Primary Care Practice Organization Influences Colorectal Cancer Screening Performance

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Objective. To identify primary care practice characteristics associated with colorectal cancer (CRC) screening performance, controlling for patient-level factors.

Data Sources/Study Setting. Primary care director survey (1999–2000) of 155 VA primary care clinics linked with 38,818 eligible patients' sociodemographics, utilization, and CRC screening experience using centralized administrative and chart-review data (2001).

Study Design. Practices were characterized by degrees of centralization (e.g., authority over operations, staffing, outside-practice influence); resources (e.g., sufficiency of nonphysician staffing, space, clinical support arrangements); and complexity (e.g., facility size, academic status, managed care penetration), adjusting for patient-level covariates and contextual factors.

Data Collection/Extraction Methods. Chart-based evidence of CRC screening through direct colonoscopy, sigmoidoscopy, or consecutive fecal occult blood tests, eliminating cases with documented histories of CRC, polyps, or inflammatory bowel disease.

Principal Findings. After adjusting for sociodemographic characteristics and health care utilization, patients were significantly more likely to be screened for CRC if their primary care practices had greater autonomy over the internal structure of care delivery ($p < .04$), more clinical support arrangements ($p < .03$), and smaller size ($p < .001$).

Conclusions. Deficits in primary care clinical support arrangements and local autonomy over operational management and referral procedures are associated with significantly lower CRC screening performance. Competition with hospital resource demands may impinge on the degree of internal organization of their affiliated primary care practices.

Key Words. Primary health care, colorectal cancer, prevention, quality of health care, veterans

Colorectal cancer (CRC) is a major source of preventable cancer morbidity and mortality, accounting for 10 percent of all U.S. cancer deaths (American Cancer Society 2004). Despite the availability of effective screening tests and widespread recognition of the importance of early detection through screening, CRC screening rates remain low (Coffield et al. 2001). In 2000, only 34 percent of the eligible U.S. population was screened for CRC within recommended time frames (Subramanian et al. 2004), while the average CRC screening rate was 47 percent among enrollees in commercial health plans and 50 percent among Medicare beneficiaries (NCQA 2004).

Most assessments of screening deficiencies have focused on patient factors (e.g., payment sources, knowledge deficits, preferences). While Medicare beneficiaries are more likely to be screened than those with private insurance, gaps in screening between high- and low-income individuals persist regardless of coverage type (Adams et al. 2004). Providers perceive the lack of patients' knowledge of screening's benefits and subsequent compliance with ordered tests as substantial barriers (Dulai et al. 2004). Patient attitudes have also been identified as important predictors of screening: individuals with positive attitudes toward screening are more apt to adhere to guidelines, while those who fear finding cancer, believe that cancer is fatal or believe their personal risk is low have lower adherence rates (Montano et al. 2004). Efforts to increase screening rates by educating patients have met with less than optimal effect (Zapka et al. 2003).

Primary care physicians play a critical role in promoting and ordering screening (Schwartz et al. 1991). Patients report lack of physician recommendation as the main reason they are not up-to-date (Klabunde et al. 2005). Nearly one-third of primary care physicians rely on single-sample in-office fecal occult blood testing (FOBT), the least accurate method of CRC screening, despite guidelines to the contrary (Nadel et al. 2005). Another third recommend repeat FOBT only after a positive test, again in sharp contrast to most recommended guidelines. Provider-level determinants of screening performance have historically focused on barriers to test use, including provider

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training, demographics, and beliefs about test performance (Sandler et al. 1989). While inadequate knowledge of CRC screening guidelines for average and high-risk patients is blamed for some of the variation, interventions to improve provider knowledge run the risk of being “necessary but not sufficient” given the general inadequacy of continuing medical education alone in invoking change (Davis et al. 1995; Gennarelli et al. 2005).

Organizational structure and care processes also have potent influences on quality of care (Casalino et al. 2003). Interventions that focus on changing organizational care processes demonstrate the largest effects on prevention performance, including colon cancer screening (Stone et al. 2002). Provider-reported barriers and facilitators in their practice environments (e.g., office reminder systems) have shown particular promise in determining CRC screening variation (Dulai et al. 2004). Other practice characteristics (e.g., practice size, availability of information technology for guidelines, and reminders) have been shown to be more consistently associated with delivery of preventive care than physician characteristics, though not for CRC screening (Pham et al. 2005). The importance of primary care structure in influencing receipt of CRC screening in the context of busy office practices has therefore gained increased attention. In fact, primary care practice “office processes” account for half of all comments among patients and providers regarding what fosters or hinders CRC screening (O’Malley et al. 2004).

In relatively sharp contrast to other public and private sector settings, the U.S. Department of Veterans Affairs (VA) health care facilities have raised screening rates to 68 percent of eligible patients through substantial restructuring toward primary care delivery, implementation of an electronic health record with decision support and practice management utilities (Evans, Nichol, and Perlin 2006), and an incentivized audit-and-feedback system of externally collected performance measures (Kizer 1999). Capitalizing on data resources within what is virtually the United States’s only national health care system, we explored the contribution of primary care practice-level determinants of CRC screening variation, controlling for patient and area characteristics.

METHODS

Conceptual Model and Study Design

The conceptual model used to organize study measures adapts concepts from a hospital-based organizational taxonomy (Bazzoli et al. 1999) to a primary care perspective, aligning theory-driven constructs of centralization, integra-

tion, and differentiation with the strategic needs and structural attributes of primary care organizational features (Table 1). We further anchored this adapted taxonomy within an established conceptual framework for improving the quality of cancer care, delineating theoretical relationships between community, plan (or organization or medical group) and practice settings levels and their link to outcomes (Zapka et al. 2003).

Organization and Primary Care Practice Structure Measures

The structure of individual VA medical centers and their primary care practices was derived from a national organizational survey, the VA Survey of Primary Care Practices. This survey was administered to physician chiefs at all VA facilities serving 4,000 or more outpatients and providing 20,000 or more outpatient visits in FY98 (October 1, 1997–September 30, 1998), resulting in a census of 235 facilities (170 hospital-based and 65 community-based outpatient clinics). If a VA facility was comprised of multiple sites meeting our criteria, we identified a key informant at each geographically distinct site of care. Survey content was prioritized using a nominal group technique emphasizing integration of theoretical hypotheses and empirical evidence with expert opinion to arrive at consensus regarding core structural measures hypothesized to influence key outcome measures (Allen, Dyas, and Jones 2004). In total, 219 VA facilities completed the survey between August 1999 and January 2000 (93 percent response rate).

Measures of *centralization* included locus of authority for decision making and financial independence. For decision making, we developed scales gauging levels of authority over (1) practice structure and operations ($\alpha = 0.89$), (2) staffing and human resource management ($\alpha = 0.84$), and (3) administrative and clinical operations outside the practice ($\alpha = 0.78$). For financial independence, we identified the degree of separate budgetary control, the practice's ability to recapture cost savings associated with their efficiencies, and resource alignment to the primary care mission as measured through the degree of implementation of primary care service lines (i.e., service integration across operating units of a system) (Parker, Charns, and Young 2001). Measures of integration evaluated the level of service coordination within and outside the clinic. We focused on care arrangements hypothesized to influence physician performance, and developed *resource* scales examining the sufficiency of nonphysician staffing ($\alpha = 0.69$), relevant administrative and clinical space ($\alpha = 0.85$), and clinical support arrangements that assure on-site provision of comprehensive services ($\alpha = 0.81$) (Soban and Yano 2005). Measures

Table 1: Primary Care Practice Taxonomy: Centralization, Resources, and Complexity

<i>Domain Name/Definition</i>	<i>Measures</i>	<i>Variable Definition</i>
<i>Centralization:</i> Level of authority and control in an organization.	Implementation of a primary care service line or interdisciplinary division (as opposed to discipline-based departments)	1 = fully implemented; 0 = partially implemented, planned or not under consideration
Components or units within the organization face common resource constraints under a central leadership or authority	Separate budgetary control for primary care program (as opposed to hospital or department of medicine authority) (e.g., primary care cost center) Likelihood that cost savings could be recaptured when achieved through increased primary care efficiency (for example, by reducing staff or by implementing a cross-coverage system) by the primary care practice Level of primary care director's practice autonomy over internal administrative/clinical structure and operations (e.g., establishing clinical procedures, creating new primary care components, establishing and implementing practice guidelines in primary care) Level of primary care director's authority over practice staffing and human resource management issues (e.g., hiring or terminating primary care staff, determining staffing arrangements, evaluating performance of clinical or administrative staff) Level of primary care director's authority or organizational influence outside of primary care (e.g., obtaining primary care contract services, establishing referral mechanisms, establishing procedures for obtaining specialty consult results in a timely manner, obtaining additional resources for primary care quality improvement initiatives)	1 = yes; 0 = no 1 = very or somewhat likely, 0 = neither likely nor unlikely, somewhat unlikely or very unlikely High score = high degree of authority ($k = 4$; $\alpha = 0.89$) High score = high degree of authority ($k = 5$; $\alpha = 0.84$) High score = high degree of authority ($k = 4$; $\alpha = 0.78$)

<i>Resources:</i> Reflects mechanisms designed to integrate operations (e.g., computers, paper flow, standing committees, and meetings to communicate and coordinate people and processes of care)	Sufficiency of nonphysician staffing in primary care (i.e., RNs, LVNs, administrators and clerks) for meeting the practice's current goals	High score = greater sufficiency ($k = 3$; $\alpha = 0.69$)
	Sufficiency of administrative and clinical space in primary care (e.g., administrative offices for clinical staff and support personnel, clinical space such number of examining rooms per provider) for meeting the practice's current goals	High score = greater sufficiency ($k = 3$; $\alpha = 0.85$)
	Sufficiency of clinical support arrangements in primary care (e.g., personal computers or workstations, appropriately equipped examining and treatment rooms, equipment for pelvic exams, patient education space) for meeting the practice's current goals	High score = greater sufficiency ($k = 5$; $\alpha = 0.81$)
<i>Complexity:</i> Refers to the complexity and scope of services in the environment	Facility size (measured as number of unique outpatients served in fiscal year 2000 obtained from the VA National Patient Care Database Outpatient Clinic file) Facility type (hospital-based versus community-based primary care clinic)	Number of outpatients per 1,000 population served 1 = hospital-based; 0 = community-based
	Affiliated with an academic medical school training program for residents (measured as formal arrangement directly with the site or through a parent facility or system or other arrangement)	1 = academically affiliated; 0 = not academically affiliated
	Level of managed care penetration in local environment (measured as percent of local population enrolled in health maintenance organizations in the matched metropolitan statistical area [MSA] where each VA facility is located) (obtained from Interstudy [2001])	Percent of area population enrolled in health maintenance organizations (HMOs)

of differentiation focused on the *organizational complexity* of the practice environment, including its size, academic affiliation (presence of housestaff and other trainees), and the level of local managed care penetration. We used regions (North, Midwest, South, West) to control for geographic variations. Source items and scale development are described in an online Appendix.

CRC Screening Performance

The VA's External Peer Review Program (EPRP) contracts with trained nurse abstractors to conduct structured chart reviews of key clinical quality indicators among randomly sampled outpatients with two or more primary care visits in the past year. CRC screening is documented as evidence of (1) three returned FOBT cards in the prior 12 months, (2) performance of a flexible sigmoidoscopy in the last 5 years, or (3) performance of a colonoscopy in the last 10 years, among patients 52 years and older. Chart review results are aggregated into national datasets to which we obtained access through an approved data use agreement with the VA Office of Quality and Performance for fiscal year 2001 (October 1, 2001–September 30, 2001), mapping to patients with adequate exposure to the structure of care measured at each facility in 1999–2000 ($n = 52,323$).

To reduce the potential for misclassification of CRC screening (versus tests for diagnosis or surveillance), we matched all patients identified as eligible for CRC screening by the chart abstraction to their corollary data in the VA National Patient Care Database. As patients with a prior history of CRC, inflammatory bowel disease, or colorectal polyps are at high risk of CRC and are recommended for follow-up, we excluded them from our screening sample. Further, while screening guidelines provide no upper age limit, we eliminated patients 86 and older as the benefits of screening (especially invasive endoscopic procedures) become diminished and there is less clarity on the value of routine screening. Finally, some patients (3.6 percent) were documented as having refused one or more of the CRC screening tests. While some criteria suggest that these are screening failures, we coded these refusals as being guideline-adherent (Walter et al. 2004).

Patient-Level Covariates

Patient-level covariates were selected on the basis of their hypothesized association with the likelihood of being screened. We excerpted demographic data (age, gender, race/ethnicity, income, insurance status) and number of primary care visits in the 24 months before the chart review from the VA

Outpatient Clinic File. We categorized veterans' race-ethnicity as white (non-Hispanic), black (non-Hispanic), and other (Hispanic, Asian, other). We used a matched dataset comprised of veterans dually eligible for VA and Medicare services, where race data are based on beneficiary self-report ($n = 40,584$, 77.6 percent of sample) to supplement VA race data ($n = 7,400$, 14.1 percent). The remaining 4,339 patients (8.3 percent) were included with white race. We transformed insurance status into dummy variables, using "no insurance" as the referent ($n = 18,511$) compared with Medicare/Medicaid ($n = 26,468$) and other coverage (private, Champus, worker's compensation, other) ($n = 7,234$). Insurance status was missing for 0.2 percent ($n = 110$).

Data Linkage and Statistical Analysis

We linked organizational data ($n = 219$) with the patient-level data ($n = 52,323$) using station identifiers from which each patient was sampled, confirmed through evaluation of each patient's visit patterns. After linkage, we dropped two sites for which insufficient EPRP data were available (fewer than 30 cases), three sites outside the United States, and another 59 sites missing scale scores for resource sufficiency or autonomy, for a remaining 155 primary care clinics. We evaluated characteristics of omitted sites and eliminated patients sampled from those sites, resulting in a sample of 38,818.

We used descriptive statistics to examine practice features and accompanying patient samples. We evaluated relationships between our hypothesized organizational predictors and facility-level CRC screening rates using correlation coefficients for continuous variables and ANOVA for categorical variables, applying a cutpoint of $p \leq .10$ as our inclusion criterion. We also examined correlations among hypothesized predictor variables; among inter-correlated variables, we selected the variable with the strongest relationship to our dependent variable. We included these organizational measures in logistic regression to estimate the influence of specific organizational characteristics on a patient's probability of receipt of CRC screening, adjusting for cluster effects and patient-level covariates associated with screening using *STATA* 8.0.

RESULTS

Organizational Characteristics of Primary Care Clinics ($n = 155$)

Clinics were evenly distributed across the nation (22.9 percent East, 25.2 percent Midwest, 29.9 percent West, and 22.0 percent South). Of the 155 clinics, 97 were hospital-based and 58 were community-based practices

serving an average of 9,592 patients ($\pm 4,964$). Nearly two-thirds were academic practices (64.5 percent), with the remainder having no formal arrangements with academic medical schools for training residents or other trainees (Table 2). Clinics were in relatively high managed care markets, with about one-quarter of individuals in the surrounding communities being enrolled in HMOs (Table 2). Omitted facilities were not significantly different in regional representation, size, or academic affiliation.

Over half had fully implemented service lines (i.e., interdisciplinary divisions) to align resources within primary care (Table 2), but less than one-third had budgetary control over operations and fewer still anticipated being able to recapture any cost savings that might be achieved through PC efficiencies. Authority over the internal structure and operations of the practice was relatively high (from 72.9 to 83.2 percent of VA facilities reported having a good deal-to-complete authority over operational issues), but only half had authority over hiring and firing staff; they were more likely to have input on performance evaluations. Influence on services and functions outside of the practice was more limited, ranging from being able to obtain additional resources for focused quality improvement initiatives (about a third of practices) to establishing their own referral mechanisms to specialists (about half of practices).

Sufficiency of resources to assure the integration, coordination, and delivery of comprehensive services was more variable (Table 2). The majority had adequately equipped treatment and examining rooms, however, the number of examining rooms per provider was sufficient in only 27 percent of practices. Primary-care based clerks, receptionists and nurses were also in relatively short supply.

Characteristics of Enrolled Patients Eligible for CRC Screening (n = 38,818)

The mean age among eligible patients in our sample was 68.8 (± 8.9). The sample was primarily male, white, and low-income, with high visit rates and either public or no insurance (Table 3). Patient characteristics that were predictive of receipt of CRC screening included male gender, older age, higher income, the presence of some form of health insurance, and higher primary care visit rates. We did not find any racial differences in receipt of screening (Table 5).

Practice Structure and Screening Rates

Overall, these facilities achieved a 62.2 percent CRC screening rate (± 12.8 percent), ranging from 29.1 to 89.3 percent of eligible patients. Authority over the internal structure and operations of the practice was significantly

Table 2: Organizational Characteristics of VA Primary Care Practices ($n = 155$)

<i>Organizational Characteristics</i>	<i>Percent</i>
<i>Practice centralization</i>	
Fully implemented service line or interdisciplinary division in primary care	58.0
Separate <i>budgetary control</i> for primary care program	31.0
Likelihood that <i>cost savings</i> achieved through primary care efficiencies could be <i>recaptured by the practice</i> (percent rated very-to-somewhat likely)	24.4
Primary care authority for practice staffing and human resource management issues*	
Recruiting and hiring primary care staff	51.0
Terminating primary care staff	51.0
Determining staffing arrangements (e.g., shifting staff, assigning staff duties)	65.8
Evaluating performance of primary care clinical staff	83.2
Evaluating performance of primary care administrative staff	72.9
Primary care authority or organizational influence outside of primary care*	
Obtaining primary care contract services (e.g., laboratory, community providers)	37.4
Establishing referral mechanisms (e.g., electronic notification, nurse case manager coordination)	53.5
Establishing procedures for obtaining specialty consult results in a timely manner	40.6
Obtaining additional resources for primary care quality improvement initiatives	36.1
<i>Practice resources</i>	
Sufficiency of <i>nonphysician staffing</i> in primary care (mostly-to-completely)	
Nurses (RNs, LVNs)	26.5
Administrators	40.0
Clerks and receptionists	25.2
Sufficiency of administrative and clinical space in primary care (usually-to-always)	
Administrative offices for clinical staff	40.6
Administrative offices for support personnel	43.2
Clinical space (e.g., number of examining rooms per provider)	27.1
Sufficiency of <i>clinical support arrangements</i> in primary care (usually-to-always)	
Personal computers or workstations	44.5
Appropriately equipped examining rooms	50.3
Appropriate equipped treatment rooms (e.g., sigmoidoscopy, podiatry, others)	54.2
Equipment for pelvic exams	42.6
Patient education space (e.g., classrooms, workstations, etc.)	34.8
<i>Practice complexity</i>	
HMO market penetration (percent of area population enrolled in HMO)	26.0
Academically affiliated primary care practices	64.5

*Expressed as percent facilities rating good deal-to-complete authority over each function.

correlated with CRC screening ($r = 0.18$; $p < .01$) (centralization), as was the sufficiency of clinical support arrangements ($r = 0.22$; $p < .001$) (resources). Facility size was significantly, negatively correlated with CRC screening ($r = -0.16$; $p < .05$) (complexity). Other measures were not significantly correlated with CRC screening.

Table 3: Characteristics of Patients Eligible for CRC Screening ($n = 38,818$)

<i>Individual Patient Characteristics</i>	<i>Number</i>	<i>Percent</i>
Age (years)		
52–64	12,156	31.3
65–74	14,098	36.3
75–85	12,564	32.4
Gender		
Male	34,605	89.2
Race		
White*	33,450	86.2
Black	4,289	11.1
Other race**	1,079	2.8
Income		
<\$10,000/year	14,044	36.2
\$10,000—19,999/year	12,097	31.2
\$20,000—29,999/year	7,494	19.3
\$30,000+/year	5,183	13.4
Primary care visits (past 12 months)		
Fewer than 6 primary care visits	8,999	23.2
6–10 primary care visits	17,030	36.3
More than 10 primary care visits	12,789	32.4
Insurance		
None	14,255	36.7
Public (Medicare or Medicaid)	19,234	50.0
Private (HMO, PPO, Champus, “other”)	5,329	13.7

*Includes unknown race

**Combines Hispanic, Asian, and other race categories.

After adjusting for region and individual patient characteristics, patients who received their care from a primary care practice characterized by higher centralization (as measured by primary care practice autonomy) ($p < .04$) and resources (as measured by sufficiency of clinical support arrangements) ($p < .03$) were significantly more likely to receive CRC screening (Table 5). Conversely, patients receiving care from a practice characterized by higher complexity (as measured by facility size) were significantly less likely to receive CRC screening ($p < .001$).

DISCUSSION

We found that patients who received their care at practices characterized by higher levels of local practice autonomy and with greater clinical support

Table 4: Bivariate Relationships between Practice Characteristics and CRC Screening

	Relationship to Facility-Level CRC Screening Performance	
	Correlation	ANOVA
<i>Centralization</i>		
Primary care practice authority [†] over:		
Internal clinical structure/operations	$r = 0.18^{**}$	
Staffing/human resource management	$r = -0.04$	
Organizational influence outside practice	$r = 0.01$	
Service line implemented (yes/no)		$F(1, 123) = 1.51$
Primary care practice able to recapture and redirect cost savings [‡]		$F(1, 125) = 1.67$
<i>Resources</i>		
Separate budget for primary care (yes/no)		$F(1, 128) = 0.16$
Sufficiency of primary care resources [†] :		
Clinical and administrative space	$r = -0.04$	
Clinical support arrangements	$r = 0.22^{***}$	
Nonphysician staffing	$r = -0.01$	
<i>Complexity[§]</i>		
Facility size (# unique outpatients served)	$r = -0.16^*$	
Hospital-based versus community-based clinic		$F(1, 153) = 3.89$
HMO-managed care penetration (%)	$r = 0.09$	
Academically affiliated practice (yes/no)		$F(1, 212) = 0.46$

* $p < .05$;** $p < .01$;*** $p < .001$ for Pearson's correlation coefficients and ANOVAs.

[†]Represent standardized subscale scores (mean = 50, SD = 10) derived from principal components analysis with varimax rotation of survey items asking about how much authority primary care leaders have for specific actions (e.g., internal structure/operations) and also among items asking about sufficiency of clinicians, support staff, space and equipment (Soban and Yano 2005).

[‡]Dichotomized Likert scale, "very likely" and "somewhat likely" versus "neither likely nor unlikely," "somewhat unlikely," and "very unlikely."

[§]Facility size represents caseload for fiscal year 2000. Obtained through an approved data use agreement with InterStudy, HMO penetration (2001) represents the percent of the population enrolled in HMOs in VA-matched Metropolitan Statistical Areas (MSAs). Type of practice (hospital- versus community-based) ($p = .051$) is associated with size and practice autonomy, but has a weaker relationship with CRC screening, so we retained size and autonomy in the final model.

resources in primary care were more likely to receive CRC screening; this was especially true for smaller institutions.

Practice autonomy may be foundational to a broad range of performance measures given the complexity of managing the demands of primary care practice (Crabtree et al. 1998). The ability to have control over the work

Table 5: Practice-Level Predictors of Patients' Receipt of CRC Screening: Results of Cluster-Adjusted Logistic Regression

	<i>Coefficients</i>	<i>Robust SE</i>	<i>P> z </i>	<i>95 % Confidence Intervals</i>	
Practice characteristics (<i>n</i> = 155)*					
Practice authority for clinical protocols [†]	0.08	0.04	0.04	0.00	0.15
Sufficiency of clinical support arrangements	0.11	0.05	0.03	0.01	0.21
Size (unique pts, expressed in 10,000) [‡]	−0.18	0.08	0.02	−0.33	−0.02
Midwest region	0.08	0.10	0.41	−0.11	0.28
Western region	0.01	0.10	0.93	−0.19	0.21
Southern region	−0.15	0.11	0.16	−0.36	0.06
Patient-level covariates (<i>n</i> = 38,818)*					
Age group: 65–74 years old	0.25	0.04	0.00	0.18	0.32
Age group: 75–85 years old	0.17	0.04	0.00	0.09	0.25
Male gender	0.08	0.04	0.03	0.01	0.16
Income: \$10,000—19,999/year	0.03	0.03	0.31	−0.03	0.08
Income: \$20,000—29,999/year	0.11	0.03	0.00	0.05	0.17
Income: \$30,000+/year	0.17	0.04	0.00	0.09	0.24
Visit category: 6–10 primary care visits	0.32	0.03	0.00	0.26	0.38
Visit category: > 10 primary care visits	0.37	0.04	0.00	0.29	0.46
Black race	−0.01	0.05	0.90	−0.10	0.09
Other race	−0.13	0.11	0.25	−0.34	0.09
Insurance: Medicare, Medicaid	0.17	0.04	0.00	0.10	0.24
Insurance: Private (includes Champus and other)	0.17	0.04	0.00	0.09	0.25

*Reference groups for selected dummy variables were Eastern region, 52–64 year old age group, female gender, income <\$10,000/year, <6 primary care visits (past 12 months), white race, and no insurance.

[†]Type of practice is associated with practice autonomy, i.e., community-based practices have less practice autonomy than hospital-based practices ($p < .05$), but has a weaker relationship to CRC screening, so we retained practice autonomy in the final model.

[‡]Since size overlaps with type of practice, we tested for interaction effects and found none.

of primary care may be a key ingredient for implementing prevention-oriented care processes, including “office-systems” approaches emphasizing internal restructuring of care processes (e.g., chart flowsheets, feedback reports) (Carpiano et al. 2003). Adequate clinical support resources (e.g., adequately equipped exam rooms, sufficient computer access) may support implementation of these care processes and offset competing demands in busy office settings by leveraging physicians' time (Jaen, Stange, and Nutting 1994). Empirical evidence also suggests a strong mediating role for the electronic medical record by improving documentation and physician guideline adherence (Elson and Connelly 1995).

Interestingly, these performance differences were not associated with concomitant needs for more nonphysician staff or greater staffing authority, and were accomplished in smaller care environments. Evidence regarding the influence of practice size on preventive service delivery is mixed. In studies of high-, medium-, and low-volume primary care practices, patients seen by high-volume physicians had lower preventive service rates (Zyzanski et al. 1998). In contrast, practice volume was a positive predictor of higher cervical cancer screening both within (Goldzweig et al. 2004) and outside the VA (Battista, Williams, and MacFarlane 1990). Diffusion theory suggests size is typically a positive predictor of organizational innovativeness, but probably as a function of what size “buys” in terms of other structural attributes (e.g., resources) (Rogers 1995). However, we focused on larger clinics than those typically studied; as practices grow in size and complexity, they tend to increase the number of hierarchical levels and become more formal and bureaucratic (Kralewski, Pitt, and Shatin 1985). Our finding is thus consistent with Rogers’ assertion that formalization (more common in larger organizations) is negatively associated with innovation (in this case, structures and processes to facilitate CRC screening). This also raises an important issue about the nature of screening: while all screening tests require certain minimum training standards, some are single-encounter activities (e.g., flu shot), while others require coordination across work-units. CRC screening is in the latter group due to the coordination needed to achieve a complete diagnostic evaluation (Yabroff et al. 2005).

At the heart of the Institute of Medicine’s *Crossing the Quality Chasm* was the need to address the improvement of quality of care through major changes in how health care is organized (Institute of Medicine 2000). Their central tenet was that only through significant, sustained and innovative efforts to reorganize the health care system were substantive gains in quality of care and health outcomes possible. VA’s reorganization of care presaged this report by having already launched significant internal restructuring of the care delivery system, including changes in delivery models (e.g., primary care teams) and adoption of new technologies (e.g., performance standards) and management strategies (e.g., reminders, guidelines, performance audit-and-feedback). While these structural changes in the aggregate have been found to be associated with substantial gains in VA quality over time and in comparison with Medicare (Jha et al. 2003), relatively little is known about discrete organizational characteristics that empirically contributed to these changes in performance. This work begins to open the “black box” underlying these performance gains and demonstrates at least in part the impact of VA’s

“primary care directive” (1994), which mandated development of primary care teams throughout VA (Soban and Yano 2005). This policy shift began the process of over-turning VA’s emphasis on specialty-oriented hospital-based care and provided the organizational substrate on which the subsequent highly publicized VA reorganization could be launched.

In contrast to recent work among over 3,500 doctors in the Community Tracking Study, we also identified discrete mutable features of primary care practice associated with higher CRC screening performance. In that study, no organizational characteristics were associated with CRC screening in contrast to influenza and pneumonia vaccinations, mammography, diabetic eye exams or HbA1c monitoring (Pham et al. 2005). They also combined academic facilities, hospital-based primary care and HMOs into an “all other” category, which unlike our study, limited their ability to examine organizational factors in these other settings. At the same time, since the clinics we studied were relatively large, our findings may be more applicable to other academic group practices, clinic systems, and health plans than to small group or solo practices.

To further place our findings in organizational context, the VA has been described as being most akin to a staff-model HMO, which provides the rationale for benchmarking services and quality to Kaiser Permanente health care settings (Kerr et al. 2004). However, with the reorganization of the mid-1990s, VA reinvented itself a step further as an integrated delivery system (IDS), each practice being linked through electronic medical records, policies, procedures, and reporting authority and performance accountability back through an established hierarchical management infrastructure (i.e., vertical reporting of community-based outpatient clinics to medical centers, horizontal consolidations of medical centers into health systems, and integration of geographically proximal systems, centers and clinics into networks) (Gillies, Shortell, and Young 1997). Focused on the health care needs of a specific community—in this case, veterans—the VA may be achieving some of the promise of a “community health management system” (Shortell, Gillies, and Anderson 1994). Such integrated delivery systems outside the VA, especially those in HMO settings, typically outperform less organized care models (Kellie et al. 1996).

This study has several limitations. While grounded in theory, our conceptual framework does not incorporate all possible explanatory variables, and unmeasured characteristics at the organizational, provider, and patient levels may also account for some of the variation seen (e.g., culture, climate, patient preferences). While our sample size of practices is large, we also have limited degrees of freedom for evaluating some of our existing measures given

their prevalence and/or distribution (e.g., within academic practices, by hospital-versus community-based practices). As an observational study, we are also unable to attribute causality to these structural attributes.

The VA's performance gains have garnered significant interest as a public sector turn-around (Stires 2006), generating questions about how to translate lessons from these successes into opportunities for quality improvement outside the VA (Lomas 2003). The largest U.S. integrated health care delivery system, the VA annually serves over 4 million veterans, who on average tend to have worse health status, fewer options and lower income compared to nonusers and to same-age, same-gender civilians (Rogers et al. 2004). For many, the VA is a safety net provider for uninsured and underinsured veterans who rely on VA's extensive coverage of prescription benefits, mental health care and nursing home care (Shen et al. 2003). Veterans' acute and chronic care needs also pose barriers to addressing their preventive service needs (Flocke, Stange, and Goodwin 1998). As a result, the VA's ability to accomplish this level of screening among such chronically ill, older veterans is unusual compared with other care settings.

While the VA's mission focus on veterans may be unique, the organizational structures of care within the VA's primary care practices that we measured are not unlike those evaluated in other medical group practices in managed care environments in terms of administrative controls, patient care systems standardization and integration, and other care management processes (Kralewski et al. 1998). It is the degree of organization that the VA has accomplished in the past decade in the face of survival threats that has yielded higher accomplishment of these management objectives. That being said, the VA certainly has its own organizational inertia, cultural milieu, and substantial bureaucracy. The VA case example simply provides additional evidence that the obstacles to improving the quality of care in U.S. health care settings may be overcome when the provider, organizational, and public policy barriers are adequately addressed.

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SUPPLEMENTARY MATERIAL

The following supplementary material for this article is available online:
Appendix. Selected Measures of Primary Care Practice Structure.