

# Predicting Adherence to Colonoscopy or Flexible Sigmoidoscopy on the Basis of Physician Appointment–Keeping Behavior

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**Background:** Poor patient attendance to scheduled flexible sigmoidoscopy or colonoscopy may contribute to deficient colorectal cancer screening.

**Objective:** To examine the association of physician appointment–keeping behavior with attendance to scheduled endoscopic studies of the colon.

**Design:** Retrospective cohort.

**Setting:** 23 sites performing endoscopic procedures in a health care system.

**Patients:** 11 803 patients scheduled for a first colon study with 3 or more scheduled physician visits from June 1999 through November 2001.

**Measurement:** 2 outcomes from health system computerized records: 1) attendance at the first scheduled colon study and 2) among nonattendees, attendance at the study rescheduled within 6 months. Physician visit adherence was defined as the proportion of physician visits kept, grouped by quartile. Adjusted associations were examined in conditional logistic regression.

**Results:** Of 11 803 patients, 62% attended the first colon study.

Of the 4496 nonattendees, 2739 (61%) rescheduled and, of these, 64% kept that appointment. Compared with the highest quartile of physician visit adherence (>85%), the adjusted odds ratio of attending the first colon study decreased as physician visit adherence decreased: Adjusted odds ratios were 0.94 (95% CI, 0.89 to 1.00) for 76% to 85% adherence, 0.87 (CI, 0.81 to 0.92) for 66% to 75% adherence, and 0.79 (CI, 0.73 to 0.85) for adherence of 65% or less. Among nonattendees who rescheduled, the lowest quartile of physician visit adherence ( $\leq 65\%$ ) was the only statistically significant predictor of attending the rescheduled study (adjusted odds ratio, 0.87 [CI, 0.78 to 0.98]).

**Limitations:** The adherence measure applies only to patients with at least 3 scheduled visits. Persons having a colon study outside of the system could have been misclassified.

**Conclusion:** Physician appointment–keeping behavior predicted attendance to colorectal endoscopic studies in this cohort and may help identify persons who need interventions to promote adherence.

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Experts have endorsed periodic direct visualization of the colorectum to screen for colorectal cancer (1, 2). However, in 2001 the Behavioral Risk Factor Surveillance System found that less than half of eligible persons (48%) 50 years of age or older had had colonoscopy or flexible sigmoidoscopy (3). Endoscopic studies of the colorectum are particularly taxing for patients because they require substantial preparation, as well as keeping the appointment. We hypothesized that patients who were generally nonadherent to physician visits would also be less likely to keep their appointments for colon studies. Computerized scheduling data can now be used to evaluate patients' appointment-keeping behavior. These data may help to identify patients in greatest need of interventions to improve adherence to colonoscopy and flexible sigmoidoscopy.

## METHODS

### Study Sample

We used the University of Pennsylvania Health System's ambulatory scheduling and billing system (IDX Systems Corp., Burlington, Vermont) to identify all patients with flexible sigmoidoscopy or colonoscopy (colon study) scheduled by a primary care practice from June 1999 through November 2001. To focus on the first colon study, we considered only patients without a previous colon study since the scheduling system began in December 1997. Referring primary care practices ranged from large urban clinics and

physician practices to small suburban physician practices. Sites performing these endoscopic procedures used various approaches to remind patients about scheduled studies, but there were several commonalities. All sites reminded patients by telephone before the procedure and mailed brochures about the preparation and the procedure. Patients who canceled their appointments could reschedule them immediately. Primary care physicians were not routinely notified when patients did not keep colon study appointments, but the scheduling system would have indicated this.

### Outcome Variables

Our primary outcome was having "arrived" at the colon study appointment compared with cancellation or not showing up. For both the colon study appointment and physician visits, the patient was judged to have kept an appointment if a cancellation was followed by an arrival within 1 day. Among those patients who did not arrive but rescheduled within 6 months, our secondary outcome was arrival at the second appointment. We used the scheduling information from the IDX system from January 2000 through August 2002 to examine the disposition of follow-up colon studies.

### Primary Predictor Variable

We examined all scheduled physician visits to both primary care and subspecialty physicians in the health system up to 2 years before the first colon study appointment

to define physician visit adherence. Physician visit adherence was measured as the proportion of all scheduled physician appointments within 2 years preceding the first colon study appointment that had an “arrived” status. Study participants had a median of 13 scheduled visits to health system providers over a 2-year period (interquartile range, 7 to 25 visits), and the median proportion of visits that were kept was 75% (interquartile range, 65% to 86%). We created variables for quartiles of scheduled visits in the study time frame.

### Other Study Variables

Because Asian and Hispanic persons made up only 4% of the sample, they were analyzed with white persons. Insurance type was classified as Medicare, Medicaid, commercial, or other (self-pay or unknown). From the 2000 U.S. Census, we determined the median household income associated with the ZIP code of each patient’s residence. Missing data for race or ethnicity ( $n = 1033$ ), ZIP code ( $n = 10$ ), and median household income information for the ZIP code ( $n = 310$ ) was imputed by using multiple imputation (4) in the SAS procedures PROC MI and PROC MIANALYZE (SAS Institute, Inc., Cary, North Carolina).

We created an indicator for a chronic medical condition identified by 2 occurrences of coded diagnoses on inpatient or outpatient encounters: hypertension, diabetes mellitus, chronic obstructive heart disease, chronic bronchitis, asthma, coronary artery disease, congestive heart failure, peripheral vascular disease, cancer (lung, breast, uterus, prostate, or ovarian), and renal failure (available upon request). We also created an indicator for at least 2 occurrences of coded diagnoses for any chronic gastrointestinal conditions (available upon request). The 23 practices (primarily gastroenterology) where the procedures were scheduled were classified by urban versus suburban location. Finally, we created a variable for the 6-month time period in which the first colon study was scheduled.

### Statistical Analysis

We examined unadjusted and adjusted associations of patients’ adherence to physician visits with attending the first colon study appointment and, among nonattendees, with attending a rescheduled appointment within 6 months. Unadjusted analyses were performed by using the chi-square test. In all our adjusted analyses, conditional logistic regression was used to control for confounding because of clustering of patients in sites performing the endoscopic procedures. The clustering of similar patients in the study center is not addressed directly by conventional methods, such as generalized estimating equations or random-effects models. The variable for urban versus suburban practice location was not included in the conditional logistic regression model because it did not vary with the clustering variable (that is, practice). We also examined adjusted associations of patient characteristics with low

#### Context

Flexible sigmoidoscopy and colonoscopy are important screening tools for colon cancer, but many patients miss scheduled appointments for these procedures.

#### Contribution

In a large health care system in Philadelphia, 62% of 11 803 patients attended scheduled colon studies. Among patients who kept more than 85% or fewer than 66% of their scheduled visits with physicians in the past 2 years, 70% and 52%, respectively, attended the colon study appointment.

#### Implications

Patients who frequently miss scheduled appointments with their physicians will probably miss appointments for sigmoidoscopy and colonoscopy.

—The Editors

physician visit adherence. Analyses were performed by using SAS software, version 8.0.

### RESULTS

For the 13 142 identified patients with a first colon study appointment from June 1999 through November 2001, we excluded patients with fewer than 3 physician visits in the preceding 2 years ( $n = 1258$ ) because having few visits limited our examination of physician visit adherence. Other exclusions included death within study time frame ( $n = 73$ ), missing sex data ( $n = 2$ ), and no arrived visits to yield clinical data ( $n = 6$ ). Persons with few physician visits had slightly higher adherence to the first colon study (64%) than did study participants (61%).

Our final study sample included 11 803 persons with 228 577 scheduled visits to system providers and had procedures scheduled at 23 sites. Of these sites, 5 had fewer than 10 patients scheduled and 17 had more than 20 patients scheduled. Only 62% of the 11 803 study patients kept their first colon study appointment (Table 1). Of the 4496 nonattendees, 61% rescheduled within 6 months and, of these, 64% kept the second appointment. Adherence to physician visits was linearly associated with colon study adherence. Of patients in the lowest quartile of physician visit adherence (that is, those who kept  $\leq 65\%$  of visits), roughly half attended their first colon study compared with 70% of persons in the highest adherence level (that is, those who kept  $>85\%$  of visits). Female sex; black race or ethnicity; median annual household income less than \$25 000; chronic disease; and Medicaid, self-pay, or unknown insurance were negatively associated with keeping the first or the rescheduled colon study appointment. A gastrointestinal condition, colonoscopy, and a suburban gastroenterology practice had statistically significantly

**Table 1. Patient Demographic, Clinical, and Health Care Use Characteristics by Completion of First Scheduled Colon Study and, among Nonattendees, by Completion of a Rescheduled Study**

Characteristic	Patients Who Completed First Scheduled Colon Study	First Study Nonattendees Who Rescheduled Colon Study within 6 Months
Total patients	11 803 (61.9)	2739 (64.2)
Physician visit adherence		
≤65%	3022 (52.0)*	847 (57.9)*
66%–75%	3030 (61.4)	723 (63.1)
76%–85%	2765 (65.1)	606 (68.2)
>85%	2986 (69.5)	564 (71.9)
Age		
<50 y	2489 (61.3)†	556 (63.0)
50–54 y	2333 (59.2)	598 (60.2)
55–59 y	1863 (61.7)	456 (64.7)
60–64 y	1429 (63.9)	319 (69.0)
65–69 y	1306 (63.1)	296 (64.9)
≥70 y	2383 (63.5)	514 (66.3)
Sex		
Women	6626 (59.8)*	1613 (61.3)*
Men	5177 (64.7)	1126 (68.3)
Race or ethnicity		
Black	3428 (57.8)*	877 (57.7)*
Nonblack	8375 (64.8)	1862 (67.2)
Chronic medical conditions		
No	8080 (63.1)*	1828 (65.8)†
Yes	3728 (59.4)	911 (61.0)
Gastrointestinal disease		
No	9306 (59.1)*	2327 (63.9)
Yes	2497 (72.5)	412 (65.5)
Median annual income (by ZIP code)		
\$25 000	3192 (54.4)*	820 (58.1)*
\$25 000–\$40 000	3084 (62.6)	681 (65.8)
\$40 000–\$50 000	2558 (66.2)	549 (65.2)
>\$50 000	2969 (65.5)	689 (69.1)
Type of insurance		
Commercial	8850 (63.2)*	2006 (65.5)‡
Medicaid	684 (49.1)	199 (53.8)
Medicare	2160 (61.4)	505 (63.6)
Self-pay or unknown	109 (50.5)	29 (58.6)
Type of procedure		
Colonoscopy	7383 (63.1)*	1737 (65.5)
Flexible sigmoidoscopy	4420 (59.9)	1002 (62.0)
6-mo period of procedure		
1 June 1999–30 November 1999	2480 (63.5)	557 (62.7)‡
1 December 1999–31 May 2000	2634 (62.5)	626 (70.0)
1 June 2000–30 November 2000	2377 (62.0)	547 (59.6)
1 December 2000–31 May 2001	2153 (60.6)	502 (63.2)
1 June 2001–30 November 2001	2159 (60.5)	507 (64.7)
Location of gastroenterologist's office		
City	7149 (59.0)*	1813 (64.6)
Suburban	4654 (66.4)	926 (64.0)

\*  $P < 0.001$ .

†  $P < 0.05$ .

‡  $P \leq 0.01$ .

higher proportions of patients attending the first colon study.

After adjustment, patient demographic characteristics were no longer predictive of colon study adherence (Table

2). A gastrointestinal condition was still statistically significantly associated with greater colon study adherence. Persons keeping 65% or fewer physician visits were 26% less likely to attend their first colon study than the highest quartile (>85% of visits kept). The 2 lowest quartiles of physician visit adherence both had statistically significantly lower adjusted odds of keeping the colon study appointments. This association did not change in a second model, which included only patients without a gastrointestinal diagnosis ( $n = 10\ 189$ ) (data not shown). Persons who rescheduled ( $n = 2739$ ) differed significantly from those who did not ( $n = 1757$ ) only in regard to race or ethnicity (32% black vs. 38% other race or ethnicity;  $P < 0.001$ ), lower neighborhood income ( $P < 0.001$ ), and colonoscopy test scheduled (63% vs. 56%, respectively;  $P < 0.01$ ). In a model predicting arrival at a rescheduled appointment (Table 2), the lowest quartile of physician visit adherence was the only variable statistically significantly associated with adherence.

In a conditional logistic regression model examining predictors of poor physician visit adherence (≤65%) that included 25.6% of the original study sample, poor adherence was more likely ( $P < 0.01$ ) for persons younger than 65 years of age than for those 70 years of age or older. The highest adjusted odds were for persons younger than 50 years of age (1.67 [95% CI, 1.49 to 1.88]). Other significant predictors included black race or ethnicity (1.38 [CI, 1.25 to 1.52]), female sex (1.14 [CI, 1.06 to 1.23]), Medicaid insurance (1.40 [CI, 1.20 to 1.64]), and self-pay or unknown insurance (1.44 [CI, 1.06 to 1.96]). Persons with a gastrointestinal condition were somewhat less likely than those without a gastrointestinal condition to have low physician visit adherence (0.92 [CI, 0.84 to 1.00];  $P = 0.05$ ).

## DISCUSSION

Almost 40% of nearly 12 000 patients in our large health care system did not keep their first scheduled appointment for a colonoscopy or a flexible sigmoidoscopy. Roughly 1000 persons in this cohort did not keep 2 sequential appointments, and nearly 1800 additional persons did not reschedule. Some of the latter group could have had their test performed outside of our study sites, but this is unusual for patients of health system providers. Patient nonadherence with scheduled breast and cervical cancer screening is also common, ranging from 15% to 25% (5–7); however, the proportion of patients not keeping colon study appointments appears to be higher. Patients have been found to view these colorectal screening tests as “violating” and painful (8). Patients often do not appreciate the risk for colorectal cancer (9). Additional deterrents are volume of bowel preparation and embarrassment (10, 11). Given these barriers to these colorectal studies, it is not surprising that failure to keep these scheduled tests seems to be common.

Physicians have difficulty accurately predicting which

patients will not adhere to health care (12) or medications (13). Patient adherence to scheduled studies may help to improve this prediction. We observed a dose–response relationship between decreasing physician visit adherence and lower adjusted odds of keeping the first appointment for these colorectal studies. Among patients who rescheduled after missing that appointment, only the lowest adherence group ( $\leq 65\%$ ) had statistically significantly poorer adherence.

Among inner-city women with abnormal Papanicolaou smears, failure to keep physician visits was associated with a 70% reduction in the adjusted odds of keeping a colposcopy appointment (14). Missing physician appointments was the strongest predictor of having undetectable viral load among HIV-infected persons who started receiving highly active antiretroviral therapy (15). Therefore, appointment-keeping behavior seems to reflect general health care behaviors, including adherence to tests and medications.

As in other research (16), our study found that persons with a gastrointestinal condition were more likely to keep their colon study appointment, but those with other medical comorbid conditions were not (17). Keeping colon study appointments was less likely for women, persons who designated their race or ethnicity as black, and persons with low income. Other studies have observed a similar sex gap in receipt of sigmoidoscopy (18) and colonoscopy (19). Black people were previously reported to be less likely to receive colorectal studies than white people (20). Persons from low-income areas not only are less likely to receive cancer screening (21) but are also at increased risk for failing to keep physician appointments (22).

Our study has several limitations. Our data come from only 1 health care system, but it delivers care to a large segment of the population in our region. Furthermore, to examine adherence to appointments, we included only patients who had 3 or more scheduled visits to system physicians. We imputed race and ZIP code data by using SAS software, version 8.0, where assumptions made in imputing data were still experimental. We did not have practice-specific information on how patients were reminded about the colonoscopy appointment. In addition, we could only roughly distinguish screening from diagnostic procedures. Our clinical information came from administrative data, so we did not have information on a family history of colorectal cancer. Finally, health care providers in some other health care settings might not be able to access a similar data source on their patients' appointment-keeping behavior.

The use of a patient's appointment-keeping behavior as a characteristic to target efforts to improve attendance to colon studies avoids stigmatizing approaches that focus on patient race or ethnicity or income to identify persons at greater risk for poor adherence. Colonoscopy requires substantial resources, including a short-procedure unit, an anesthetist, and a gastroenterologist; therefore, helping patients keep their appointments is important. This study

**Table 2. Adjusted Associations of Patient, Practice, and Procedure Characteristics with Completing First Scheduled ( $n = 11\ 803$ ) Colon Study Appointment or among Those Rescheduling within 6 Months ( $n = 2739$ ) Keeping the Second Colon Study Appointment**

Characteristic*	Adjusted Odds Ratio (95% CI) of Colonoscopy or Flexible Sigmoidoscopy	
	First Appointment	Rescheduled Appointment
Age		
<50 y	0.96 (0.89–1.03)	0.95 (0.84–1.07)
50–54 y	0.94 (0.87–1.01)	0.93 (0.82–1.04)
55–59 y	0.96 (0.87–1.06)	0.95 (0.80–1.12)
60–64 y	1.01 (0.93–1.09)	0.99 (0.86–1.12)
65–69 y	1.00 (0.92–1.08)	0.99 (0.86–1.13)
Women	0.95 (0.91–1.00)†	0.95 (0.88–1.02)
Black race or ethnicity	0.97 (0.91–1.04)	0.96 (0.86–1.07)
Median annual household income in ZIP code of residence		
<\$25 000/y	0.95 (0.87–1.03)	0.93 (0.81–1.07)
\$25 000–\$40 000/y	0.98 (0.92–1.05)	0.96 (0.86–1.08)
\$40 000–\$50 000/y	1.00 (0.94–1.07)	0.96 (0.86–1.08)
Chronic medical condition	0.97 (0.92–1.03)	0.97 (0.88–1.06)
Gastrointestinal condition	1.24 (1.17–1.31)‡	1.05 (0.95–1.16)
Insurance type		
Commercial	1.05 (0.98–1.13)	1.04 (0.93–1.17)
Medicaid	0.93 (0.82–1.06)	1.00 (0.83–1.19)
Self-pay/unknown	0.90 (0.68–1.19)	1.01 (0.69–1.49)
Physician visit adherence		
$\leq 65\%$	0.79 (0.73–0.85)‡	0.87 (0.78–0.98)†
66%–75%	0.87 (0.81–0.92)‡	0.90 (0.81–1.00)
76%–85%	0.94 (0.89–1.00)	0.95 (0.86–1.05)
Colonoscopy	1.08 (1.01–1.14)†	1.08 (0.96–1.23)
Time period of first scheduled procedure		
First 6 mo	1.09 (1.01–1.17)†	1.01 (0.87–1.18)
Second 6 mo	1.05 (0.98–1.13)	1.11 (0.96–1.28)
Third 6 mo	1.03 (0.96–1.11)	0.92 (0.79–1.08)
Fourth 6 mo	1.00 (0.92–1.08)	0.98 (0.84–1.14)

\* Reference groups: age  $\geq 70$  y, male sex, nonblack race or ethnicity, median annual household income in ZIP code of residence  $\geq \$50\ 000$ , no chronic medical condition, no gastrointestinal condition, Medicare insurance, kept  $>85\%$  of physician office or clinic appointments, sigmoidoscopy, time period of first scheduled procedure within the last 5 months of study.

†  $P < 0.05$ .  
‡  $P < 0.001$ .

describes a useful tool to predict those patients who will not adhere to colon study appointments for interventions to address barriers to adherence. These patient-oriented interventions should accompany efforts to improve physicians' understanding of and commitment to colorectal cancer screening.

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