The Effects of Physician Supply on the Early Detection of Colorectal Cancer

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BACKGROUND. Policymakers question whether there is a relationship between the number and distribution of physicians and the outcomes for important health conditions. We hypothesized that increasing primary care physician supply would be related to earlier detection of colorectal cancer.

METHODS. We identified incident cases of colorectal cancer occurring in Florida in 1994 (n = 8933) from the state cancer registry. We then obtained measures of physician supply from the 1994 American Medical Association Physician Masterfile and examined the effects of physician supply (at the levels of county and ZIP code clusters) on the odds of late-stage diagnosis using multiple logistic regression.

RESULTS. For each 10-percentile increase in primary care physician supply at the county level, the odds of late-stage diagnosis decreased by 5% (adjusted odds ratio [OR] = 0.95; 95% confidence interval [CI], 0.92 - 0.99; *P* = .007). For each 10-percentile increase in specialty physician supply, the odds of late-stage diagnosis increased by 5% (adjusted OR = 1.05; 95% CI, 1.02 - 1.09; *P* = .006). Within ZIP code clusters, each 10-percentile increase in the supply of general internists was associated with a 3% decrease in the odds of late-stage diagnosis (OR = 0.97; 95% CI, 0.95 - 0.99; *P* = .006), and among women, each 10-percentile increase in the supply of obstetrician/gynecologists was associated with a 5% increase in the odds of late-stage diagnosis (OR = 1.05; 95% CI, 1.01 - 1.08; *P* = .005).

CONCLUSIONS. If the relationships observed were causal, then as many as 874 of the 5463 (16%) late-stage colorectal cancer diagnoses are attributable to the physician specialty supply found in Florida. These findings suggest that an appropriate balance of primary care and specialty physicians may be important in achieving optimal health outcomes.

KEY WORDS. Colorectal neoplasms; physicians, family; health policy; health manpower. *(J Fam Pract 1999; 48:850-858)*

There has been great interest in the composition of the physician workforce in the United States.[1-7] Most studies have concluded that there is an overabundance of specialist physicians. The adequacy of the supply of primary care physicians, however, has been debated, with some studies concluding that there is a deficit,[2,7,8] while others argue the current supply is adequate.[9-11]

Absent from this debate, however, have been studies demonstrating the effects of physician supply on health-related outcomes. A few investigations have suggested that an oversupply of specialists may contribute to higher health care costs.[5,12-14] The health benefits of increasing physician supply are less clear. Hospitalization rates for selected conditions have been correlated with primary care physician supply,[15,16] as have access and use of ambulatory health services.[17-20] It is not known, however, whether physician supply affects other health outcomes or to what extent the supply of primary care and specialist physicians independently affect health outcomes.

We examined the effects of physician supply on stage at diagnosis for patients with colorectal cancer in Florida during 1994. Colorectal cancer is the second leading cause of cancer mortality in the United States, and stage at diagnosis is the most important prognostic determinant.[21] Physicians can diagnose colorectal cancer at an earlier stage by eliciting and promptly evaluating signs and symptoms and by providing recommended screening tests, including fecal occult blood testing and flexible sigmoidoscopy.[22] Studies[23-28] have consistently shown that access to health care and a physician's recommendation for screening are important predictors of cancer screening. It might be expected, therefore, that the early detection of colorectal cancer would be dependent on the availability of physician services.

As a marker of access to physician services,[29,30] we hypothesized that increasing physician supply would be associated with earlier stage at diagnosis for colorectal

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cancer. We also hypothesized that the supply of primary care physicians, because of their responsibility to provide comprehensive preventive care, would be a more important determinant of cancer stage than the supply of non–primary-care specialists. In addition, we hypothesized that the supply of family physicians/general internists would be more likely related to stage at diagnosis than other primary care specialties because of the inclusion of sigmoidoscopy in their training and practice.[31-35] One study that included Florida family physicians, for example, found that more than 50% reported performing sigmoidoscopy in their office.[36]

METHODS

Sources of Data

Incident cases of colorectal cancer (n = 9551) occurring in 1994, the most current year for which all relevant data were available, were identified from the Florida Cancer Data System (FCDS), a population-based statewide cancer registry. The FCDS has well-established methods to ensure complete case finding (including cooperative arrangements with other state tumor registries) and standardized procedures for quality control. Study cases included cancers of the colon, rectosigmoid junction, and rectum. We excluded tumors of the anal canal.

To include information that is not routinely available from the FCDS (insurance payer, comorbidity, socioeconomic status), cases were linked with state discharge abstracts. The State of Florida Agency for Health Care Administration (AHCA) maintains discharge abstracts for admissions to all nonfederal acute care hospitals, ambulatory surgical centers, freestanding radiation therapy centers, and diagnostic imaging centers. The data abstracted include social security number, date of birth, sex, race-ethnicity, discharge diagnoses (up to 10), and insurance payer.

FCDS cases were linked with discharge abstracts through a matching process using social security number, sex, race-ethnicity, and date of birth. Cases that successfully matched on all variables were considered valid matches. Cases were also considered valid matches if the sole discrepancy was a social security number or date of birth that differed by only one digit (suggesting data entry errors). Using this method 82.8% of eligible cases were successfully matched, a rate similar to that achieved in a comparable study.[37] Using 1990 US Census data, each individual was assigned the median income/education level of either the Census tract (87% of cases) or ZIP code (13% of cases) of their residence. The use of Census-derived measures of socioeconomic status have been validated in previous studies.[38-41] Our study method was approved by the University of South Florida Institutional Review Board.

The main outcome, stage at diagnosis, was defined as the summary stage at the time of diagnosis using the Surveillance Epidemiology and End Results Site-Specific Summary Staging Guide.[42] For these analyses, stage at diagnosis was classified as either early stage (in situ, local) or late stage (regional, distant). Stage at diagnosis was available for 8933 (93.5%) of the incident colorectal cancer cases. Unstaged patients were older ($P = .001$), had less education ($P = .03$) and income ($P = .003$), were more likely to be widowed ($P = .001$) and nonwhite ($P = .02$). There were no sex differences ($P = .71$) or insurance payer differences ($P = .20$) between staged and unstaged patients. The supply of total physicians ($P = .48$), primary care physicians ($P = .25$), and specialist physicians ($P = .60$) also did not differ between staged and unstaged patients.

We obtained data on physician supply from the 1994 American Medical Association (AMA) Physician Masterfile, which includes allopathic and osteopathic physicians regardless of AMA membership,[43] and population estimates from the 1990 US Census. We created physician supply variables for total physicians, primary care physicians, non-primary-care physicians, and for the individual physician specialties. Primary specialty is self-designated by physicians as the area in which they spend the majority of their clinical time. Physicians were classified as primary care if their primary specialty was either family/general practice, obstetrics/gynecology, or general internal medicine, regardless of their secondary specialty designation.[44,45] Primary care practice content has been verified for physicians meeting this definition.[46] Physicians who indicated they were engaged in full-time direct patient care were counted as one full-time equivalent (FTE); those who indicated in the masterfile that they were either semiretired, in residency training, or engaged in teaching or research were counted as 0.5 FTE.[44] We excluded physicians who indicated they were no longer involved in direct patient care. Previous studies have validated the data contained in the 1994 AMA Physician Masterfile.[43,46-48]

Physician supply was measured from 2 perspectives: regionally by county and locally using ZIP codes. Because we thought individual ZIP codes were too small a unit to assess the availability of physicians, we created a composite measure of local physician supply. We geocoded cases and used their longitude and latitude to determine the 5 closest ZIP codes (by centroid) to the ZIP code of their residence. We then calculated the supply of physicians in patients' ZIP code of residence and the surrounding 5 closest ZIP codes. Similar methods have been used in studies of health care access.[49] To determine if results were sensitive to the number of ZIP codes chosen to define a cluster, we repeated the analyses using other cluster sizes (3, 7, and 10 ZIP codes).

Other variables used in multivariate analyses included insurance payer (Medicare, Medicare health maintenance organization [HMO], Medicaid, commercial indemnity, commercial preferred provider organization, commercial HMO, uninsured [includes self-pay, charity], or other [includes Civilian Health and Medical Program of Uniformed Services, Veterans Affairs, worker's compensation, and other state and local government programs]); race-ethnicity, including white (non-Hispanic), black (non-

Hispanic), Hispanic, or other; marital status (never married, married, divorced, separated, or widowed); and comorbidity. Comorbidity was determined using methods described by Deyo[50] and Charlson.[51] We used International Classification of Diseases, Ninth Revision, Clinical Modification mapping of comorbid conditions as described by Deyo.[50] We excluded cancer-related conditions. We used the original weights described by Charlson[51] in calculating a morbidity index (theoretical range = 0 - 23). We defined 3 categories of comorbidity (0, 1, 2+) on the basis of a patient's index score. There were 1997 cases (21.3%) with one comorbid condition, and 739 cases (7.9%) with 2 or more comorbid conditions.

Multivariate Analysis

We examined the relationship between physician supply and the odds of late-stage diagnosis using multiple logistic regression. Potential confounding variables were modeled in a similar fashion in all logistic models: age (as a continuous variable), level of education (3 indicator variables), level of income (4 indicator variables), insurance payer (7 indicator variables), race-ethnicity (3 indicator variables), sex, comorbidity (single ordinal variable), and marital status (4 indicator variables).

In the first step of our analysis, we contrasted the effects of the supplies of primary care physicians and specialty physicians by including their county-level measures in the logistic model described above. We chose county-level supply measures as the relevant variable for several reasons. We anticipated most patients would be willing to travel some distance to receive specialty care. Also, we considered ZIP code clusters too small an area to adequately measure access to specialty care, especially in urban areas where they are closely spaced. In addition, several Florida health care programs that affect primary and specialty care access are structured and financed at the county level.

We adjusted primary care and specialty physician supplies simultaneously so that effects of primary care supply were adjusted for specialty supply, and vice versa. In addition to examining their main effects, we also examined whether there was a statistical interaction between primary care and specialty care effects. Because specialty physician supply was likely to be correlated with community characteristics, we also stratified analyses by urban or nonurban residence and by high (above the median) versus low (below the median) socioeconomic area of residence.

In the second step of our analysis, we contrasted the effects of individual primary care specialty supplies (family/general practice, general internal medicine, obstetrics/gynecology) by including measures of their supply at the ZIP code cluster level in the logistic model. We chose ZIP code cluster measures of physician supply for this part of the analysis in accordance with the belief that the choice between an internist, family physician, or gynecologist as a patient's primary care physician would be most likely influenced by the availability of these physicians at the local level rather than at the regional level. We also simultaneously controlled the effects of individual supplies of primary care physicians and adjusted for overall physician supply in ZIP code clusters.

To allow for nonlinear relationships, we created indicator variables by percentiles of physician supply in all logistic models.[52] Cases in the lowest 10th percentile of physician supply were designated as the referent group, and 9 indicator variables were created corresponding to each 10-percentile increase in physician supply (n = approximately 900 patients per group). Relationships were then examined by graphing the 9 corresponding odds ratios.[53-55] Linear relationships between physician supply and the odds of late-stage diagnosis were subsequently tested in logistic models using the chi-square likelihood ratio test.[52]

Because all patients residing in the same county are assigned the same measure of physician supply, there may be correlation of error terms. Clustering by county could lead to underestimation of standard errors in logistic models.[56] To examine this possibility we reestimated parameters and their errors using the method of generalized estimating equations, which controls for clustered or correlated data.[57,58]

For odds ratios that were significant, we estimated the number and percentage of late-stage colorectal cancers that could be attributed to the existing physician supply. We first used methods described by Zhang and Yu[59] to estimate the corresponding risk ratios from the odds ratios derived from logistic models, then used established methods to derive attributable percentages and numbers from the risk ratios.[53]

RESULTS

The study population consisted of the 8933 Florida residents who were diagnosed with colorectal cancer in 1994 for whom stage at diagnosis was known (Table 1). Table 2 shows the local and regional physician supply for subjects' places of residence. At the county level, the supply of specialty physicians was more than twice that of primary care physicians. At the local level family/general practice and internal medicine physicians made up the majority of the primary care physicians in patients' ZIP code clusters.

Figure 1 shows the relationship between total physician supply at the county level and the odds of late-stage diagnosis. Odds ratios are relative to cases in the lowest 10th percentile of total physician supply. There was no apparent relationship, either linear or nonlinear, between increasing physician supply and the odds of late-stage diagnosis (χ^2 for linear trend = 0.11; P = .74).

Figure 2 shows the separate relationships of primary care and non–primary-care physician supplies with stage at diagnosis. Controlling for specialty physician supply, the effects of primary care physician supply were linear (χ^2 = 7.34; P = .007). For each 10-percentile increase in primary

TABLE 1

Characteristics of Men and Women with Colorectal Cancer in Florida, 1994 (N = 8933)

Characteristic*	Mean/Median (SD)
Mean age, years	71.5 (11.6)
Median household income, dollars†	28,929 (10,593)
	No. (%)
Sex	
Men	4555 (51.0)
Race/Ethnicity	
White, non-Hispanic	7626 (85.4)
Black, non-Hispanic	534 (6.0)
Hispanic	701 (7.8)
Other	72 (0.8)
Education†	
High school education or less	4162 (46.9)
More than high school education	4715 (53.2)
Marital status	
Never married	623 (7.9)
Current	5399 (61.5)
Divorced	548 (6.2)
Separated	31 (0.3)
Widowed	2182 (24.8)
Insurance payer	
Medicare	5284 (65.3)
Medicare HMO	452 (5.6)
Medicaid	119 (1.5)
Commercial insurance	709 (8.8)
Commercial HMO	662 (8.2)
Commercial PPO	484 (6.0)
Uninsured	234 (2.9)
Other	146 (1.8)
Cancer stage	
In situ	612 (6.9)
Local	2858 (32.0)
Regional	3977 (44.5)
Distant	1486 (16.6)

SD denotes standard deviation; HMO, health maintenance organization; PPO, preferred provider organization

*Numbers for individual categories may not sum to total sample size because of missing data.

†By census tract or ZIP code of residence.

care physician supply, the odds of late-stage diagnosis decreased by 5% (adjusted odds ratio [OR] = 0.95, 95% confidence interval [CI], 0.92 - 0.99). Controlling for primary care physician supply, the effects of specialty physician supply were also linear ($\chi^2 = 7.66$, $P = .006$). For each 10-percentile increase in specialty physician supply, the odds of late-stage diagnosis increased by 5% (adjusted OR = 1.05; 95% CI, 1.02 - 1.09). There was no statistical interaction between the effects of primary care and specialty physician supplies (OR = 0.998; $P = .49$).

Table 3 shows the effects of primary care and specialty physician supplies when analyses were stratified by characteristics of the patient's residence. In urban and high socioeconomic areas, an increasing supply of primary care physicians was associated with earlier diagnosis of colorectal cancer, while an increasing supply of specialty physicians was associated with greater odds of late-stage diagnosis. In nonurban areas there was a trend toward earlier stage at diagnosis with increasing supply of primary care physicians that did not reach statistical significance.

Comparing primary care physician specialty supplies at the local level, an increasing supply of general internists was found to be associated with decreased odds of late-stage diagnosis (χ^2 for linear trend = 7.54, $P = .006$). For each 10-percentile increase in the supply of general internists the odds of late-stage diagnosis decreased 3% (adjusted OR = 0.97; 95% CI, 0.95 - 0.99). In contrast, an increasing supply of obstetrician/gynecologists at the local level was associated with greater odds of late-stage diagnosis (χ^2 for linear trend = 9.52; $P = .002$). Each 10-percentile increase in the supply of obstetrician/gynecologists was associated with a 4% increase in the odds of late-stage diagnosis (adjusted OR = 1.04; 95% CI, 1.01 - 1.06). There was no significant association between the supply of family/general practice physicians at the local level and the odds of late-stage diagnosis (χ^2 for linear trend = 2.83, $P = .09$).

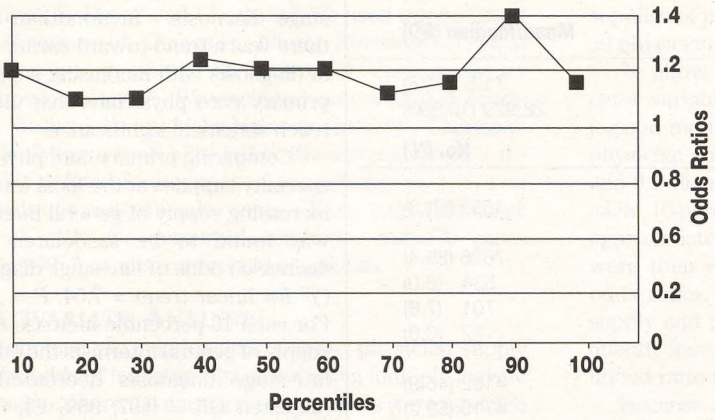
Because obstetrician/gynecologists only serve as primary care providers for women, we repeated analysis stratified by sex (Table 4). There was no statistical association between primary care physician specialty supplies and odds of late-stage diagnosis for men. Among women, however, increasing supplies of family/general practitioners and general internists were associated with lower odds of late-stage diagnosis, while an increasing supply of obstetrician/gynecologists was associated with greater odds of late-stage diagnosis.

We also examined whether the odds of late-stage diagnosis might be affected by the supply of gastroenterologists. The supply of gastroenterologists was not associated with stage at diagnosis when measured at either the county level (adjusted OR = 1.007; 95% CI, 0.98 - 1.03; $P = .55$) or at the local level (adjusted OR = 1.007; 95% CI, 0.998 - 1.02; $P = .14$).

Results were similar when logistic models were repeated with cases restricted to invasive cancers only, to patients having fee-for-service insurance only, or when cases were restricted to ages for which colorectal screen-

FIGURE 1

The total regional physician supply and odds of late-stage diagnosis.



Test of linear trend: (χ^2 = 0.11; P = .74)

Note: Odds ratios for late-stage diagnosis adjusted for patient's age, sex, race-ethnicity, marital status, income, education, insurance payer, and comorbidity (N = 8035). Referent group is patients in the lowest 10th percentile of physician supply. Physician supply was assessed at the county level.

ing is most commonly recommended (50 years and older).[22,60,61] Results also did not differ when physician supply was measured relative to other ZIP code cluster sizes (3, 7, and 10 ZIP codes).

We reestimated model parameters and errors using the method of generalized estimating equations to control for any effects of clustering within the data. Results were similar. The effects of regional primary care and specialty care supplies, for example, were unchanged when potential clustering of data was taken into account (primary care physician supply OR = 0.95; 95% CI, 0.91 - 0.99; P = .01; specialty care physician supply OR = 1.05; 95% CI, 1.01 - 1.09; P = .007).

TABLE 2

Local and Regional Physician Supply for Patients with Colorectal Cancer in Florida, 1994 (N = 8933)

Physician Supply*	Mean (SD)	Median	Range
Regional†			
Total physicians	205.2 (63.5)	218.2	15.5 - 561.4
Primary care physicians	63.6 (15.0)	65.6	9.1 - 125.0
Specialty physicians	141.6 (49.5)	152.6	0 - 436.4
Local‡			
General internal medicine	28.4 (27.3)	21.9	0 - 408.4
Obstetrics/gynecology	13.9 (19.0)	8.4	0 - 315.9
Family/general practice	32.9 (27.6)	26.4	0 - 369.5

SD denotes standard deviation.

* Physicians/100,000 population.

†Regional physician supply measured at the county level.

‡Local primary care physician supply measured at the level of ZIP code clusters.

DISCUSSION

The supplies of primary care and specialty physicians were significantly associated with stage at diagnosis for patients with colorectal cancer. As the supply of primary care physicians increased, the odds of late-stage diagnosis decreased. Unexpectedly, an increasing supply of specialist physicians was found to be associated with later stage at diagnosis. We found no relationship, however, between overall physician supply and stage at diagnosis.

If the associations we observed were causal, it would imply that physician supply had a fairly substantial impact on the likelihood of early colorectal cancer diagnosis. The odds ratio contrasting the highest primary care physician supply with the lowest was 1.60, which is similar in magnitude to the odds ratio we have previously reported (OR = 1.67) describing the effects of being uninsured.[62] On the basis of the odds ratios we observed in this study, we concluded that 437 (8%) of the 5463 patients diagnosed with late-stage colorectal cancer in Florida could theoretically have been diagnosed at an earlier stage if all patients resided either in counties having a primary care physician supply of the highest decile or in counties having a specialty physician supply of the lowest decile. If both conditions were true, 874 of the 5463 (16%) patients diagnosed with late-stage cancer could theoretically have been diagnosed earlier.

Although it is easy to envision how an adequate supply of primary care physicians might contribute to earlier detection of colorectal cancer, it is less clear why an increasing supply of specialists would be detrimental. One possibility is that primary care physicians provide early cancer detection services that specialists do not, and that they compete to provide for patients' health care needs. If patients are more likely to have their health care needs met by specialists when there is an abundant supply, this may result in decreased exposure to early detection services supplied by primary care physicians.

Could the association between late-stage diagnosis and increased specialty physician supply have resulted from referral of patients with late-stage disease to specialists? If physician supply had been assessed at the locations

TABLE 3

Effects of Physician Supply on the Odds of Late-Stage Colorectal Cancer Diagnosis, by Urban or Nonurban Setting and Socioeconomic Status of Patients' Residence

Physician Supply	OR	*P*	OR	*P*
	Urban		Nonurban	
Primary care	0.919	.009	0.957	.052
Specialty care	1.124	.001	1.020	.401
	High SES		Low SES	
Primary care	0.928	.003	0.980	.465
Specialty care	1.072	.007	1.029	.302

OR denotes odds ratio; SES, socioeconomic status.
Note: Urban is defined as census tract or ZIP code that is 100% urban (n = 4227). Nonurban is defined as census areas that contain at least some outside-urban or rural components (n = 3808). High and low SES defined as areas above and below respectively the median of a combined measure of education and income level. Odds ratios represent the change in the odds of late-stage diagnosis with each 10-percentile increase in physician supply.

TABLE 4

The Effects of Local Primary Care Physician Supply on the Odds of Late-Stage Diagnosis, by Sex

Sex	Adjusted OR*	95% CI	*P*
Men (n = 4092)			
Family/general physicians	1.00	0.97 - 1.03	.960
Internal medicine physicians	0.97	0.94 - 1.01	.092
OB/gynecology physicians	1.03	1.00 - 1.06	.103
Women (n = 3923)			
Family/general physicians	0.96	0.94 - 0.99	.014
Internal medicine physicians	0.96	0.93 - 0.998	.036
OB/gynecology physician	1.05	1.01 - 1.08	.005

OR denotes odds ratio; CI, confidence interval; OB, obstetrics.
*Odds ratios (*P* values) for late-stage diagnosis (regional/distant) adjusted for patient's age, education, income, race-ethnicity, marital status, insurance payer, comorbidity, and total physician supply. Odds ratios represent the change in the odds of late-stage diagnosis with each 10-percentile increase in physician supply.

where cancers were diagnosed, then referral patterns could have contributed to this finding. The effects of physician supply were assessed according to the patients' residences, however, not the location where their cancer was diagnosed and should not have been affected by referral patterns.

Could the association have resulted from a greater supply of specialists uncovering more cases of existing late-stage disease? This could conceivably occur for slow growing tumors such as prostate cancer, but would not be expected for more aggressive tumors, such as colorectal cancer. Late-stage colorectal cancers not diagnosed in 1 year will become evident in subsequent years through overt symptoms or death. If the association between late-stage colorectal cancer diagnosis and specialty supply was due to increased detection, one would also expect to find a substantial association between stage at diagnosis and the supplies of gastroenterologists. We did not find that association.

The other possible explanation for these findings is that the relationships observed were the result of confounding with some other factor. The multivariate models, however, controlled for patients' age, sex, race-ethnicity, marital status, comorbidity, type of health insurance, and community measures of socioeconomic status. It is unclear what other factor would be related to stage at diagnosis and have separate and opposite associations with primary care and specialty physician supply.

There is increasing interest in understanding the differences between specialty and primary health care services. Some studies have found no difference in outcomes between the 2 systems of care,[63-66] while others have suggested additional health benefits to specialty care.[66-68] Most have found that primary health care services were less expensive.[67,70,71]

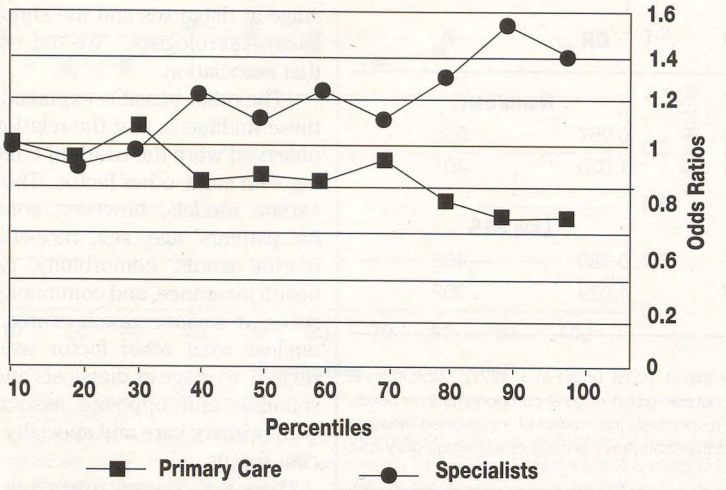
The full value of primary care may result from addressing other health care needs in addition to a specific illness.[72] Stange and colleagues,[73] for example, found that family physicians addressed at least one US Preventive Services Task Force recommendation for preventive care in 39% of visits for chronic illness. Recent evidence suggests that most specialists are not likely to address health care needs outside their specialty.[46,74] Medical subspecialists who are serving as patients' primary providers, however, may be similar to generalists in their delivery of preventive care. Future studies are needed to examine physician supply by type of subspecialty and by other physician characteristics related to the delivery of preventive care.[75-78]

Several investigators[9,11] have argued that the balance between primary and specialty physician supply is irrelevant and that the population level supply of primary care physicians is the only measure important for policy. Our results do not support this premise and suggest that the balance between primary care and specialty physician supplies may well affect important health outcomes.

Among the primary care specialties examined, an increasing supply of general internists was associated with

FIGURE 2

The regional primary care and specialty physician supply and odds of late-stage diagnosis.



Tests of linear trend:
Primary care physician supply ($\chi^2 = 7.34$; $P = .007$)
Specialty physician supply ($\chi^2 = 7.66$, $P = .006$)
Note: Odds ratios for late-stage diagnosis adjusted for patient's age, sex, race/ethnicity, marital status, income, education, insurance payer, and comorbidity (N = 8035). Referent group is patients in the lowest 10th percentile of physician supply. Primary care and specialty physician supplies have been adjusted simultaneously. Physician supply measured at the county level.

earlier stage detection of colorectal cancer, while the opposite was true for the supply of obstetrician/gynecologists. General internists and family physicians may be more likely to include colorectal cancer screening in their practice than are obstetrician/gynecologists, which would explain our findings among women.[31-33,79,80] Obstetrician/gynecologists, however, have shown consistently higher rates of screening for breast and cervical cancers.[76,77,79,81] In addition, obstetrician/gynecologists may not assume the role of primary provider for older women who are at the greatest risk of colorectal cancer.[82]

LIMITATIONS

This study has a number of potential limitations. First, socioeconomic status was not measured at the individual level. Previous studies, however, have validated the use of aggregate measures of socioeconomic status.[38-41]

Although physician supply is an important variable relevant to health care policy, it can be considered only an aggregate measure of individual patients' use of physician services. In future research it will be important to measure actual use of physician services at the individual patient level to confirm these relationships. Finally, our study was restricted to incident cases of colorectal cancer in Florida, which may not be representative of other diseases or other parts of the country.

CONCLUSIONS

We found that an increasing supply of primary care physicians was associated with earlier detection of colorectal cancer. Increasing specialty physician supply, however, was associated with later-stage detection. These findings suggest several potential policy recommendations that would improve health outcomes. In the short term, specialists should be aware of these findings and look at health screening practices within their own patient populations. This is particularly important if they are acting as the primary care physician, whether by their own choice or by default. Similarly, patients who have a specialist acting as their primary care physician should either see a family physician or internist for their ongoing preventive care or ask their specialist for the appropriate screening tests.

In the health policy and reimbursement arenas, there is an ongoing debate concerning whether specialists should be allowed to serve as primary care physicians. The insurance companies, legislators, and regulators who wrestle with these decisions should consider important factors, such as early detection of cancer when they establish their policies. Finally, when our society looks at the overall delivery of health care services, we must strive not just for the right number of physicians but also for an appropriate balance between primary care and specialty physician supply to achieve optimal health outcomes.

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