PHYSICIAN BELIEFS AND PATIENT PREFERENCES: A NEW LOOK AT REGIONAL VARIATION IN HEALTH CARE SPENDING

ONLINE APPENDIX

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Appendix A: A Model of Variation in Utilization

We develop a simple model of patient demand and physician supply. The demand side of the model is a standard one; the patient's indirect utility function is a function of out-of-pocket prices (p), income (Y), health (h), and preferences for care (η); V = V(p, Y, h, η). Solving this for optimal intensity of care, x, yields x^D.

On the supply side, we assume that physicians seek to maximize the perceived health of their patient, s(x), by appropriate choice of inputs x, subject to patient demand (x^D), financial considerations, and organizational factors.

Following Chandra and Skinner (2012), we write the physician's overall utility as:

$$\text{(A.1)} \quad U = \Psi s(x) + \Omega(W + \pi x - R) - \phi(|x - x^D|) - \varphi(|x - x^O|)$$

where Ψ is perceived social value of improving health, Ω is the physician's utility function of own income, comprising her fixed payment W (a salary, for example) net of fixed costs R, and including the incremental "profits" from each additional test or procedure performed, π.[35] The sign of π depends on the type of procedure and the payment system faced by the physician.

The third term represents the loss in provider utility arising from the deviation between the quantity of services the provider actually recommends (x) and what the informed patient demands (x^D). This function could reflect classic supplier-induced demand – from the physician's point of view, x^D is too low relative to the physician's optimal x – or it may reflect the extent to which physicians are acting as the agent of the (possibly misinformed) patient, for example when the patient wants a procedure that the physician does not believe is medically appropriate. The fourth term reflects a parallel influence on physician

[35] We ignore capacity constraints, such as the supply of hospital or ICU beds.

decision-making exerted by organizational factors that do not directly affect financial rewards, such as (physician) peer pressure.

The first-order condition for (1) is:

$$\text{(A.2)} \quad \Psi s'(x) = -\Omega'\pi + \phi' + \varphi' \equiv \lambda$$

Physicians provide care up to the point where the choice of x reflects a balance between the perceived marginal value of health, $\Psi s'(x)$, and factors summarized by λ: (a) the incremental change in net income π, weighted by the importance of financial resources Ω', (b) the incremental disutility from moving patient demand away from where it was originally, ϕ', and (c) the incremental disutility from how much the physician's own choice of x deviates from her organization's perceived optimal level of intervention, φ'.

In this model,[36] there are two ways to define "supplier-induced demand." The broadest definition is simply the presence of any equilibrium quantity of care beyond the level of the *ex-ante* preferences of an informed patient, i.e. $x > x^D$. This is still relatively benign, as the marginal value of this care may still be positive. Supplier-induced demand could more narrowly be defined as $s(x) - s(x^D) \leq 0$; for additional care provided at the margin, patients gain no improvement in health outcomes and may even experience a decline in health or a significant financial loss. Importantly, both of these definitions are ambiguous about the question of physician *knowledge* of inducement beyond clinically appropriate levels. That is, a physician with strong (but incorrect) beliefs may over-treat her patients, even in the absence of financial or organizational incentives to do so.

To develop an empirical model, we adopt a simple closed-form solution of the utility function for physician i:[37]

[36] A more general model would account for the patient's ability to leave the physician and seek care from a different physician, as in McGuire (2011).

[37] We are grateful to Pascal St.-Amour for suggesting this approach.

(A.1′) $U_i = \Psi s_i(x_i) + \omega[W_i + \pi_i x_i - R_i] - \frac{\phi}{2}(x_i - x_i{}^D)^2 - \frac{\varphi}{2}(x_i - x_i{}^O)^2$

Note that ω/Ψ reflects the relative tradeoff between the physician's income and the value of improving patient lives, and thus might be viewed as a measure of "professionalism," as in Campbell, et al. (2010). The first-order condition is therefore:

(A.2′) $s_i'(x_i) \; = \lambda \equiv (-\omega\pi_i + \phi(x_i - x_i{}^D) + \varphi(x - x_i{}^O))/\Psi$

Note that λ is linear in x with an intercept equal to $-(\omega\pi_i + \phi x_i{}^D + \varphi x_i{}^O)/\Psi$. Note also the key assumption that patients are sorted in order from most appropriate to least appropriate for treatment, thus describing a downward sloping s'(x) (marginal utility of treatment) curve. The equilibrium is where s'(x) = λ, at point A. A shift in the intercept, which depends on reimbursement rates for procedures π, taste for income ω, regional demand x^D, and organizational or peer effects x^O, would yield a different λ*, and hence a different utilization rate. However, all of these factors affect the intensity of treatments via a movement *along* the marginal benefit curve, s′(x).

Alternatively, it may be that $s_i'(x)$ differs across physicians – i.e. physician productivity differs, rather than physician constraints. For example, if $g_i'(x) = \alpha_i + s'(x)$, where s′(x) is average physician productivity and α varies across regions, this would be represented as a shift in the marginal benefit curve. Point C in Figure 1 corresponds to greater intensity of care than point A and arises naturally when the physician is *or just believes* she is more productive. For example, heart attack patients experience better outcomes from cardiac interventions in regions with higher rates of revascularization, consistent with a Roy model of occupational sorting (Chandra and Staiger, 2007). Because patients in regions with high intervention rates benefit differentially from these interventions, this scenario does not correspond to the narrow definition of "supplier-induced demand."

The productivity shifter α_i may also vary because of "professional uncertainty" – a situation in which the physician's perceived α_i differs from the true α_i (Wennberg, et al., 1982). Physicians may be overly optimistic with respect to their ability to perform procedures, leading to expected benefits that exceed actual realized benefits, as noted in the main text. For example, suppose the actual benefit is s′(x) but the physician's perceived benefit is g′(x). The equilibrium is point D: the marginal treatment harms the patient, even though the physician believes the opposite, incorrectly believing they are at point C. In equilibrium, this supplier behavior would appear consistent with classic supplier-induced demand, but the cause is quite different.

Empirical Specification. To examine these theories empirically, we consider variation in practice at the regional level (for reasons explained below) but adjusting for health status, h. Taking a first-order Taylor-series approximation of equation (A.2′) for region i yields a linear equation that groups equilibrium outcomes into two components, demand factors Z^D and supply factors Z^S:

$$\text{(A.3)} \quad x_i = \bar{x} + Z_i^D + Z_i^S + \varepsilon_i.$$

The demand-side component is:

$$\text{(A.4)} \quad Z_i^D = \frac{\phi}{\mathrm{M}}(x_i^D - \bar{x}^D)$$

where $M = -\Psi s''(\bar{x}) + \phi + \varphi$. This first element of equation (5) reflects the higher average demand for health care, multiplied by the extent to which physicians accommodate that demand, ϕ. The supply side component is:

$$\text{(A.5)} \quad Z_i^S = \frac{1}{M}\{\omega\Delta\pi_i + \pi\Delta\omega_i + \varphi(x_i{}^O - \bar{x}^O) + \Psi\Delta\alpha_i\}$$

The first term in equation (A.5) reflects how the difference in profits in region i vs. the national average ($\Delta\pi$) affects utilization. The second term reflects the extent to which physicians weigh income more heavily. The third term captures organizational goals in region i relative to national averages $(x_i{}^O - \bar{x}^O)$. The final term captures the impact of different physician beliefs about productivity of the treatment $(\Delta\alpha_i)$; this term shifts the marginal productivity curve.

Equation (A.3) can be expanded to capture varying parameter values as well. For example, in some regions, physicians may be more responsive to patient demand (a larger ϕ_i). Such interaction effects, would reflect the interaction of supply and demand and would magnify the responses here.

Appendix B: Survey Questions and Definitions

Clinical Vignettes and Response Options

Panel I: Patient Questions

SCENARIO 1- Questions relating to less-severe cardiac care preferences: *Suppose you noticed a mild but definite chest pain when walking up stairs....Suppose you went to your regular doctor for that chest pain and your doctor did not think you needed any special tests but you could have some tests if you wanted.*
a) If the tests did not have any health risks, do you think you would probably have the tests or probably not have them?
  a - have tests
  b - not have tests
b) Suppose your doctor told you he or she did not think you needed to see a heart specialist, but you could see one if you wanted. Do you think you would probably ask to see a specialist, or probably not see a specialist?
  a - see specialist
  b - not see specialist

SCENARIO 2 - Questions relating to end of life care preferences: *The next set of questions are about care a patient may receive during the last months of life. Remember, you can skip any question you don't want to answer. Suppose that you had a very serious illness. Imagine that no one knew exactly how long you would live, but your doctors said you almost certainly would live less than 1 year.*
a) If you reached the point at which you were feeling bad all the time, would you want drugs that would make you feel better, even if they might shorten your life?
  a - yes: drugs
  b - no
b1) If you needed a respirator to stay alive, and it would extend your life for a week, would you want to be put on a respirator?
b2) If it would extend your life for a month, would you want to be put on a respirator?
  a - yes: respirator
  b - no

Answers other than "yes" or "no" (e.g., "not concerned" or "I dont know") are treated as missing data. Item non-response was less than 1% among eligible respondents.

Panel II: Physician Questions

In the next set of questions, you will be presented with brief clinical descriptions for three different patients. For each, you will be asked a series of questions regarding how you would be likely to treat that patient were he or she in your care.

PATIENT A - CARDIOLOGIST - *For this question, think about a patient with stable angina whose symptoms and cardiac risk factors are now well controlled on current medical therapy. In general, how frequently do you schedule routine follow-up visits for a patient like this?*
  *Answer recorded in number of months
PATIENT A - PCPs: *In general, how frequently do you schedule routine follow-up visits for a patient with well-controlled hypertension?*
  *Answer recorded in number of months

PATIENT B: *A 75 year old man with severe (Class IV) congestive heart failure from ischemic heart disease, is on maximal medications and has effective disease management counseling. His symptoms did not improve after recent angioplasty and stent placement and CABG is not an option. He is uncomfortable at rest. He is noted to have frequent, asymptomatic nonsustained VT on cardiac monitoring. He has adequate health insurance to cover tests and medications. At this point, for a patient presenting like this, how often would you arrange for each of the following?*

CARDIOLOGIST SURVEY

a - Repeat angiography
b - Initiate antiarryghmic therapy
c - Recommend an Implantable Cardiac Defibrilator (ICD)
d - Recommend biventricular pacemaker for cardiac resynchronization
e - Initiate or continue discussions about palliative care

POSSIBLE RESPONSES

1 Always/Almost always
2 Most of the time
3 Some of the time
4 Rarely
5 Never

PATIENT C: *An 85 year old male patient has severe (Class IV) congestive heart failure from ischemic heart disease, is on maximal medications, and is not a candidate for coronary revascularization. He is on 2 liters per minute of supplemental oxygen at home. He presents to your office with worsening shortness of breath and difficulty sleeping due to orthopnea. Office chest xray confirms severe congestive heart failure. Oxygen saturation was 85% and increased to 94% on 4 liters and the patient is more comfortable. He has adequate health insurance to cover tests and medications. At this point, for a patient presenting like this, how often would you arrange for each of the following?*

PCP and CARDIOLOGIST SURVEY

a - Allow the patient to return home on increased oxygen and increased diuretics
b - Admit to the hospital for aggressive diuresis (not to the ICU/CCU)
c - Admit to the ICU/CCU for intensive therapy and monitoring
d - Place a pulmonary artery catheter for hemodynamic optimization
e - Recommend biventricular pacemaker for cardiac resynchronization
f - Initiate or continue discussions about palliative care

POSSIBLE RESPONSES (both surveys)

1 Always/Almost always
2 Most of the time
3 Some of the time
4 Rarely
5 Never

Full Variable Definitions

Panel I: Patient variables:

Have unneeded tests patient share	Fraction of patients who would like to have tests even if “doctor did not think [they were] needed”
See unneeded cardiologist patient share	Fraction of patients who would like to see a specialist even if doctor “did not think [patient] needed to”
Aggressive patient preferences share	Fraction of patients who would like to be on a respirator to extend their life by 1 week or 1 month
Comfort patient preferences share	Fraction of patients who would like to take drugs to be comfortable, “even if they might shorten [their] life”

Panel II: Physician (cardiologist & PCP) variables:

Cowboy physician (share)	(Fraction of) cowboys among the local (HRR-level) physician population surveyed
Comforter physician (share)	(Fraction of) comforters among the local (HRR-level) physician population surveyed
Low follow-up physician (share)	(Fraction of) physicians (HRR-level) who recommend follow-up less frequently than medical guidelines suggest
High follow-up physician (share)	(Fraction of) physicians (HRR-level) who recommend follow-up more frequently than medical guidelines suggest
Responds to patient expectations	Physician at least “sometimes” intervenes when “patient expected to undergo the procedure”
Responds to colleague expectations	Physician at least “sometimes” intervenes when “colleagues would do so in the same situation”
Responds to referrer expectations	Physician at least “sometimes” intervenes “to satisfy the expectations of the referring physician”
Responds to malpractice concerns	Physician at least “sometimes” intervenes “to protect against a possible malpractice suit”

Panel III: Other variables (all physicians):

Practice Type 1	Physician is part of a solo or 2-person practice
Practice Type 2	Physician is part of a singe or multi speciality group practice
Practice Type 3	Physician is part of a group or staff model HMO or a Hospital based practice
Fraction capitated patients	Fraction of patients for which physician is reimbursed on a captiated basis
Fraction Medicaid patients	Fraction of patients a physician sees who are on Medicaid
Fraction Medicare patients	Fraction of patients a physician sees who are covered by Medicare
Weekly patients days	Number of days per week a physician spends seeing patients
Age	Physician’s age in years
Board certified	Physician is currently board certified in her speciality
Cardiologists per 100k	Cardiologists per 100,000 Medicare beneficiaries in HRR of practice as reported in the 2005 Dartmouth Atlas

Notes: detailed explanations of the algorithm used to define “Cowboys” (physicians aggressive beyond clinical guidelines) and “Comforters” (physicians who show a strong likelihood of recommending palliative and comfort-oriented care) are described in the paper. The indicator for “Aggressive Patient Preferences” combines two questions: affirmative responses to both part b1 and b2 of Patient Scenario 2 (see Appendix A above for original survey text)

Appendix C: Further Results

Appendix Table C1: Regression Estimates of Medicare Expenditures
(Cardiologists Only)

	Cardiologists						
	Medicare spending in last two years of life (columns 1-6)						Overall
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cowboy physician share	0.477	0.415	0.337	0.443	0.365		0.483
	(0.132)	(0.125)	(0.119)	(0.122)	(0.114)		(0.168)
Comforter physician share	-0.215	-0.221	-0.190	-0.174	-0.150		-0.191
	(0.102)	(0.088)	(0.081)	(0.082)	(0.075)		(0.124)
High follow-up physician share		0.800	0.820	0.795	0.789		0.719
		(0.470)	(0.444)	(0.450)	(0.417)		(0.580)
Low follow-up physician share		-0.342	-0.315	-0.398	-0.355		-0.611
		(0.142)	(0.140)	(0.152)	(0.136)		(0.196)
Have unneeded tests patient share			0.227		0.283	0.514	0.326
			(0.228)		(0.225)	(0.263)	(0.273)
See unneeded cardiologist patient share			0.409		0.374	0.539	0.255
			(0.177)		(0.168)	(0.262)	(0.189)
Aggressive patient preferences share				-0.615	-0.490	-0.012	-0.976
				(0.426)	(0.400)	(0.503)	(0.465)
Comfort patient preferences share				-0.360	-0.368	-0.383	-0.723
				(0.191)	(0.190)	(0.222)	(0.247)
N	74	74	74	74	74	74	74
R^2	0.251	0.358	0.422	0.394	0.456	0.199	0.397

2-year end-of-life spending (outcome in columns 1-6) and overall spending (outcome in column 7) are in natural log form and are price, age, sex, and race adjusted. Results shown are for the 74 Hospital Referral Regions (HRRs) with survey responses for at least 3 patients, 1 primary care physician, and 3 cardiologists. All regressions include a constant and control for the fraction of primary care physicians in the sample. Survey sampling weights take into account differences in the number of physician observations per HRR.

Appendix Table C2: Regression Estimates of Medicare Expenditures
(PCPs Only)

	PCPs						
	Medicare spending in last two years of life (columns 1-6)						Overall
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cowboy physician share	0.276	0.235	0.278	0.231	0.291		0.521
	(0.180)	(0.100)	(0.099)	(0.098)	(0.095)		(0.155)
Comforter physician share	0.035	0.082	0.108	0.046	0.062		-0.047
	(0.157)	(0.112)	(0.109)	(0.092)	(0.088)		(0.114)
High follow-up physician share		0.751	0.689	0.738	0.661		0.840
		(0.112)	(0.107)	(0.108)	(0.100)		(0.148)
Low follow-up physician share		-0.345	-0.253	-0.366	-0.329		0.026
		(0.224)	(0.276)	(0.195)	(0.218)		(0.253)
Have unneeded tests patient share			0.233		0.381	0.514	0.471
			(0.207)		(0.188)	(0.263)	(0.250)
See unneeded cardiologist patient share			0.168		0.110	0.539	-0.024
			(0.177)		(0.171)	(0.262)	(0.217)
Aggressive patient preferences share				0.065	0.167	-0.012	0.079
				(0.340)	(0.336)	(0.503)	(0.381)
Comfort patient preferences share				-0.185	-0.237	-0.383	-0.562
				(0.172)	(0.167)	(0.222)	(0.201)
N	74	74	74	74	74	74	74
R^2	0.047	0.553	0.571	0.565	0.591	0.199	0.553

2-year end-of-life spending (outcome in columns 1-6) and overall medicare spending (outcome in column 7) are in natural log form and are price, age, sex, and race adjusted. Results shown are for the 74 Hospital Referral Regions (HRRs) with survey responses for at least 3 patients, 1 primary care physician, and 3 cardiologists. All regressions include a constant and control for the fraction of primary care physicians in the sample. Survey sampling weights take into account differences in the number of physician observations per HRR.

Appendix Table C3: Regression Estimates of Medicare Expenditures
(Age, Sex, and Race-Adjusted Physician and Patient Survey Data)

Combined sample: PCPs and cardiologists							
	Medicare spending in last two years of life (columns 1-6)						Overall
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cowboy physician share (adj)	0.726	0.682	0.718	0.681	0.717		0.933
	(0.200)	(0.158)	(0.150)	(0.147)	(0.142)		(0.204)
Comforter physician share (adj)	-0.338	-0.207	-0.208	-0.167	-0.167		-0.310
	(0.146)	(0.105)	(0.111)	(0.103)	(0.106)		(0.154)
High follow-up physician share (adj)		1.150	1.105	1.131	1.080		1.277
		(0.220)	(0.217)	(0.209)	(0.204)		(0.262)
Low follow-up physician share (adj)		-0.442	-0.411	-0.572	-0.530		-0.919
		(0.260)	(0.264)	(0.307)	(0.297)		(0.394)
Have unneeded tests patient share (adj)			0.272		0.279	0.078	0.392
			(0.187)		(0.201)	(0.302)	(0.230)
See unneeded cardiologist patient share (adj)			0.053		0.075	0.493	-0.141
			(0.164)		(0.162)	(0.257)	(0.199)
Aggressive patient preferences share (adj)				-0.456	-0.423	-0.477	-0.811
				(0.424)	(0.416)	(0.633)	(0.496)
Comfort patient preferences share (adj)				-0.133	-0.193	-0.228	-0.517
				(0.156)	(0.182)	(0.214)	(0.199)
N	74	74	74	74	74	74	74
R^2	0.284	0.573	0.588	0.584	0.600	0.083	0.578

2-year end-of-life spending (outcome in columns 1-6) and overall medicare spending (outcome in column 7) are in natural log form and are price, age, sex, and race adjusted. Results shown are for the 74 Hospital Referral Regions (HRRs) with survey responses for at least 3 patients, 1 primary care physician, and 3 cardiologists. All regressions include a constant and control for the fraction of primary care physicians in the sample. All respondent data adjusted for age, sex, race/ethnicity. Survey sampling weights take into account differences in the number of physician observations per HRR.

Appendix Table C4: Regression Estimates of Medicare Expenditures
(Age, Sex, and Race-Adjusted Physician Survey Data)

Combined sample: PCPs and cardiologists							
	Medicare spending in last two years of life (columns 1-6)						Overall
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cowboy physician share (adj)	0.726	0.682	0.695	0.688	0.704		0.927
	(0.200)	(0.158)	(0.145)	(0.146)	(0.138)		(0.204)
Comforter physician share (adj)	-0.338	-0.207	-0.192	-0.169	-0.174		-0.315
	(0.146)	(0.105)	(0.107)	(0.103)	(0.100)		(0.152)
High follow-up physician share (adj)		1.150	1.030	1.121	0.974		1.167
		(0.220)	(0.210)	(0.206)	(0.197)		(0.253)
Low follow-up physician share (adj)		-0.442	-0.417	-0.535	-0.455		-0.805
		(0.260)	(0.261)	(0.299)	(0.278)		(0.349)
Have unneeded tests patient share			0.382		0.452	0.500	0.550
			(0.183)		(0.196)	(0.255)	(0.245)
See unneeded cardiologist patient share			0.123		0.102	0.543	-0.125
			(0.148)		(0.145)	(0.260)	(0.181)
Aggressive patient preferences share				-0.404	-0.225	-0.021	-0.592
				(0.445)	(0.414)	(0.518)	(0.448)
Comfort patient preferences share				-0.236	-0.294	-0.426	-0.649
				(0.158)	(0.168)	(0.217)	(0.201)
N	74	74	74	74	74	74	74
R^2	0.284	0.573	0.606	0.587	0.624	0.203	0.597

2-year end-of-life spending (outcome in columns 1-6) and overall medicare spending (outcome in column 7) are in natural log form and are price, age, sex, and race adjusted. Results shown are for the 74 Hospital Referral Regions (HRRs) with survey responses for at least 3 patients, 1 primary care physician, and 3 cardiologists. All regressions include a constant and control for the fraction of primary care physicians in the sample. Physician survey data adjusted for age, sex, race/ethnicity. Survey sampling weights take into account differences in the number of physician observations per HRR.

Appendix Table C5: Expanded Regression Estimates of Medicare Expenditures

Combined Sample: Cardiologists and PCPs				
	(1)	(2)	(3)	(4)
Cowboy physician share	0.887	0.810	0.942	0.854
	(0.201)	(0.182)	(0.224)	(0.184)
Comforter physician share	-0.311	-0.325	-0.301	-0.326
	(0.162)	(0.170)	(0.167)	(0.172)
High follow-up physician share	1.272	1.140	1.309	1.172
	(0.238)	(0.252)	(0.230)	(0.252)
Low follow-up physician share	-0.556	-0.429	-0.575	-0.450
	(0.290)	(0.229)	(0.290)	(0.234)
Fraction capitated patients		0.001		0.001
		(0.003)		(0.003)
Fraction Medicaid patients		-0.003		-0.003
		(0.010)		(0.009)
Single/multi speciality group practice		-0.185		-0.183
		(0.226)		(0.232)
Group/staff HMO or hospital-based practice		0.439		0.400
		(0.218)		(0.212)
Responds to patient expectations			0.212	0.158
			(0.209)	(0.189)
Responds to colleague expectations			-0.062	-0.011
			(0.180)	(0.175)
Responds to referrer expectations			-0.005	0.004
			(0.180)	(0.170)
Responds to malpractice concerns			-0.209	-0.126
			(0.171)	(0.159)
N	74	74	74	74
R^2	0.555	0.597	0.565	0.601

2-year end-of-life spending (outcome in columns 1-6) and overall medicare spending (outcome in column 7) are in natural log form and are price, age, sex, and race adjusted. Results shown are for the 74 Hospital Referral Regions (HRRs) with survey responses for at least 3 patients, 1 primary care physician, and 3 cardiologists. All regressions include a constant and control for the fraction of primary care physicians in the sample. Survey sampling weights take into account differences in the number of physician observations per HRR.

Appendix Table C6: Regression Estimates of Medicare Expenditures with Interaction Terms and Additional Measures of Spending

Combined Sample of PCPs and Cardiologists (dependent variables listed in column headings; all in natural logs)					
	(1) 2-yr end-of-life spending (as in Table 3, col. 5)	(2) 2-yr end-of-life spending	(3) 2-yr end-of-life spending	(4) Total spend (average per beneficiary)	(5) Total spend (hip fracture cohort)
Cowboy physician share	0.685	0.903	0.688	0.904	0.292
	(0.123)	(0.445)	(0.118)	(0.182)	(0.084)
Comforter physician share	-0.151	-0.142	0.502	-0.274	-0.051
	(0.096)	(0.091)	(0.297)	(0.136)	(0.067)
High follow-up physician share	0.917	0.999	0.894	1.066	0.322
	(0.166)	(0.155)	(0.164)	(0.215)	(0.108)
Low follow-up physician share	-0.345	-0.259	-0.350	-0.673	-0.109
	(0.239)	(0.215)	(0.213)	(0.289)	(0.152)
Have unneeded tests patient share	0.351	0.254	0.394	0.421	0.047
	(0.193)	(0.195)	(0.184)	(0.239)	(0.131)
See unneeded cardiologist patient share	0.132	0.116	0.120	-0.079	0.171
	(0.130)	(0.125)	(0.123)	(0.151)	(0.109)
Aggressive patient preferences share	-0.294	0.627	1.340	-0.695	-0.057
	(0.379)	(0.496)	(0.713)	(0.404)	(0.250)
Comfort patient preferences share	-0.282	-0.275	-0.072	-0.639	-0.094
	(0.144)	(0.208)	(0.233)	(0.173)	(0.104)
Cowboy share * aggressive patient preferences share		-3.259			
		(1.162)			
Cowboy share * comfort patient preferences share		0.188			
		(0.697)			
Comforter share * aggressive patient preferences share			-4.461		
			(1.669)		
Comforter share * comfort patient preferences share			-0.592		
			(0.513)		
N	74	74	74	74	74
R^2	0.662	0.688	0.680	0.623	0.431

2-year end-of-life spending and overall spending are in natural log form and are price, age, sex, and race adjusted. Hip fracture cohort spending is adjusted for age, sex, race, comorbid conditions at admission, and the hierarchical condition categories risk-adjustment index for the six months prior to admission. Results shown are for the 74 Hospital Referral Regions (HRRs) with survey responses for at least 3 patients, 1 primary care physician, and 3 cardiologists. All regressions include a constant and control for the fraction of primary care physicians in the sample. Survey sampling weights take into account differences in the number of physician observations per HRR.

Appendix Table C7: Summary Statistics for Additional AMI Data in Table 4

(137 HRRs, N = 603,457)			
	Mean	Median	Standard Deviation
1-Year Medicare Expenditures	45,827	32,859	42,208
Median ZIP Household Income	56,251	50,623	22,497
Log 1-Year Medicare Expenditures	10.41	10.40	0.80
1-Year Survival	0.68	1.00	0.47
Same Day PCI (stent)	0.26	0.00	0.44
Age	78.85	79.00	8.28
Fraction Black	0.08	0.00	0.26
Fraction Hispanic	0.02	0.00	0.13
Fraction Asian	0.01	0.00	0.12
Fraction Female	0.50	1.00	0.50
Average HCC	1.73	1.31	1.35
Vascular Disease	0.08	0.00	0.27
Pulmonary Disease	0.17	0.00	0.38
Dementia	0.03	0.00	0.18
Renal Disease	0.18	0.00	0.38
Cancer (non-metastatic)	0.05	0.00	0.22
Cancer (metastatic)	0.01	0.00	0.11
Congestive Heart Failure	0.40	0.00	0.49
AIDS	0.00	0.00	0.02
Plegia (stroke)	0.00	0.00	0.05
Liver disease	0.00	0.00	0.06
Diabetes	0.26	0.00	0.44
Rheumatologic Disease	0.01	0.00	0.10
Peripheral Vascular Disease	0.02	0.00	0.12
AMI Location: Anterolateral	0.02	0.00	0.14
Anterior wall	0.07	0.00	0.26
Inferolateral	0.02	0.00	0.13
Inferoposterior	0.01	0.00	0.11
All other inferior	0.09	0.00	0.28

Appendix Table C8: Regression Estimates of Medicare Expenditures with Additional Survey Data

Combined Sample of PCPs and Cardiologists (dependent variable = 2-year end-of-life spending)				
	(1)	(2)	(3)	(4)
Cowboy physician share	0.854	0.800	0.913	0.848
	(0.188)	(0.175)	(0.212)	(0.177)
Comforter physician share	-0.326	-0.335	-0.315	-0.336
	(0.159)	(0.164)	(0.162)	(0.164)
High follow-up physician share	1.239	1.138	1.275	1.173
	(0.234)	(0.254)	(0.225)	(0.254)
Low follow-up physician share	-0.533	-0.405	-0.554	-0.430
	(0.270)	(0.215)	(0.267)	(0.220)
Fraction capitated patients		0.001		0.000
		(0.003)		(0.003)
Fraction Medicaid patients		-0.003		-0.003
		(0.010)		(0.010)
Single/multi speciality group practice		-0.156		-0.152
		(0.231)		(0.238)
Group/staff HMO or hospital-based practice		0.466		0.424
		(0.215)		(0.208)
Responds to patient expectations			0.211	0.162
			(0.203)	(0.186)
Responds to colleague expectations			-0.060	-0.018
			(0.174)	(0.171)
Responds to referrer expectations			-0.001	0.014
			(0.179)	(0.170)
Responds to malpractice concerns			-0.233	-0.152
			(0.171)	(0.157)
N	74	74	74	74
R^2	0.564	0.606	0.576	0.611

2-year end-of-life spending is reported in natural log form and is price, age, sex, and race adjusted. Results shown are for the 74 Hospital Referral Regions (HRRs) with survey responses for at least 3 patients, 1 primary care physician, and 3 cardiologists. All regressions include a constant and control for the fraction of primary care physicians in the sample. Survey sampling weights take into account differences in the number of physician observations per HRR.