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ABSTRACT

What are the important tradeoffs in consulting a single expert for both diagnosis and treatment? On one hand, an integrated diagnostician may have the incentive to recommend treatments that are not in the buyer's best interests. On the other hand, joint production of diagnosis and treatment by an integrated diagnostician may be more efficient. We examine an important special case of this problem: the costs and health outcomes of elderly Medicare beneficiaries with coronary artery disease. We compare the empirical consequences of diagnosis by an "integrated" cardiologist -- one who can provide surgical treatment -- to the consequences of diagnosis by a non-integrated cardiologist. Diagnosis by an integrated cardiologist leads, on net, to higher health spending but similar health outcomes. The net effect contains three components: reduced spending and improved outcomes from better allocation of patients to surgical treatment options; increased spending conditional on treatment option; and worse outcomes from poorer provision of non-surgical care. We conclude that accounting more completely for doctors' incentives to refer patients in setting reimbursements, or in the alternative, allowing doctors more freedom to make and receive payments for referrals, could reduce spending and improve quality.

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Introduction

Anyone who has consulted a doctor, plumber, or auto mechanic has experienced the tradeoffs in consulting a single expert to both diagnose and treat a problem in the presence of asymmetric information. On one hand, integrated diagnosticians -- those who also sell treatments -- may have the incentive to give advice that is not in the buyer's best interests. As the theoretical models in Taylor (1995) and Wolinsky (1993) point out, because the buyer has imperfect information on the scope of the problem (if he did not, he would not have needed to consult a diagnostician in the first place), the diagnostician inevitably has the incentive to recommend treatments that are more profitable, even if they are more costly, lower quality, or less appropriate. On the other hand, joint production of diagnosis and treatment may be more efficient. The diagnostician may have better information about how to treat the problem than he could (or would) provide to an independent third party. Or, the diagnostician may be able to treat the problem himself less expensively or more effectively ("half the cost is opening the engine block").

We examine an important special case of this problem: the costs and quality of care of a random sample of Medicare beneficiaries with coronary artery disease. We compare patients who were diagnosed by an "integrated" cardiologist -- one who also provides surgical treatment -- to patients who were diagnosed by a non-integrated cardiologist. We decompose the total effect of diagnosis by an integrated cardiologist into the parts due to the change in the type of treatment and the parts due to the relative efficiency of each type of treatment. With this information, we quantify the potential upsides and downsides to diagnosis by an integrated expert. We identify these effects based on differences across geographic areas in the number of integrated cardiologists per capita. Our estimates are consistent under the assumption that unobserved patient characteristics and other determinants of spending are similar in across areas with many versus few integrated cardiologists; we explore the validity of this assumption below.

The paper proceeds in four sections. Section I reviews the previous empirical literature on the problems of obtaining diagnosis and treatment from a single expert when that expert has better information than the buyer on the source of the buyer's problem. Section II discusses the details of the problem that we study and presents our models. Section III describes our data. Section IV presents our results, and Section V concludes with the implications of our results for economic theory and health policy.

I. Empirical Work: Agency Problems When Diagnosticians Provide Treatment

Several recent papers have investigated the extent of moral hazard in integrated diagnosticians' advice. Thomas Hubbard (1998, 2002) analyzes data from the California vehicle emissions inspection market, in which inspectors can also provide repairs to help vehicles pass. He finds that vehicle pass rates at small garages are greater than those at chain stores and government-owned facilities, holding other factors constant. He concludes that inspectors' desire for repeat business leads them to pass vehicles more frequently, and so is sufficient to overcome the potential moral hazard problem in integrated diagnosis-repair markets.

Other work concludes that expert moral hazard is a more significant market failure. Steve Levitt and Chad Syverson (2005) compare data on sales of homes owned by real-estate agents and by non-agents. They find that agent-owned homes sell for more than comparable homes and stay on the market longer, holding all else constant.

Toshiaki Iizuka (2004) studies the Japanese prescription drug market, in which doctors not only prescribe drugs but also purchase and dispense them. He shows that elimination of the profit incentive for physician prescriptions would reduce drug expenditures in Japan by 14%, holding retail drug prices and other factors constant.

Our paper is also related to the long-standing health services literature on supplier-induced demand. These papers, starting with the classic study by Fuchs (1978), document the positive correlation across areas between the supply of doctors and the cost and intensity of medical care. However, this literature does not identify the specific mechanism causing the observed correlation: the relationship between density of doctors and intensity of care could be due to physicians' moral hazard, to differences in patient preferences across areas, or to something else.[1]

Our paper fills many of the gaps in these literatures. It examines the effects of integration in an important but understudied context: the use of costly and risky imaging of people's coronary arteries to detect blockages that, if untreated, can lead to heart attacks and other serious health events. It quantifies the impact of integration on both financial and health outcomes, allowing us to make tentative welfare conclusions about the integration of diagnosis and treatment. And, it identifies the mechanisms through which integration can have both an upside and a downside for patients under what we show to be plausible assumptions.

II. Integration of Diagnosis and Treatment in Cardiac Care

[1] But see Gruber and Owings (1996), who identify the effect of supplier-induced demand by estimating the correlation across areas between birth rates and rates of use of cesarean sections.

Diagnostic angiography, also known as catheterization, was invented in 1959 by Mason Sones at the Cleveland Clinic.[2] The invention of catheterization, a technique for imaging the locations of coronary artery blockages, significantly altered the course of modern cardiac care. Most notably, catheterization was the first step toward the invention of a new procedure in the 1970s called percutaneous transluminal coronary angioplasty. Angioplasty uses a surgically-inserted balloon-tipped catheter to clear arterial blockages that, if untreated, can lead to serious adverse health events like heart attacks. Prior to the invention of angioplasty, the only surgical treatment for such blockages was bypass surgery, which grafts a blood vessel from a patient's leg into his chest to improve the flow of blood around the blockage. Although bypass surgery is more appropriate than angioplasty for some patients, it is much more invasive, and so results in higher procedural mortality and morbidity.

In addition to transforming the treatment of arterial blockages, the invention of angioplasty transformed the industrial organization of cardiac care. Prior to angioplasty's invention, there were two types of cardiac doctors: cardiologists, who diagnosed patients and offered non-surgical treatment (e.g., prescription drugs); and cardiac surgeons, who did not diagnose patients and offered surgical treatment in the form of bypass. After its invention, as summarized in table 1, there were three types of cardiac doctors: non-interventional, or medical, cardiologists, who diagnosed patients and offered non-surgical treatment; cardiac surgeons, who did not diagnose patients and offered surgical treatment in the form of bypass; and a new type of "integrated" cardiologist, called an interventional cardiologist, who both diagnosed patients and offered surgical treatment in the form of angioplasty.

[2] This historical narrative is a summary of Mack (2003).

The experiment in this paper is to compare the type of treatment, spending, and health outcomes for otherwise similar patients diagnosed by an interventional versus a non-interventional cardiologist. We do this with two statistical models.

The first model specifies the type of treatment of patient j = 1,…,N as a function of the patient's personal characteristics X_j (age, gender, black/nonblack race, specific diagnosis, and illness severity at the time of the diagnosis) and the characteristics of the patient's hospital and diagnosing cardiologist. If the patient is initially diagnosed by an interventional cardiologist, then $I_j = 1$; otherwise, $I_j = 0$. In addition, the diagnosing cardiologist and hospital of diagnosis have other characteristics Z_j.

Cardiologists offer one of three treatment recommendations: angioplasty (denoted by an indicator variable $A_j = 1$), bypass surgery (denoted by an indicator variable $B_j = 1$), or drugs and other non-surgical care (denoted by an indicator variable $C_j = 1$).

We specify treatment choice as a multinomial logit function, i.e.,

$$\Pr(A_j = 1) = \frac{e^{\alpha+\beta_A I_j+\delta_A X_j+\gamma_A Z_j}}{1+\sum_{\tau=A,B,C} e^{\alpha+\beta_\tau I_j+\delta_\tau X_j+\gamma_\tau Z_j}}, \quad \Pr(B_j = 1) = \frac{e^{\alpha+\beta_B I_j+\delta_B X_j+\gamma_B Z_j}}{1+\sum_{\tau=A,B,C} e^{\alpha+\beta_\tau I_j+\delta_\tau X_j+\gamma_\tau Z_j}}, \text{ and}$$

$$\Pr(C_j = 1) = \frac{1}{1+\sum_{\tau=A,B,C} e^{\alpha+\beta_\tau I_j+\delta_\tau X_j+\gamma_\tau Z_j}}.$$

The second model specifies spending and health outcomes, conditional on type of treatment, as a linear function of X_j, I_j, Z_j, A_j, B_j, and C_j:

$$Y_j = \begin{array}{l} \phi + \theta X_j + \lambda I_j + \pi Z_j + \sigma^A A_j + \sigma^B B_j + \sigma^C C_j + \omega^A A_j * I_j + \omega^B B_j * I_j + \omega^C C_j * I_j \\ \quad + \zeta^A A_j * Z_j + \zeta^B B_j * Z_j + \zeta^C C_j * Z_j + \varepsilon_j \end{array}$$

where Y_j is total spending or health outcome in the year after diagnosis, and $E(\varepsilon \mid \ldots) = 0$.

The main concern with multinomial logit estimates of β and OLS estimates of (λ,ω) is selection bias -- unobserved differences in the health or preferences of patients treated by an interventional versus a non-interventional cardiologist. For example, a patient with characteristics X diagnosed by an interventional cardiologist and hospital with characteristics Z may be sicker than an observably identical patient diagnosed by an observably identical non-interventional cardiologist at an observably identical hospital, which could lead him to have different treatments, spending, and health outcomes even in the absence of a causal effect. To address this concern, we estimate the treatment type equations with a two-stage method that substitutes the predicted values of I and Z for the actual values, using each patient's three-digit-zip-code average level of I and Z as excluded instruments (standard errors are calculated using the bootstrap method, sampling with replacement 100 times). We estimate the spending and health outcome models by instrumental variables, again using each patient's three-digit-zip-code average level of I and Z as excluded instruments (with heteroscedasticty-robust standard errors). To the extent that there are no differences across areas in the unobserved determinants of patients' health spending or health status that are correlated with the area density of types of cardiologist or hospital, estimates of the effect of I versus N from this model will be consistent.[3] We investigate the validity of this assumption below.

III. Data

We examine a 20% random sample of all patients who received a diagnostic catheterization in 1998, in either an inpatient or outpatient setting. We restrict our sample

[3] To the extent that there are spillover effects of interventional cardiologists in an area -- that is, the presence of interventional cardiologists affects the treatment decisions of non-interventional cardiologists -- estimates from the area effects models will be consistent for the sum of the direct and the spillover effects.

to patients who were enrolled in fee-for-service Medicare continuously for the 365 days preceding and the 365 days following their catheterization. We identify the doctor who performed each patient's catheterization in our study period using physician claims data. We classify each patient's diagnosing doctor (also using physician claims data) as interventional if the doctor billed Medicare for any angioplasties in 1998 or 1999 or non-interventional if the doctor billed Medicare for neither angioplasty nor bypass in 1998 or 1999. We delete the handful of patients were diagnosed by a cardiac surgeon (i.e., if the doctor billed Medicare for a bypass surgery in 1998 or 1999).

We calculate the following patient characteristics X from these longitudinal claims data: three sets of 32 indicator variables to capture all of the patients' ICD-9 diagnoses at the time of his catheterization, at his most recent past acute care hospital admission in the preceding 365 days (if any), and at his most recent past non-acute care hospital admission in the preceding 365 days (if any); the total number of days in the acute-care and non-acute care hospital in the preceding 365 days; the total Medicare expenditures on acute-care and non-acute-care hospital services in the preceding 365 days; and age, gender, and race. We calculate the following physician and hospital characteristics Z: catheterization volume of the diagnosing cardiologist; angioplasty or bypass-surgery volume of the treatment physician (if any); catheterization volume of the hospital at which the test occurred; angioplasty or bypass volume of the hospital at which the treatment occurred; and the size (number of beds) and system, teaching, and for-profit/nonprofit status of the hospital at which the diagnosis occurred. To identify the cost consequences of these differences in treatment paths, we calculated the total Medicare hospital and physician spending (including all deductibles and copayments) incurred by each patient in the 365 days following his diagnosis. To identify the outcome consequences, we calculated the rate of readmission for heart failure (HF) and heart attack (AMI) in the 365 days following the diagnosis (excluding readmissions within the first 30 days, because they may be associated with the initial diagnostic process), and the mortality rate in the 365 days following the diagnosis.

Table 2 investigates the validity of the key assumptions necessary to identify the causal effects of diagnosis by an interventional cardiologist. The first column of the table presents descriptive statistics for the half of the sample of patients from areas with a high density of interventional cardiologists; the second column presents statistics for the other half of the sample. The first row shows that the probability of diagnosis by an interventional cardiologist is strongly correlated with the area density of interventional cardiologists. Patients from areas with many interventional cardiologists are 21.5 percentage points more likely to be diagnosed by an interventional cardiologist, around 25 percent more likely.

However, there is little evidence that these areas differ in terms of patients' health status in the year before diagnosis with cardiac illness. According to the second and third rows, patients from high-density areas spend fractionally fewer days in the hospital and $62 less on hospital care in total, with neither difference statistically significant. Thus, unobserved heterogeneity across areas in patient health is unlikely to bias our estimates of the effect of diagnosis by an interventional cardiologist.

According to the fourth row, patients from high-density areas spend $578 less on all Medicare covered services in the year after diagnosis, which is statistically significant at conventional levels. This suggests that unobserved heterogeneity across areas in other factors such as patients' taste for intensive medical treatment would, if anything, lead to a downward bias in our estimates of the effect of diagnosis by an interventional cardiologist on the cost of care in the year after diagnosis. The usual omitted variable problem in studies of supplier-induced demand is that areas with a greater number of physicians or specialists have higher health spending overall; but, in our experiment, the opposite is true.

IV. Results

Table 3 presents the effects of diagnosis by an interventional versus a non-interventional cardiologist on Medicare-covered spending and health outcomes in the year after diagnosis. The table has three panels. The top panel of the table presents the aggregate effects, $E(Y \mid I=1) - E(Y \mid I=0)$. The leftmost four columns present the raw difference in means; the rightmost four columns present the difference, adjusted for selection and the characteristics of patients, doctors, and hospitals. The top panel shows that treatment by an interventional cardiologist leads to significantly higher spending in the year after diagnosis, but statistically indistinguishable health outcomes. Adjusted for selection and differences in characteristics, patients diagnosed by an interventional cardiologist experienced $2,847 higher spending (standard error $747), about 10% greater than average (from table 2, average spending is $28,553 = ($28,264 + $28,842) / 2). However, the effect of diagnosis by an interventional cardiologist has no significant effect on health outcomes. These estimates are unlikely to be due to unobserved differences across areas in demand or patient preferences. According to table 2, omitted variable bias should if anything lead to underestimation of any positive gap in spending between interventional cardiologists and non-interventional cardiologists.

The total effect of diagnosis by an interventional cardiologist consists of several opposing component parts. The second and third panels of table 2 decompose the total effect into five factors.[4] The first group of factors includes two that are due to the redirection of patients who would have otherwise received bypass or non-surgical treatment by interventional cardiologists into the treatment they provide -- angioplasty.[5] The second and third rows of the table show that the redirection of bypass patients to angioplasty results in significant spending reductions of $1,024 per patient; the redirection of non-surgical patients results in significant spending increases of $535 per patient. This is not surprising, given the average subsequent-year spending (unadjusted for selection or characteristics) by type of treatment is $49,222 for bypass patients, $29,681 for angioplasty patients, and $18,569 for non-surgical patients (not published in any table). The redirection of patients to angioplasty has a small but significant adverse effect on health outcomes, leading to increases in readmission with AMI in the 31-365 days following diagnosis of approximately a tenth of a percentage point (on a base of 2 percentage points, not published in any table).

Perhaps more surprising are the effects of the second group of factors, those due to interventional cardiologists' relative efficiency in managing patients with each type of treatment. According to the fourth row, diagnosis by an interventional cardiologist leads

[4] We derive this decomposition in an appendix.

[5] The following table presents the probability of each type of treatment by type of diagnosing cardiologist:

	Interventional Cardiologist	Non-interventional Cardiologist
Treatment A: angioplasty	0.303	0.226
Treatment B: bypass	0.217	0.240
Treatment C: non-surgical	0.479	0.534

to significantly higher spending on angioplasty patients ($1,179, standard error $327) with no improvement in health outcomes. According to the fifth row, diagnosis by an interventional cardiologist also leads to much higher spending on bypass patients ($1,744, standard error $461), but dramatically lower mortality (1.195 percentage points, standard error 0.517). On a base of one-year mortality of 10.5 percentage points (not published in any table), this amounts to more than 10%. According to the sixth row, diagnosis by an interventional cardiologist leads to statistically indistinguishable increases in spending on non-surgical patients, but dramatically higher mortality (0.889 percentage points, standard error 0.560; significant at the 10 percent level).

V. Conclusions

What are the important tradeoffs from integrating diagnosis and treatment in the presence of asymmetric information? Economic theory suggests two opposing effects. Diagnosticians who sell treatment may give advice that is not in the buyer's best interests, but joint production of diagnosis and treatment may be more efficient. Despite the obvious importance of this question, and its prevalence in a wide range of markets other than health care, little empirical work has examined integration's effects.

This paper examines the treatments, health spending, and health outcomes of elderly Medicare beneficiaries with a common form of coronary artery disease. We compare beneficiaries who were diagnosed by a cardiologist who provides integrated diagnosis and surgical treatment (a.k.a. an interventional cardiologist) to those diagnosed by a cardiologist who is not integrated (a.k.a. a non-interventional, or medical, cardiologist). We find, on net, that diagnosis by an interventional cardiologist leads to increases in health spending of approximately 10 percent, but not better health outcomes.

This aggregate effect masks several important, opposing components. First is the unsurprising moral hazard effect: diagnosis by an interventional cardiologist leads to significantly more angioplasties -- the surgical treatment that interventional cardiologists provide. However, because several of the new angioplasty patients used to receive (much more costly) bypass surgery, the extra angioplasties lead to slightly lower health spending overall -- approximately $500, or around 2 percent -- and small but statistically significant increases in adverse health outcomes.

The effects due to interventional cardiologists' relative efficiency in managing patients with each type of treatment are more surprising. Interventional cardiologists do not manage angioplasty patients more efficiently; angioplasty patients diagnosed by an interventional cardiologist have higher spending and about the same health outcomes. The big advantage to diagnosis by an interventional cardiologist accrues to patients who are treated with bypass surgery by a cardiac surgeon. These patients have significantly higher health spending and dramatically lower mortality rates. This could be due to interventional cardiologists' sorting patients into bypass surgery or allocating patients to cardiac surgeons more effectively. The big disadvantage to diagnosis by an interventional cardiologist accrues to patients who are treated non-surgically; these patients have significantly higher mortality. This could be due to interventional cardiologists' lack of ability or incentives to treat non-surgical patients effectively.

Our results point out an important inconsistency in Medicare reimbursement policy, and indeed an important general problem in contracting in the presence of asymmetric information. Explicit "kickback" payments from treating to diagnosing doctors are banned by law (for public purchasers such as Medicare and Medicaid) and by contract (for private purchasers like insurance companies and large employers). However, the principle underlying this ban is not generally applied to doctors' decision to provide integrated diagnosis and treatment, even though integration can have the same effects on incentives and behavior as kickbacks do. In addition, allowing integration but banning kickbacks effectively allows rent capture by integrated but not non-integrated doctors, which can distort treatment decisions even further.[6]

How should these incentive problems be resolved? A blanket ban on the integration of diagnosis and treatment would be completely impractical. Every doctor provides both diagnosis and therapeutic services; interventional cardiologists are only one example. Thus, we conclude that paying integrated doctors differently, or allowing doctors more freedom to make and receive payments for referrals, could reduce cost and improve quality.

For example, our results suggest that interventional cardiologists' important strength may be more in the triaging of surgically-treated patients than in the provision of angioplasty. If further research finds this to be true, then paying interventional cardiologists more for diagnosis and less for treatment could help reduce spending and improve outcomes. Our results also suggest that interventional cardiologists' important weakness may be in the management of non-surgical patients. If further research finds this to be true, then paying interventional cardiologists to refer patients to non-interventional cardiologists for non-surgical treatment, or allowing non-interventional cardiologists to pay for referrals, could also improve productivity in health care.

[6] See Pauly (1979) for a detailed discussion of the welfare effects of kickbacks in health care.

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Appendix: Derivation of Decomposition

The expected difference in medical expenditures or health outcomes for a patient diagnosed by an interventional versus a non-interventional cardiologist can be written as the difference between the sums of the products of the probabilities of each type of treatment (A: Angioplasty; B: bypass; C: non-surgical) and the expected outcome conditional on treatment (subscripts and conditioning on X and Z are suppressed for simplicity in notation):

$$(1)\quad E(Y \mid I{=}1) - E(Y \mid I{=}0) = \Pr(A \mid I{=}1)*E(Y \mid I{=}1, A) - \Pr(A \mid I{=}0)*E(Y \mid I{=}0, A) + \Pr(B \mid I{=}1)*E(Y \mid I{=}1, B) - \Pr(B \mid I{=}0)*E(Y \mid I{=}0, B) + \Pr(C \mid I{=}1)*E(Y \mid I{=}1, C) - \Pr(C \mid I{=}0)*E(Y \mid I{=}0, C)$$

But because a patient must always receive some treatment ($1 = \Pr(A \mid I{=}1) + \Pr(B \mid I{=}1) + \Pr(C \mid I{=}1) = \Pr(A \mid I{=}0) + \Pr(B \mid I{=}0) + \Pr(C \mid I{=}0)$), the expected difference in utilization or outcomes can be written as the sum of five components:

$$(2)\quad E(Y \mid I) - E(Y \mid I{=}0) = [\Pr(B \mid I{=}0) - \Pr(B \mid I{=}1)] * [E(Y \mid I{=}1, A) - E(Y \mid I{=}1, B)] + [\Pr(C \mid I{=}0) - \Pr(C \mid I{=}1)] * [E(Y \mid I{=}1, A) - E(Y \mid I{=}1, C)] + \Pr(A \mid I{=}0) * [(E(Y \mid I{=}1, A) - E(Y \mid I{=}0, A)] + \Pr(B \mid I{=}0) * [(E(Y \mid I{=}1, B) - E(Y \mid I{=}0, B)] + \Pr(C \mid I{=}0) * [(E(Y \mid I{=}1, C) - E(Y \mid I{=}0, C)]$$

As long as interventional cardiologists are less likely than non-interventional cardiologists to treat patients non-surgically and with bypass, the first term of this decomposition can be interpreted as the portion of the expected difference in utilization or outcomes due to the redirection of bypass patients to angioplasty; the second term as the portion due to the redirection of non-surgical patients to angioplasty; the third term as the portion due to the difference in utilization or outcomes of angioplasty patients diagnosed by an interventional cardiologist; the fourth term as the portion due to the difference in utilization or outcomes of bypass patients diagnosed an interventional cardiologist; and the fifth term as the portion due to the difference in utilization or outcomes of non-surgical patients diagnosed by an interventional cardiologist.

Table 1: Types of Cardiac Doctors and the Services That They Provide

	Non-interventional cardiologists	Interventional cardiologists	Cardiac surgeons
Diagnostic services	Catheterization	Catheterization	None
Treatment services	Non-surgical	Non-surgical Surgical: angioplasty	Surgical: bypass

Table 2: Diagnosing Cardiologist, Health Status at Diagnosis, and Subsequent Spending of Patients in Areas with High and Low Numbers of Inteventional Cardiologists

	Patients from areas with…		
	above-median density of interventional cardiologists	below-median density of interventional cardiologists	Difference
Probability of diagnosis by interventional cardiologist	0.870	0.655	0.215**
Number of days in hospital in in year before diagnosis	2.94	2.98	-0.04
Hospital spending in year before diagnosis	$3,925	$3,987	-$62
Total spending in year after diagnosis	$28,264	$28,842	-$578**
Number of patients	53244	53103	

** significant at the 5% level.

Table 3: Effect of Diagnosis by Interventional versus Non-interventional Cardiologist on Health Spending and Health Outcomes in the Year After Diagnosis (standard errors in parentheses)

	Raw Differences Between Patients Diagnosed by Interventional versus Non-interventional Cardiologists				Differences Controlling for Patient, Doctor, Hospital, and Selection			
	Spending	AMI Readmit	HF readmit	Mortality	Spending	AMI readmit	HF readmit	Mortality
<u>**I. Total effect**</u>								
1. E(Y | I=1) – E(Y | I=0)								
	$216	0.166%	0.219%	0.910%	$2,847	0.393%	0.584%	-0.463%
					($747)	(0.428%)	(0.840%)	(0.861%)
<u>**II. Portion due to type of treatment**</u>								
2. Portion due to the redirection of bypass patients to angioplasty								
[Pr(B | I=0) – Pr(B | I=1)] * [E(Y | I=1, A) – E(Y | I=1 , B)]								
	-$445	0.041%	-0.032%	-0.052%	-$1,024	0.175%	0.060%	-0.057%
					($172)	(0.069%)	(0.115%)	(0.118%)
3. Portion due to the redirection of non-surgical patients to angioplasty								
[Pr(C | I=0) – Pr(C | I=1)] * [E(Y | I=1, A) – E(Y | I=1, C)]								
	$577	0.107%	-0.032%	-0.112%	$535	0.123%	0.018%	-0.040%
					($173)	(0.049%)	(0.043%)	(0.045%)
<u>**III. Portion conditional on type of treatment**</u>								
4. Angioplasty								
Pr(A | I=0) * [(E(Y | I=1, A) – E(Y | I=0, A)]								
	-$398	0.035%	-0.040%	0.371%	$1,179	0.259%	-0.173%	-0.059%
					($327)	(0.255%)	(0.392%)	(0.392%)
5. Bypass surgery								
Pr(B | I=0) * [(E(Y | I=1, B) – E(Y | I=0, B)]								
	-$27	0.000%	-0.046%	0.009%	$1,744	-0.047%	0.600%	-1.195%
					($461)	(0.232%)	(0.500%)	(0.517%)
6. Non-surgical treatment								
Pr(C | I=0) * [(E(Y | I=1, C) – E(Y | I=0, C)]								
	$510	-0.017%	0.369%	0.694%	$414	-0.116%	0.079%	0.889%
					($415)	(0.269%)	(0.527%)	(0.560%)