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Influence of Primary Care Use on Population Delivery of Colorectal Cancer Screening

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Abstract

Objective—Colorectal cancer (CRC) screening is commonly initiated during primary care visits. Thus, at the population level, limited primary care attendance may constitute a substantial barrier to CRC screening uptake. Within a defined population, we quantified the percent of CRC screening underuse that is potentially explained by low use of primary care visits.

Methods—Among 48,712 adults aged 50-78 years eligible for CRC screening within a Washington state health plan, we estimated the degree to which a lack of CRC screening in 2002-2003 (fecal occult blood testing, sigmoidoscopy, or colonoscopy) was attributable to low primary care use, expressed as the population attributable risk percent (PAR%) associated with 0 to 3 primary care visits during the two-year period.

Results—In analyses adjusted for age, comorbidity, non-primary care visit use, and prior preventive service use, low primary care use in 2002-2003 was strongly associated with a lack of CRC screening among both women and men. However, a majority of unscreened women and men had ≥ 4 primary care visits. Thus, whether low primary care use was defined as 0, 0 to 1, 0 to 2, or 0 to 3 primary care visits, the PAR% associated with low primary care use was large in neither women (range: 3.0-6.8%) nor men (range: 5.6-11.5%).

Conclusions—Health plan outreach efforts to encourage primary care attendance would be unlikely to substantially increase population uptake of CRC screening. In similar settings, resources might be more fruitfully devoted to the optimization of screening delivery during primary care visits that patients already attend.

Keywords

Primary Care; Colorectal Cancer Screening; Gender; Healthcare Disparities; Multivariable Analysis

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The CRN consists of the research programs, enrolled populations, and data systems of 14 health maintenance organizations nationwide. The overall goal of the CRN, and the National Cancer Institute initiative under which it was funded, is to use this consortium of delivery systems to conduct research on cancer prevention, early detection, treatment, long-term care and surveillance. A portfolio of research studies encompasses cancer control topics ranging from modification of behavioral risk factors such as smoking to cancer care at the end of life.

INTRODUCTION

Although screening can reduce reducing colorectal cancer (CRC) mortality (1), nearly half of eligible patients in the U.S. have not been screened (2). Screening can be accomplished via several testing options, including fecal occult blood testing, sigmoidoscopy, and colonoscopy (3), but completion of each test is a multi-step process, typically initiated by a primary care physician's order or by a primary care physician's referral to a specialist. Thus, a patient-physician encounter, particularly within primary care, may be a crucial first step in the process of CRC screening, and patients who attend few or no primary care visits may be especially likely to remain unscreened.

Indeed, a primary care physician's recommendation and assistance are consistent and powerful predictors of patient completion of CRC screening (4-7). However, it is possible that a substantial fraction of the unscreened population receives little or no primary care, and so has little or no opportunity to receive a physician's recommendation. Understanding how the unscreened population is presently served by primary care can assist health plans in judging the relative importance of opportunistic and outreach strategies to increasing screening. If limited or absent primary care use is common and strongly associated with a lack of screening, then health systems might invest in efforts to promote primary care attendance, while perhaps also developing outreach strategies to encourage CRC screening independent of primary care. On the other hand, if most patients attend primary care visits yet still go unscreened, resources might be better devoted to maximizing the opportunistic delivery of CRC screening during primary care visits that patients are already attending.

We estimated the extent to which limited or absent primary care use contributes to underuse of CRC testing within the population served by a large U.S. health plan. Because the health plan collects relatively comprehensive utilization data for all enrollees, we could ascertain completion of CRC testing across an entire population, including patients with few or no primary care visits. We hypothesized that receipt of little or no primary care would constitute a substantial barrier to population delivery of CRC testing. In addition, we hypothesized that the contribution would be relatively greater among men at onset of screening eligibility (age 50 years), because, unlike women, men in their early fifties may not be accustomed to routine physician visits for preventive care.

METHODS

Setting and Subjects

Subjects were enrolled in Group Health, a pre-paid health plan that serves approximately 350,000 enrollees in western Washington State. Data sources to determine eligibility and study variables included automated health care and pharmacy data and a regional Surveillance Epidemiology and End Results (SEER) cancer registry, which have been used extensively for research. The Group Health Human Subjects Review Committee approved the study methods.

We identified a population-based cohort of enrollees who were aged 50-78 years on January 1, 2002 and who were eligible for CRC screening in 2002-2003 based on absence of sigmoidoscopy, colonoscopy, or barium enema in 1997-2001. Subjects were continuously enrolled during the study years and five prior years to enable ascertainment of CRC testing from 1997 to 2003. Additionally, subjects lacked diagnostic indications for surveillance or diagnostic CRC testing [i.e., any positive fecal occult blood test (FOBT) in 1997-2001, a history of prior colorectal cancer, colonic polyps, or inflammatory bowel disease]. CRC diagnoses were identified by SEER registry linkage. Diagnostic and procedural codes used to identify diagnoses and CRC tests have been previously reported (8,9).

Enrollees either select or are assigned primary care physicians and are encouraged to seek most initial care from primary care physicians located at 20 clinics across the Puget Sound region. Although clinic staff schedule new appointments with assigned primary care physicians whenever possible, patients may seek and receive care from other plan physicians (including specialists). In 2002-2003, plan recommendations regarding CRC screening for adults aged 50 years and older were consistent with the 2002 recommendations of the U.S. Preventive Services Task Force but emphasized regular FOBT and periodic sigmoidoscopy (10). Primary care physicians, however, could refer patients for screening colonoscopy.

Outcomes

We classified subjects as unscreened if none of the following four CRC tests were completed in 2002-2003: FOBT, sigmoidoscopy, colonoscopy, or double-contrast barium enema. FOBT completion was ascertained using automated laboratory data. Sigmoidoscopy, colonoscopy, and barium enema tests were identified from procedural codes on outpatient and inpatient encounters. Due to concerns about misclassification (11), we did not attempt to distinguish screening from diagnostic CRC tests.

Primary Care Use

Health plan databases define adult primary care providers based on generalist specialty (i.e., family medicine, general internal medicine, or generalist nurse practitioners or physician assistants) and practice location at one or more primary care clinics. We used automated healthcare data to count the number of visits to primary care providers and classified patients as having 0, 1, 2, 3, 4, 5, 6 to 7, or ≥ 8 visits in the two year study period. We categorized primary care use in this fashion to allow dose-response analyses by exposure to primary care. We selected an upper cut-off of ≥ 8 visits in 2002-2003, because only 40% of the population had ≥ 8 visits, so these patients are above the population median in primary care use. Encounters with obstetrician-gynecologists were not considered primary care visits, because these clinicians do not function in this capacity in the plan.

Covariates

We analyzed outpatient and inpatient encounter data to compute an automated form of the Charlson comorbidity index (12). We determined counts of non-primary care visits (including specialist and emergency visits but not mental health visits). We also developed two variables to reflect preventive health behavior in the previous two years (2001-2002), because we believed these would correlate with unmeasured patient attitudes and beliefs regarding preventive health care. First, we counted the number of FOBTs completed in 2001-2002. Second, we determined whether patients received a preventive health examination in 2001-2002 as defined in previous research (8,13). To develop proxy measures of socioeconomic status (i.e., median household income and proportion of persons aged 25 years and older that completed high school in the residence ZIP code) (14), we linked subjects to a health plan database of year 2000 Census data. The large majority of subjects (95.1%) were successfully linked to Census data; no patient covariates were significantly associated with successful Census linkage (including age, sex, comorbidity, and health care use variables described above).

Analyses

The analytic goal was to estimate the population attributable risk (PAR%) of going unscreened for CRC associated with decreasing exposure to primary care. PAR% estimates the proportion of disease that is attributable to a risk factor in a population and, therefore, provides policymakers with useful information about the value to population health of devoting resources to ameliorate or remove the risk factor (15). An important property of PAR% is that

it depends not only on the strength of the risk factor, expressed as relative risk, but also on the prevalence of the risk factor among diseased persons. In our context, the “disease” is lack of screening and the “risk factor” is a lower vs. a higher number of primary care visits, and PAR % is calculated as:

$$[(RR - 1) / RR] * P,$$

where RR is the adjusted relative risk of going unscreened associated with a specific number of primary care visits (relative to the referent of ≥ 8 primary care visits) and P is the proportion of unscreened subjects with that number of primary care visits (16).

We first performed descriptive analyses to identify covariates that were significantly associated with limited primary care use. In particular, we used chi-square tests to compare the distribution of covariates among patients with 0 or 1 primary visits and ≥ 2 primary care visits. We chose these visit categories because relative risks of lack of screening were found to be particularly elevated for those with 0 or 1 primary care visit.

Using random-effects logistic regression, we then estimated the relative odds of going unscreened associated with different numbers of primary care visits while adjusting for age (in five-year categories), sex, Charlson comorbidity index (0, 1, 2, ≥ 3), non-primary care visits (quintiles), and number of FOBTs (0, 1, ≥ 2) and preventive health examination receipt in 2001-2002. We used random-effects models to correct standard errors for clustering of patients within primary care physician practices. We then used fitted models to predict adjusted percents of unscreened patients within each primary care visit stratum among both women and men (17). Using these adjusted percents, we computed the adjusted relative risk (RR) of lack of screening as the ratio of the predicted percent unscreened within each strata and the predicted percent of patients with ≥ 8 primary care visits that were unscreened (the referent).

We then estimated the adjusted proportion of all unscreened women and men that were within each primary care visit stratus (i.e., “P” in the formula for PAR% given above). First, we estimated the adjusted number of men or women in each primary care visit strata as the product of the predicted percent unscreened (from our logistic model) and the total (crude) number of women and men within the strata. We then estimated the adjusted proportion of the total number of unscreened women and men that were in the each visit strata as the ratio of the adjusted number of women and men in each strata and the total number of women and men in all visit strata. Using the adjusted relative risks and adjusted proportions of the unscreened population within each primary care visit stratum, we finally computed the PAR% for each primary care visit stratum for both women and men.

While initial analyses grouped primary care visits discretely (i.e., 0, 1, 2, 3, etc.), additional models grouped those with the lowest number of primary care visits (i.e., 0 to 1, 0 to 2, 0 to 3). These models allowed us to calculate the PAR% using more or less stringent definitions of limited primary care visits and to assess whether there was a threshold of primary care exposure beyond which the PAR% was very small. We also calculated the PAR% among women and men of different ages to judge whether limited primary care made a relatively greater contribution to lack of screening among younger men or women. Finally, among the subjects successfully linked to Census data (n=46,324), we repeated the analyses while additionally adjusting for neighborhood median household income and educational status. Because results were essentially unchanged, we report results among the full sample without these adjustments.

RESULTS

Among 48,712 women and men who were eligible for CRC screening, the mean number of primary care visits in 2002-2003 was 8.7 (median=6; SD=9.7). Women had a greater mean number of primary care visits than men (9.6 vs 7.6 visits; pairwise comparison, $p<0.001$), and a smaller proportion of women had fewer than two visits than men (10.3% of all women vs. 17.0% of all men; $p<0.001$). Compared to patients with two or more primary care visits, patients with zero or one visits were significantly more likely to be younger and of lesser comorbidity (Table 1). Additionally, patients with zero or one primary care visits had fewer non-primary care visits and were less likely to have completed FOBTs or attended preventive health examinations in 2001-2002.

Among both women and men, relative risks of going unscreened in 2002-2003 were highest among those with zero primary care visits and declined with an increasing number of primary care visits (Table 2). Indeed, the adjusted percent of women and men with zero visits that were unscreened exceeded 98%. Nevertheless, even among women and men with ≥ 8 primary care visits, over half of patients remained unscreened. Relative to patients with ≥ 8 visits, the risk of being unscreened was approximately 60% greater among women and 70% greater among men with zero primary care visits. However, a majority of unscreened women and men attended four or more primary care visits in 2002-2003, while a minority of unscreened women (14.3%) and men (23.1%) had zero or one primary care visits. As a result, the PAR% of zero visits was only 3.0% among women and 5.6% among men. Similarly, the PAR% of having one primary care visit was 1.9% among women and 3.6% among men.

Because a greater proportion of unscreened men had relatively few primary care visits than women, the PAR% associated with low visits was higher among men than women whether low visits was defined as 0, 0 to 1, 0 to 2, or 0 to 3 primary care visits (Table 3). For example, the PAR% associated with attendance of 0 to 3 visits was approximately 70% greater among men than women (11.5% vs. 6.8%, respectively). Meanwhile, among men, receipt of few visits was especially common among unscreened younger men. Thus, the PAR% associated with 0 to 3 visits among men aged 50-54 years was 12.1% compared to 5.4% among men aged 75-78 years. Among women, a similar fraction of younger and older unscreened women received few visits. Thus, in contrast to the male population, the PAR% associated with few visits was generally similar among younger and older women.

DISCUSSION

Among a population-based sample of health plan enrollees eligible for CRC screening, most patients who went unscreened over a two-year period received several primary care visits during that time. Although receipt of few primary care visits was associated with lack of screening, the fraction of lack of screening that could potentially be attributed to limited primary care exposure (i.e., 0 to 3 visits over a two-year period) exceeded 10% only among men. Among women, the fraction of lack of screening associated with limited primary care visits was substantially less, because a large majority of unscreened women had more than three primary care visits. In similar settings, policymakers and health system leaders may wish to prioritize interventions to optimize opportunistic delivery of CRC screening during existing primary care visits, rather than outreach efforts to encourage primary care attendance among population subgroups that are accessing little or no primary care. Alternatively, programs to promote CRC screening independently of primary care may hold promise.

Research suggests several potential targets for improving the delivery of CRC screening during primary care visits. Because patients consistently cite the importance of a physician's recommendation in motivating CRC screening (4-7), health systems should prioritize

interventions with proven efficacy in increasing physicians' CRC screening recommendations, including: i) educational programs to increase provider awareness of CRC screening guidelines (18); ii) systems to prompt patients to inquire about CRC screening (19-21) or to remind providers at the point-of-care regarding patient eligibility (20,22,23); iii) financial incentives for providers or patients (24,25); and iv) promotion of visits dedicated to the delivery of evidence-based preventive services (8,24,26). Primary care systems could also augment CRC screening by assigning non-physician team members (e.g., nurses or medical assistants) tasks of assessing and counseling patients regarding CRC screening eligibility (27-29). Finally, there is likely room for improving the effectiveness of provider counseling regarding CRC screening, as many CRC screening discussions apparently do not conclude with patient uptake of CRC screening (30,31).

Although the strength of the association between limited primary care and absence of CRC screening was similar among women and men, the PAR% was greater among men than women, because a greater proportion of unscreened men had few primary care visits. In addition, the PAR% of limited primary care was highest among younger men (aged 50-59 years). While many women aged 50-59 years may be accustomed to seeking regular primary care services for breast and cervical cancer screening, many men of the same age may be unaware of guidelines recommending CRC screening for adults aged 50 years and older. In addition, younger men may perceive the attendance of a preventive physician visit as contrary to current social norms, suggesting the need for public health messages encouraging men over age 50 years to discuss CRC screening and other evidence-based preventive services with primary care physicians.

Relative risk estimates in our study may be subject to residual confounding by unmeasured patient characteristics that are associated with both primary care attendance and completion of CRC screening. To the extent that unmeasured patient factors explain observed associations rather than visit attendance, our study may exaggerate the true PAR% associated with low numbers of primary care visits. In addition, CRC tests may have been performed for diagnostic rather than screening purposes. Because patients with more primary care visits may be more likely to have tests performed for diagnostic purposes, we may have overestimated the true percent of patients who received CRC screening to a relatively greater extent in strata of patients with greater numbers of primary care visits. Such differential misclassification would tend to inflate PAR% estimates by increasing both the RR associated with low visits and P (the proportion of all unscreened patients that had low visits). In spite of potential biases that may inflate PAR% estimates, PAR% estimates were generally small, so the policy implications of our findings do not seem altered.

The comprehensiveness of the health plan data (including data on patients who received zero primary care visits) enabled us to quantify the impact of primary care use on the delivery of CRC screening to an entire population. Nevertheless, the population was insured by a single integrated health plan with a relatively high degree of primary care access. In other populations with lesser access to primary care, limited primary care use may contribute to a greater extent to slow population uptake of CRC screening.

Among health plan enrollees, limited primary care attendance was associated with a lack of CRC screening, yet most unscreened women and men attended regular primary care over a two-year period. Our study therefore suggests that health plan efforts to increase population use of CRC screening might best prioritize the successful delivery of CRC screening during primary care visits that patients already attend.

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Table 1
Patient Characteristics by Sex and Primary Care Visit Use, 2002-2003

Variable	Women (N=26,314)		Men (N=22,398)	
	Primary Care Visits			
	0 to 1 (n=2,699)	>=2 (23,615)	0 to 1 (n=3,808)	>=2 (n=18,590)
	Column %		Column %	
Age, y*				
50-54	36.0	32.5	45.7	31.5
55-59	21.9	21.6	25.0	23.4
60-64	12.8	12.8	12.6	14.3
65-69	10.6	10.4	6.9	10.9
70-74	11.0	12.5	6.3	11.9
75-78	7.7	10.4	3.6	8.1
Charlson Comorbidity Index				
0	89.9	73.7	91.0	71.7
1	7.0	16.4	6.4	17.3
2	2.1	6.5	2.1	6.8
>=3	1.0	3.5	0.5	4.2
Non-primary care Visits, 2002-2003 (Quintile)				
0	46.6	8.5	49.8	12.1
1 to 2	33.6	27.0	33.8	28.6
3 to 5	11.6	25.1	10.2	23.0
6 to 9	5.1	16.7	4.1	16.1
>=10	3.1	22.8	2.1	20.3
Fecal Occult Blood Tests, 2000-2001				
0	86.9	71.8	87.7	75.4
1	12.2	25.4	11.9	22.0
>=2	0.9	2.9	0.4	2.7
One or More Preventive Health Examinations, 2000-2001	39.0	63.4	26.0	41.3

* In χ^2 analyses within sex strata, all listed patient characteristics differ significantly by primary care visits ($p < 0.001$).

Table 2

Population Attributable Risk Percents (PAR%) of Lack of Colorectal Cancer Screening Associated Primary Care Visit Number, 2002-2003 (N=26,314 women and 22,398 men)

Primary Care Visits	Women				Men			
	Adjusted % Unscreened*	Relative Risk of Being Unscreened*	Percent of Total Unscreened in Strata, %	PAR%	Adjusted % Unscreened*	Relative Risk of Being Unscreened*	Percent of Total Unscreened in Strata, %	PAR%
0	98.5	1.62	7.7	3.0	98.2	1.76	13.0	5.6
1	86.0	1.42	6.6	1.9	83.9	1.50	10.7	3.6
2	74.4	1.23	7.4	1.4	70.7	1.27	10.4	2.2
3	70.4	1.16	8.0	1.1	66.4	1.19	10.1	1.6
4	65.5	1.08	7.7	0.6	61.2	1.10	8.5	0.7
5	64.1	1.06	7.3	0.4	59.7	1.07	6.9	0.4
6 to 7	62.8	1.04	13.1	0.5	58.2	1.04	11.4	0.5
>=8	60.6	1.0 (ref)	42.1	---	55.9	1.0 (ref)	29.0	---

* Adjusted for age (50-54, 55-59, 60-64, 65-69, 70-74, 74-78 years), Charlson comorbidity index (0, 1, >=2), quintile of non-primary care visits, number of fecal occult blood tests (0, 1, >=2) and receipt of a preventive health examination in 2001-2002.

Population Attributable Risk Percents (PAR%)* by Sex, Age, and Number of Primary Care Visits, 2002-2003

Table 3

Age	Women						Men		
	Primary Care Visits						Primary Care Visits		
	0	0 to 1	0 to 2	0 to 3	0	0 to 1	0 to 2	0 to 3	
All ages combined	3.0	4.8	5.9	6.8	5.6	9.0	10.6	11.5	
Age group, y									
50-54	2.8	4.5	5.6	6.6	6.3	10.1	11.5	12.1	
55-59	3.4	5.1	6.6	7.6	6.1	9.8	11.8	12.7	
60-64	3.5	5.5	6.1	7.2	5.8	9.2	10.9	11.3	
65-69	3.5	5.3	6.4	6.9	4.3	6.7	8.0	9.1	
70-74	2.9	4.8	5.9	6.6	3.6	5.9	7.3	8.4	
75-78	2.0	3.3	4.0	4.6	2.4	4.1	4.9	5.4	

* PAR% computed as $[(RR-1)/RR] \times P$, where RR is the stratum-specific adjusted relative risk of being unscreened, and P is the adjusted proportion of the total unscreened population that is within the stratum.