursement

\$	Bed size			Average-Total
	<100	100-299	300+	
<u>Average</u>				
Paid	4,656	5,167	5,439	5,082
Correct	4,060	4,950	5,356	4,764
Difference	596	217	83	318
<u>Total</u>				
Paid	121,069	129,182	135,980	386,231
Correct	92,899	82,677	75,613	255,757
Difference	28,170	46,505	60,367	130,474
[Percent]	[23.3]	[36.0]	[44.4]	.9]

\* Discharge weighted.

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### Appendix F-3: DRG 121 estimated overpayments

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Fiscal Year	Reimbursement (\$ million)	Overpayment (\$ million)
1984	259.0	11.4
1985	487.6	21.4
1986	567.8	25.0
1987	590.4	26.0
1988 est.	744.7	32.8
1989 est.	852.2	37.5
1990 est.	959.6	42.2

Overpayment is calculated as 4.4 percent of reimbursement.  
Estimates based on linear regression.

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**Appendix G-1: Major Diagnostic Categories for discharges incorrectly assigned to DRG 121**

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#	MDC	Bed size			Total
		<100	100-299	300+	
05	Circulatory	8	3	4	15

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**Appendix G-2: DRGs frequently miscoded to DRG 121**

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#	DRG	Bed size			Total	[Percent]
		<100	100-299	300+		
122	uncomplicated myocardial infarction	3	1	1	5	[33.3]
123	myocardial infarction, expired	1	2	0	3	[20.0]
138	arrhythmias	1	0	1	2	[13.3]
140	angina	2	0	1	3	[20.0]
	other	1	0	1	2	[13.3]
	<b>Total</b>	<b>8</b>	<b>3</b>	<b>4</b>	<b>15</b>	<b>[100.0]</b>

## Appendix H-1: DRG 121 clinical incidents

Number [Percent]	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	1 [3.8]	1 [4.0]	0 [0.0]	2	[2.6]	[2.3]	[3.3]
Premature discharge	0 [0.0]	0 [0.0]	0 [0.0]	0	[0.0]	[0.0]	[0.0]

## Appendix H-2: DRG 121 clinical incidents comparison

Percent		Bed size			Weighted percentage		
		<100	100-299	300+	Sample	Discharge	Hospital
Unnecessary admissions	DRG 121	0.0	0.0	0.0	0.0	0.0	0.0
	NDRGVS	12.6	10.1	8.9	10.5	10.2	11.3
Poor quality of care	DRG 121	3.8	4.0	0.0	2.6	2.3	3.3
	NDRGVS	11.4	5.1	3.5	6.6	5.5	8.1
Premature discharge	DRG 121	0.0	0.0	0.0	0.0	0.0	0.0
	NDRGVS	2.1	0.8	0.4	1.1	0.8	1.4