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The Role of Training Environment Care Intensity in US Physician Cost Consciousness

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Abstract

Objective—To examine a potential relationship between training environment and physician views about cost consciousness. Patients and

Methods—This was a cross-sectional study of US physicians who responded to the “Physicians, Health Care Costs, and Society” survey conducted between May 30, 2012 and September 30, 2012 for whom information was available about the care intensity environment of their residency training hospital. The exposure of interest was a measure of healthcare utilization environment during residency from Dartmouth Atlas’ Hospital Care Intensity (HCI) index of primary training hospital. Main outcome measure was agreement with an 11-point cost-consciousness scale. Generalized estimating equations method was used to measure the association between exposure and outcome.

Results—Of the 2,556 physicians who responded to the survey 2,424 had a valid HCI index (95%), representing 649 residency programs. The mean cost-consciousness score among physicians trained at hospitals in the lowest quartile of care intensity (mean 31.8, SD 5.0) was higher than for physicians trained at hospitals in the top quartile of care intensity (mean 30.7, SD

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5.1, $P<.001$). Adjusting for other physician and practice characteristics, a population of physicians trained in hospitals with a 1.0 point higher HCI index would score about 0.83 points lower on the cost-consciousness scale (beta coefficient = -0.83 , 95% CI -1.60 to -0.05 , $P=.04$).

Conclusion—The intensity of healthcare utilization environment during training may play a role in shaping physician cost-consciousness later in their careers.

Persistently high healthcare costs in the United States have led to efforts to identify and reduce overuse of diagnostic tests and treatments, which a 2011 report estimated costing \$158–226 billion annually.¹ Efforts to reduce overuse include the Choosing Wisely campaign, which stimulates consumer and professional discussion about waste in healthcare.² National professional organizations and those charged with overseeing medical training programs have also focused increased attention on incorporating cost-effective care into graduate medical training.^{3,4} The Accreditation Council for Graduate Medical Education (ACGME) reporting milestones for internal medicine residency programs now include the practice of cost-effective care.⁵ The American College of Physicians in collaboration with the Alliance for Academic Internal Medicine developed the High Value Care curriculum for educators, residents and students.⁶ A 2012 survey of internal medicine residency programs found that only 15% had a formal curriculum on cost-conscious care, although another 50% were currently working on one.⁷

Currently, US physicians report somewhat conflicted views about their role in reducing overuse and stemming high healthcare costs. In general, physicians acknowledge that healthcare waste exists and accept some responsibility to curb overuse, but assign responsibility to others as well. For example, a 2009 survey of US primary care physicians found that 42% believed their patients were getting too much care and suggested inadequate visit length, malpractice and financial concerns as possible causes.⁸ A 2012 survey of US physicians across specialties reported that only 36% believed that practicing physicians have major responsibility for reducing healthcare costs.⁹ Physician views on overuse have been associated with practice setting, compensation type and attitudes toward clinical uncertainty, and malpractice concerns although few consistent patterns have been identified.^{10–14}

Despite the increased emphasis on cost-consciousness in medical practice and graduate medical education in particular, the effect of training institution environment on physician attitudes in this area has not been well studied. It is plausible to postulate that how resources are used during one's training can have sustained effects in one's mentality toward intensity of resource use throughout a career. The objectives of this study were to evaluate how the healthcare utilization environment of one's training institution during residency may be associated with the physicians' views about cost consciousness later in their careers.

Methods

Study Design and Participants

We conducted a secondary analysis of data from the “Physicians, Health Care Costs, and Society” survey mailed between May 30, 2012 and September 30, 2012 to 3,897 US physicians randomly selected from the American Medical Association (AMA) masterfile.^{9,10} Survey design and data collection methods for this survey have been

previously described.⁹ For each physician in the sample, residency training institution code provided in the AMA masterfile was linked to the residency program name. The residency institution code was then used to identify the primary hospital associated with the respondent training program, which was linked to the Dartmouth Atlas' hospital care intensity (HCI) index of that hospital. We used the American Association for Public Opinion Research RR2 to measure the response rate.¹⁵

Dependent Measure

Our outcome variable of interest was a physician's score on the cost-consciousness scale. Cost-consciousness was defined as "the extent to which physicians pay attention to and feel an obligation to address health care cost in their practice"⁸ and measured using an 11-item scale, which was developed post hoc using standard methods of exploratory factor analysis and has reasonable psychometric properties.⁹ The scale was computed by assigning a point value from 1 to 4 for each question, so that higher point value indicated a more cost-conscious response (i.e., agreement with a cost-conscious attitude or disagreement with a statement opposing cost-consciousness), and summing the points for all 11 scale questions.⁹

Independent Measures

Our main independent measure of interest was the HCI index of the primary training site where the physician completed residency training. We used the 2010 HCI index calculated by the Dartmouth Atlas group¹⁶ to characterize the intensity of care environment of each participant's primary training hospital. The HCI index is a composite measure of hospital days and inpatient physician visits by Medicare recipients in the last two years of life, and has been used as a measure of variation in the utilization of hospital and physician services at the hospital level.¹⁶

Because many residency programs are affiliated with multiple hospitals, we used a systematic iterative process to identify the primary training hospital's HCI index in the Dartmouth Atlas database.¹⁷ The first round consisted of searching the Dartmouth Atlas database using the name of the training institution from the AMA masterfile. Next, zip code search was used. Small differences in names such as "hospital" instead of "medical center" were disregarded as long as the addresses matched. Lastly, programs that could not be matched using exact name match or similar name plus exact zip code match were researched individually using FRIEDA and residency program websites. When a residency program appeared to operate within more than one hospital with none specified as primary, the hospital with the largest number of beds was considered the primary training hospital.

The 3,897 US physicians sampled from the AMA masterfile trained at 784 unique residency programs, of which 538 (69%) were linked to Dartmouth Atlas data directly and 111 (14%) were imputed (see method below). Of the 246 training sites that could not be linked to Dartmouth Atlas data, 93 (38%) could not be matched reliably via the abovementioned process, 39 (16%) were military or Veterans' Administration facilities, 37 (15%) did not have an HCI index calculated, 26 (11%) closed, 25 (10%) were children's hospitals, 15 (6%) were located outside of the US, and the rest were psychiatric institutions (11 hospitals or 5%). The final sample of physicians with available HCI information (respondents and non-

respondents) was 3475 (89% of all physicians sampled in the “Physicians, Health Care Costs, and Society” survey).

We adjusted for other factors that have been noted to influence physician attitudes toward cost containment, including physician experience measured as years since completing residency, current practice characteristics (practice setting and type of reimbursement), attitudes toward malpractice, comfort with uncertainty, and satisfaction with medicine as a profession. We also assessed physician gender, specialty, and geographic location of current practice.

Statistical Analysis

We used two-sample t-tests for continuous variables and chi-squared tests for categorical variables to assess differences in response rates by physician sex, age, region, practice setting, medical school location (US vs. international medical graduates), residency program region, and mean HCI index. We also compared the respondents with HCI data available to the respondents without HCI data available. To more closely explore differences in physicians’ views by training environment within the domains of the cost-consciousness scale, physician responses to individual scale items were quantified by the quartile of HCI index of the training hospital. Responses were dichotomized into “moderately agree” or “strongly agree” vs. the others (i.e., “moderately disagree” or “strongly disagree”).

We used generalized estimating equations¹⁸ to estimate the relationship between the HCI index of the primary training hospital and physician cost-consciousness scale score, accounting for correlation in outcome among physicians trained at the same residency program, assuming exchangeable variance structure. Robust standard errors were reported. The HCI index was right skewed and thus log transformation was entertained.¹⁹ Exploratory sensitivity analyses of the resulting estimates were very similar between transformed and untransformed results, therefore here we report the untransformed HCI for ease of interpretation.

We also repeated the analyses using the subset of respondents with HCI index data available within three years of the graduation date (therefore covering at least one year of residency training) to determine whether associations were similar among those with closest proximity to residency completion for whom the HCI was the most stable.

Multiple imputation using chained equations technique²⁰ was used to impute missing HCI data (n=389, 11%) as well as item-level missing data in the cost-consciousness scale. The rates of item-level missing data were less than 5% for all questions included in the scale. The results across 5 imputed data sets were combined using standard techniques, and SEs were adjusted to reflect both within- and between-imputation variability.²¹

All tests were 2-sided with $P < .05$ used as significance threshold. All analyses were performed using STATA 13.0 (StataCorp, College Station, TX). This study was reviewed and deemed exempt by the Mayo Clinic Institutional Review Board.

Results

Participant Characteristics

Of the 3,475 physicians in the sample with available HCI index data, 2,424 completed the survey (RR2¹⁵=69%). The 2,424 physicians with a valid HCI index who responded to the survey represented 95% of all 2,556 respondents to the “Physicians, Health Care Costs, and Society” survey. There were no statistically significant differences in age, sex, region, specialty, or practice setting type between the respondents and non-respondents (Table 1).

Respondent self-reported characteristics are presented in Table 2. For the 2,424 respondents included in the study, the most common practice compensation type was billing (41%), followed by salary plus bonus (35%), and salary only (18%). Over two-thirds (71%) of the respondents reported being “satisfied” or “very satisfied” with practicing medicine overall. About the same proportion (70%) agreed with the statement “My enjoyments of the practice of medicine is substantially lessened because of the threat of lawsuits.” Over half of respondents (56%) agreed with the statement “I find the uncertainty involved in patient care disconcerting.”

Physicians’ Views by the Hospital Care Intensity of Training Institution

The HCI of training hospital ranged from 0.40 to 2.26 (median 1.01, IQR 0.35). The mean cost-consciousness scale score was 31.2 (standard deviation [SD] 5.2, ranging from 11 to 44), as previously reported.⁹ The mean score among physicians trained at hospitals in the lowest quartile of care intensity (mean 31.8, SD 5.0) was higher than for physicians trained at the highest care intensity hospitals (mean 30.7, SD 5.1, $P<.001$). In unadjusted analysis, the difference in mean cost-consciousness scores between two populations of physicians trained at hospitals whose HCI index differs by one was 1.42 points (beta coefficient = -1.42 , 95% CI -2.19 to -0.65 , $P<.001$). After adjusting for physician and practice characteristics including gender, practice setting, compensation type, specialty, experience, geographic location of current practice, malpractice concerns, overall career satisfaction, and aversion to clinical uncertainty, having trained at higher hospital care intensity hospitals was associated with having slightly lower cost-consciousness scores on average in this population (beta coefficient = -0.83 , 95% CI -1.60 to -0.05 , $P=.04$) (Table 3). Current practice location in the West or Midwest was independently associated with higher cost-consciousness scale scores (beta coefficient = 1.24 , 95% CI 0.51 to 1.96 , $P<.001$ for West, beta coefficient = 0.91 , 95% CI 0.25 to 1.58 , $P=.007$ for Midwest, compared to the Northeast). Other variables associated with physician cost-consciousness scores have been previously reported.^{9,10}

We sought to explore specific domains within the 11-item scale that differed most strongly by the HCI index of the training hospital in an attempt to guide future research. After stratifying physicians into quartiles by the HCI index of training hospital, physicians who trained at hospitals in the bottom quartile of hospital care intensity were more likely to agree with the statements: “Trying to contain costs is the responsibility of every physician” (86% vs. 81%, $P=.04$), “Doctors need to take a more prominent role in limiting the use of unnecessary tests” (90% vs. 86%, $P=.03$), and “Decision support tools that show costs would

be helpful in my practice” (75% vs. 68%, $P=.006$), compared to physicians who trained at institutions in the top quartile of hospital care intensity (Table 4). Conversely, physicians who trained at hospitals in the top quartile of hospital care intensity were more likely to agree with the following statements: “It is unfair to ask physicians to be cost-conscious and still keep the welfare of their patients foremost in their minds” (46% vs. 39%, $P=.01$), “There is currently too much emphasis on costs of tests and procedures” (40% vs. 29%, $P<.001$), “Doctors are too busy to worry about costs of tests and procedures” (29% vs. 24%, $P=.04$), compared to the physicians who trained in the lowest care intensity quartile hospitals (Table 4). The rest of the individual survey items are presented in Table 4 and did not appear to differ by the quartile of HCI.

Stability of Hospital Care Intensity Index

For the subgroup of physicians with available data, the HCI index within three years of graduation was closely correlated with the 2010 HCI index (Pearson’s correlation 0.91, $P<.001$). For the subgroup of 420 physicians with HCI index data available within three years of residency graduation, a one-point difference in the HCI index of training hospital was independently associated with a decrease in cost-consciousness scores of similar magnitude as in the full sample using the 2010 HCI index (beta coefficient = -1.06 , 95% CI -2.39 to -0.28 , $P=.12$), but was not statistically significant after adjusting for physician and practice characteristics.

Discussion

Physician cost-consciousness or “the extent to which physicians pay attention to and feel the obligation to address health care costs in their practice” is increasingly important to policy makers, hospitals and other organizations that pay for health care. This study finds that years after completing training, US physicians’ degree of cost consciousness is inversely associated with the hospital care intensity environment of their training institution. Although the magnitude of the effect was small, it persisted after controlling for other physician and practice characteristics that are known to influence physician attitudes toward cost containment. As the first suggestion of a relationship between physician attitudes and prior experiences during training, these findings provide an impetus for examining and addressing graduate medical education training environment as a long-term factor in high-value cost-conscious care.

These data resonate with reports documenting the impact of residency environment on how physicians practice long after they graduate. For instance in a study of clinical outcomes, women treated by obstetricians who completed residency at low obstetrical complication rate hospitals had lower rates of obstetrical complications compared to women treated by obstetricians who trained at high complication rate hospitals.²² The findings of our study suggest that residency training environment may have a sustained impact on physician professional mentality beyond clinical skills.

Physician demographic and practice characteristics have been implicated in physician attitudes about health care costs and utilization patterns. A study of physician cost profiles using administrative claims found that senior physicians have lower overall costs compared

to physicians who more recently completed training,²³ and while the drivers of higher spending by junior physicians remain uncertain, our findings suggest that attitudes, experiences, and perhaps the culture of a training organization may play a role. Our findings are consistent with prior reports of the role of practice and compensation structure,²⁴ aversion to clinical uncertainty,²⁵ and malpractice concerns²⁶ in physician attitudes about overuse. Satisfaction with the practice of medicine overall was positively associated with cost-consciousness, but may be an artifact of agreeableness. Notably, only a quarter of respondents in this study were very satisfied with the practice of medicine overall, considerably lower than previously reported rates.²⁷

We observed variation in physician cost-consciousness by geographic region. Physicians who trained in a high-intensity training environment may choose to practice in the same region and their cost-consciousness may be influenced by the attitudes of their peers. In this analysis, we attempted to isolate the effect of residency training environment by controlling for the region of current practice in the model. However, we were unable to assess the influence of peers and current institutional culture at the practice level in this national survey sample; both may plausibly play an important role in physician cost-consciousness.

Strengths of this study include the different specialties and large number of residency programs in the sample, and the breadth of information about the physicians in the study, including their practice characteristics and attitudes toward clinical uncertainty. However, this study has important limitations. First, although widely used, the HCI index is an imperfect measure of the training program environment. Many residency programs are affiliated with multiple hospitals, which may not be well represented by the primary training hospital's HCI index. Furthermore, only a small subset of physicians in our study graduated in the years for which the HCI index was measured. However, the HCI index is a stable measure over time, and we observed a relationship between HCI and cost-consciousness that was of a similar magnitude when we restricted analyses to residents who had HCI index information at the time of residency training.

Second, the cross sectional design limits the ability to draw inferences about causality. We cannot examine from this analysis whether training environment causes individual cost-consciousness. Third, there are two potential sources of bias in our study: non-response bias attributable to survey respondents being different from non-respondents, and selection bias attributable to availability of hospital care intensity data. Fourth, the 11-item cost-consciousness scale, while developed using standard techniques and included questions from a validated 6-item scale,²⁸ has not been previously tested in the field or validated against other measures of physician cost-consciousness. Finally, there are likely many unmeasured aspects of residency culture that could be contributing to both the HCI index and cost-consciousness of physicians. Although we tried to control for those factors measurable in our data, confounding could not be fully addressed.

Conclusion

Despite these important limitations, these hypothesis-generating findings suggest that training environment may influence physicians' cost-consciousness later in their careers.

These data underscore the need for innovative interventions to engage graduate medical education training in long-term strategies to promote high-value cost-conscious care.

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Abbreviations

AMA	American Medical Association
CI	Confidence Interval
HCI	Hospital Care Intensity index
OR	Odds Ratio
SD	Standard Deviation
US	United States

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Table 1

Characteristics of US Physicians with HCI ^a Data to Whom a Survey Was Mailed, Including Respondents and Non-respondents (N = 3475)

	Overall	Respondents (n = 2424)	Non- respondents (n = 1051)	P value
Age, mean (SD), y	50.4 (8.9)	50.5 (9.1)	50.1 (8.6)	0.19
Male sex	2446 (70)	1695 (70)	751 (71)	0.36
Region of current practice ^b				
South	1158 (33)	798 (33)	360 (34)	0.78
Midwest	782 (23)	554 (23)	228 (22)	
Northeast	761 (22)	527 (22)	234 (22)	
West	772 (22)	544 (22)	228 (22)	
Practice setting type				
Group/HMO	2316 (67)	1587 (65)	729 (69)	0.07
Small/solo	625 (18)	460 (19)	165 (16)	
City/state/federal government	442 (13)	313 (13)	129 (12)	
Medical school	73 (2)	48 (2)	25 (2)	
Other	19 (1)	16 (1)	3 (0)	
Specialty				
Primary care	1356 (39)	972 (40)	384 (37)	0.13
Surgery	780 (22)	552 (23)	228 (22)	
Procedural specialty	693 (20)	463 (19)	230 (22)	
Non-procedural spec.	577 (17)	389 (16)	188 (18)	
Non clinical	63 (2)	44 (2)	19 (2)	
Other	6 (0)	4 (0)	2 (0)	

^aHCI = Hospital Care Intensity; SD = Standard Deviation; HMO = Health Maintenance Organization

^bn = 3473

Table 2

Self-reported Demographics, Practice Characteristics and Attitudes (n = 2424)

Characteristic	No. (%)
Race or ethnic group	
White or Caucasian	1863 (77)
Asian	348 (14)
Other	115 (5)
Black or African American	77 (3)
Hispanic/Latino	116 (5)
Practice compensation type (n = 2399)	
Billing only	988 (41)
Salary plus bonus	833 (35)
Salary only	441 (18)
Other	137 (6)
My enjoyment of the practice of medicine is substantially lessened because of the threat of lawsuits (n = 2420)	
Strongly disagree	273 (11)
Moderately disagree	448 (19)
Moderately agree	1045 (43)
Strongly agree	654 (27)
I find the uncertainty involved in patient care disconcerting (n = 2343)	
Strongly disagree	410 (18)
Moderately disagree	627 (27)
Moderately agree	961 (41)
Strongly agree	345 (15)
Overall, how satisfied are you with practicing medicine? (n = 2416)	
Very dissatisfied	186 (8)
Somewhat dissatisfied	515 (21)
Satisfied	1118 (46)
Very satisfied	597 (25)

Table 3

Relationship between the HCI^a Index of Residency Training Hospital and Physician Cost-Consciousness (n = 2,307)

	Beta	P value	95% CI	
HCI index of training hospital	−0.83	.04	−1.60	−0.05
Experience, years	0.08	<.001	0.05	0.10
Male gender	0.29	.23	−0.18	0.75
Region of current practice				
East	Ref			
West	1.24	<.001	0.51	1.96
Midwest	0.91	.007	0.25	1.58
South	0.41	.22	−0.24	1.06
Practice setting				
Small/solo	Ref			
Group/HMO	0.52	.09	−0.07	1.12
City/state/federal government	0.78	.20	−0.41	1.96
Medical school	0.67	.09	−0.11	1.46
Other	0.38	.76	−2.06	2.82
Specialty				
Primary care	Ref			
Surgery	−0.33	.29	−0.93	0.28
Procedural specialty	−0.42	.16	−1.01	0.17
Non-procedural specialty	−0.51	.11	−1.12	0.11
Non clinical	−0.74	.35	−2.28	0.81
Other	4.42	<.001	1.84	7.02
Compensation type				
Billing only	Ref			
Salary plus bonus	0.86	<.001	0.36	1.36
Salary only	0.61	.05	0.01	1.21
Other	0.36	.47	−0.63	1.35
I find the uncertainty involved in patient care disconcerting				
Strongly disagree	Ref			
Moderately disagree	−0.59	.09	−1.27	0.09
Moderately agree	−1.34	<.001	−1.97	−0.70
Strongly agree	−2.21	<.001	−3.04	−1.37
My enjoyment of the practice of medicine is substantially lessened because of the threat of lawsuits				
Strongly disagree	Ref			
Moderately disagree	0.38	.37	−0.45	1.20
Moderately agree	−0.60	.11	−1.33	0.13
Strongly agree	−1.31	.003	−2.18	−0.45

	Beta	P value	95% CI	
Satisfaction with medicine overall				
Very dissatisfied	Ref			
Somewhat dissatisfied	0.79	.12	−0.19	1.77
Somewhat satisfied	0.67	.18	−0.32	1.65
Very satisfied	1.56	.005	0.48	2.63

^aHCI = Hospital Care Intensity index

Table 4

No. (%) Physicians Who Answered Moderately Agree or Strongly Agree to Each Cost-Consciousness Scale Item by Hospital Care Intensity of Primary Training Hospital

	Overall	HCI ^a of Training Hospital		
		Lowest Care Intensity Quartile	Highest Care Intensity Quartile	<i>P</i> value
I try not to think about the cost to the health care system when making treatment decisions (n = 2321)	957 (41)	224 (38)	235 (41)	.30
Cost to society is important in my decisions to use or not to use an intervention (n = 2312)	1250 (54)	331 (57)	301 (53)	.20
Physicians should adhere to clinical guidelines that discourage the use of interventions that have a small proven advantage over standard interventions but cost much more (n = 2308)	1835 (80)	466 (81)	443 (78)	.20
The cost of a test or medication is only important if the patient has to pay for it out of pocket (n = 2322)	359 (15)	91 (16)	90 (16)	.92
Doctors are too busy to worry about costs of tests and procedures (n = 2324)	615 (26)	138 (24)	166 (29)	.04
Trying to contain costs is the responsibility of every physician (n = 2315)	1974 (85)	500 (86)	462 (81)	.04
There is currently too much emphasis on costs of tests and procedures (n = 2310)	780 (34)	170 (29)	225 (40)	<.001
Doctors need to take a more prominent role in limiting the use of unnecessary tests (n = 2314)	2047 (88)	522 (90)	488 (86)	.03
It is unfair to ask physicians to be cost-conscious and still keep the welfare of their patients foremost in their minds (n = 2311)	966 (42)	225 (39)	262 (46)	.01
I should be solely devoted to my individual patients' best interests, even if that is expensive (n = 2311)	1794 (78)	436 (75)	438 (77)	.58
Decision support tools that show costs would be helpful in my practice (n = 2345)	1636 (70)	436 (75)	400 (68)	.006

^aHCI = Hospital Care Intensity index