

Reducing referral delays in colorectal cancer diagnosis: is it about how you ask?

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ABSTRACT

Objectives Delays in colorectal cancer (CRC) diagnosis related to colonoscopy referrals are not well studied. The authors tested whether certain details of information transmitted through computerised provider order entry (CPOE)-based referrals affected timeliness of diagnostic colonoscopy for patients with newly diagnosed CRC.

Methods The authors studied a 6-year cohort of all newly diagnosed patients with CRC at a large tertiary care Veterans Affairs hospital and its affiliated multispecialty clinics. Referring providers included primary care clinicians, resident trainees and other specialists. From the colonoscopy referral preceding CRC diagnosis, the authors determined request date, type and frequency of diagnostic clues provided (symptoms, signs, test results), notation of urgency, and documented evidence of verbal contact between referring provider and consultant to expedite referral. The authors compared distributions of proportions of diagnostic clues between patients with a lag of >60 and ≤60 day, and examined predictors of lag time.

Results Of 367 electronic referrals identified with a median lag of 57 days, 178 (48.5%) had a lag of >60 days. Referrals associated with longer lag times included those with 'positive faecal occult blood test' (92 days, $p<0.0001$), 'haematochesia' (75 days, $p=0.02$), 'history of polyps' (221 days, $p=0.0006$) and when 'screening' (vs specific symptoms) was given as the reason for diagnostic colonoscopy (203 days, $p=0.002$). Independent predictors of shorter wait times included three diagnostic clues, notation of urgency and documentation of verbal contact.

Conclusions Attention to certain details of diagnostic information provided to consultants through CPOE-based referrals may help reduce delays in CRC diagnosis.

INTRODUCTION

Delayed colorectal cancer (CRC) diagnosis is one of the most common reasons for ambulatory diagnostic malpractice claims in the USA.^{1,2} Contributing factors in delayed CRC diagnosis include patient-related delays in seeking care and scheduling procedures, provider-related delays in ordering tests, and limited endoscopic capacity.³⁻⁷ We recently described the prevalence and types of missed opportunities for detecting and investigating clues that could have led to an earlier referral for colonoscopy.⁸ When we examined determinants of wait time between referral and diagnosis of CRC in a large tertiary care facility, we found that patients with symptoms related to CRC, abnormal lab tests or abnormal imaging studies had a shorter

lag time between referral and diagnosis compared with patients who had a positive screening test.⁹ These data suggest that the nature of referral information provided to the gastroenterologist could influence lag time between referral and colonoscopy performance.

In many integrated electronic medical records (EMRs), practitioners use computerised provider order entry (CPOE) to generate referral requests and relay relevant clinical information to the consultant. Studies of non-CPOE referrals have shown that providers do not consistently provide accurate clinical information on referral requests.¹⁰⁻¹² Whether the nature and amount of information influence the outcome of the referral is not clear. For instance, the documentation of certain diagnostic clues or flagging referrals as 'urgent' may be associated with shorter lag times for colonoscopy. We sought to determine the association between the quality and quantity of information transmitted in colonoscopy requests using CPOE and the timeliness of colonoscopy performance. We also examined the characteristics of referral requests associated with time lags of greater than 60 days from initial request to colonoscopy performance.

METHODS

We studied a cohort of all newly diagnosed patients with confirmed primary CRC diagnosed between June 2001 and June 2007 at a tertiary care Veterans Affairs facility. Colonoscopy referrals are entered through a CPOE system, which has been used in the VA setting for close to a decade (figure 1). Most outpatient referrals are initiated by approximately 50 primary care providers who practice at the facility or at one of its five community-based satellite clinics. Other referring providers include resident trainees and specialists. Most inpatient referrals are initiated by residents on medical or surgical floors. Requests are then screened by several gastroenterologists on a rotating basis. At this institution and many others, endoscopic capacity is limited by the number of endoscopy rooms, preparation and recovery space, and availability of gastroenterologists.

We examined referrals that requested a diagnostic colonoscopy or sigmoidoscopy or requested the consultant to address certain diagnostic clues suggestive of CRC. We thus focused our study only on patients for whom the referring physician requested a diagnostic colonoscopy or screening for high-risk individuals. The primary modality of CRC screening in the VA is faecal occult blood test (FOBT), and only a small proportion of

Figure 1 Order-entry template for colonoscopy referrals.

The screenshot shows a software window titled "Order a Consult". It contains several input fields and buttons. At the top left, there's a dropdown menu for "Consult to Service/Specialty" with "GASTROENTEROLOGY" selected. To the right, there are dropdowns for "Urgency" (set to "ROUTINE") and "Attention". Below these are radio buttons for "Patient will be seen as an:" with "Inpatient" and "Outpatient" options. Further right is a dropdown for "Place of Consultation" set to "CONSULTANT'S CHOICE". Below that is a text field for "Provisional Dx (REQUIRED)" with a "Lexicon" button next to it. A large text area labeled "Reason for Request" contains the following text: "Patient Age: 99", "Referring Clinic/Ward:", "Referring Provider Pager & Extension:", and "Symptoms, labs and other data:". At the bottom, there's a status bar showing "GASTROENTEROLOGY Cons CONSULTANT'S CHOICE" and two buttons: "Accept Order" and "Quit".

colonoscopies requested are related to screening in average risk individuals.^{13 14}

We excluded patients diagnosed (or who received their CRC diagnosis care) outside the institution and those with recurrent CRC. We also excluded CRC diagnosed by colonoscopy requested solely for screening in otherwise asymptomatic patients. Using the integrated EMR, we conducted a detailed review of information contained in the electronic referral request, as well as colonoscopy performance and patient characteristics. Currently the only information templated is patient age, referring clinic/ward, details of referring provider and their contact information, and free-text information about symptoms, labs and other data. For patients with more than one referral, we examined only the first request. The study was approved by the local Institutional Review Board.

Data collection procedures

Prior to the study, we designed and pilot-tested a data-collection instrument for the variables of interest. The study team supervised and trained reviewers to ensure reliable and consistent data collection. Reviewers documented the following:

1. Referral request information: Date of request; type of information provided in the request (ie, diagnostic clues such as symptoms, signs, test results); referral origin (inpatient or outpatient); notation of urgency (<7 days, <30 days, next available, or routine); specialty of the referring provider; and documented evidence of verbal contact between referring provider and consultant to expedite referral. Based on our previous work,⁸ we started with a list of diagnostic clues a priori but further developed it as we gathered new information. To evaluate the quantity of information provided to the consultant, we documented the number of diagnostic clues provided in the referral request.
2. Outcome: We recorded whether an appointment for colonoscopy was generated subsequent to the referral, and if so, the date colonoscopy was performed and any patient non-adherence (no show, cancellation).

Data analysis

Our primary outcome was the median number of days between first colonoscopy referral and colonoscopy performance. A VA

directive recommends a colonoscopy completion time of 60 days after a positive FOBT.¹⁵ Therefore, we also analysed wait times as a binary variable (≤ 60 days or > 60 days from referral to colonoscopy). We used several methods to determine the relationship of referral characteristics to lag time. We used χ^2 tests for categorical variables, Fisher exact test when the assumptions for χ^2 were not met, and non-parametric quantile regression for models with median wait time as the outcome. Quantile regression is used when parametric assumptions cannot be met and is a more robust analogue of least-squares regression under conditions of non-normality and heterogenous variability.^{16 17} Quantile regression models the relation between a set of independent variables and specific percentiles or quantiles of the outcome variable. Because the distribution of wait times was highly skewed, we used a median (a quantile describing the central location of the distribution) regression model to specify the changes in median wait times as a function of the predictor variables.

Predictor variables included the frequency of diagnostic clues (symptoms, signs, test results), referral origin (inpatient or outpatient), marking of urgency (<7 days, <30 days, next available or routine), the specialty of the requesting provider (primary care vs subspecialist) and documented evidence of verbal contact between referring provider and consulting services to expedite referral. We also tested patient demographics (age, gender, race) and clinical factors (eg, comorbid medical or psychiatric disorder) as predictors of wait time. Potential predictor variables were examined in an unadjusted model, and those with $p < 0.1$ were included in a multivariate model. Only covariates with significant ($p < 0.1$) as well as stable risk estimates were kept in the final model. Data were analysed using SAS software (SAS Institute, version 9.1.3; SAS Institute, Cary, North Carolina).

RESULTS

Between June 2001 and June 2007, 367 patients with CRC fulfilled selection criteria and had electronic referral requests for colonoscopy/sigmoidoscopy prior to CRC diagnosis. The median wait time between referral and colonoscopy performance was 57 days. Almost half (48.5%) of patients had wait times > 60 days.

Table 1 shows the distribution of median wait times by patient characteristics. Patients with congestive heart failure, coronary artery disease and diabetes had significantly longer median wait times to colonoscopy than patients without these disorders (p values ≤ 0.02). Patients with depression and post-traumatic stress disorder also had significantly greater wait times ($p=0.006$ and $p=0.04$, respectively). Demographic variables were not associated with differences in median wait times. Demographic and health characteristics were similar at the beginning and end of the study period, with the exception that hypertension was more prevalent in 2007 (77.8%) than in 2001 (54.3%) $p=0.02$. However, when we collapsed medical and psychiatric conditions across subcategories, we found that the presence of any psychiatric condition was more frequent in 2001 ($p=0.09$).

Table 2 shows median wait times for patients with diagnostic clues provided in the referral request and compares the proportions of diagnostic clues between patients with ≤ 60 and >60 -day wait times. Referrals with longer wait times contained positive FOBT, rectal bleeding, history of polyps and requests for 'screening' in the presence of other diagnostic clues.

Table 3 shows univariate associations between referral request characteristics and wait time to colonoscopy. Referrals that originated in the inpatient setting were associated with shorter wait times than outpatient referrals. Approximately half of referrals were marked as 'routine'; all others were associated with shorter wait times, particularly those marked as needed in less than 1 week. In approximately 12% of outpatient referrals, providers documented additional verbal contact with the gastroenterology service, and these requests were also associated

with shorter wait times. Referrals followed by one or more episodes of patient non-adherence were associated with the longest median wait time.

Table 4 shows the results from the final multivariable quantile regression model. The following variables were significant independent predictors of shorter wait times: referrals with three clues, inpatient referrals, referrals with urgency marked for <1 week or <30 days, referrals marked 'next available' and outpatient referrals in which verbal discussion with a consultant was documented. A gradient effect for the number of clues may not be evident due to sample size limitations, as the majority of referrals documented one or two clues. Only 46 referrals had three documented clues, and 10 referrals had four or more clues.

DISCUSSION

We evaluated referrals for 367 patients diagnosed as having CRC over a 6-year period to determine if the timeliness of diagnostic colonoscopy was associated with the quality and quantity of information transmitted via the CPOE-generated referral request. Our findings suggest that in a system with limited endoscopic capacity, both quality and quantity of information transmitted to the consultant affected the wait time between referral and colonoscopy. Shorter wait times were associated with referral requests that documented three diagnostic clues versus one clue, originated in the inpatient setting, were marked as urgent or next available (vs routine), and documented a verbal discussion with a consultant. Clues such as iron-deficiency anaemia, abnormal CT scan or barium enema, suspected mass on physical examination, abdominal pain and obstruction were

Table 1 Distribution of median wait times between referral and performance of colonoscopy for several patient characteristics; results of univariate analyses

	N (%)	Median time	Quantile regression			
			Coefficient	SE	T Value	p Value
Age						
<65	143 (39.0)	50.0	Referent			
65–74	108 (29.4)	63.0	13.0000	16.3631	0.79	0.43
>75	116 (31.6)	57.0	7.0000	16.0384	0.44	0.66
Race						
White Caucasian	187 (57.0)	57.0	Referent			
Black	112 (34.2)	45.0	–19.3445	14.5651	–1.33	0.18
Hispanic, other	29 (8.8)	61.0	–3.7262	24.8619	–0.15	0.88
Gender						
Male	364 (99.2)	56.5	–9.2321	76.6343	–0.12	0.90
Female	3 (0.8)	66.0	Referent			
Medical disorders						
Congestive heart failure	29 (7.9)	114.0	58.0000	24.5427	2.36	0.02
Coronary artery disease	83 (22.6)	88.0	36.0000	15.7661	2.28	0.02
Hypertension	244 (66.5)	64.5	23.0620	14.6306	1.58	0.12
Diabetes	99 (27.0)	88.0	36.0000	14.2310	2.53	0.01
Chronic obstructive pulmonary disease	47 (12.8)	70.0	18.0000	21.2238	0.85	0.40
Any medical condition	281 (76.6)	193.0	28.0000	16.2706	1.72	0.09
Psychiatric disorders						
Depression	47 (12.8)	108.0	55.1083	20.0249	2.75	0.006
Anxiety	17 (4.6)	118.0	62.0000	33.2869	1.86	0.06
Dementia	10 (2.7)	21.5	–24.8090	42.4349	–0.58	0.56
Post-traumatic stress disorder	18 (4.9)	115.0	67.0759	31.9511	2.10	0.04
Schizophrenia	3 (0.8)	179.0	122.2794	75.5686	1.62	0.11
Bipolar disorder	5 (1.4)	53.0	–4.0000	59.5244	–0.07	0.95
Alcohol	66 (18.0)	53.5	–2.5543	17.9672	–0.14	0.89
Any mental disorder	120 (32.9)	226.0	15.5027	14.8695	1.04	0.30

Data shown are for 367 patients diagnosed as having colorectal cancer in one tertiary centre from June 2001 to June 2007.

Table 2 Waiting times between referral to and performance of colonoscopy presented for several diagnostic clues

Clues (n=634)	All patients (n=367) Median wait in days	Wait >60	Wait <60	p Value
		days (n=178)	days (n=189)	
		n (%)		
Iron deficiency anaemia (n=47)	14.0	14 (4.6)	33 (9.9)	0.01
Faecal occult blood test positive (n=150)	92.0	95 (31.5)	55 (16.6)	<0.0001
Abnormal CT scan (n=20)	4.0	2 (0.7)	18 (5.4)	0.0006
Suspected mass (n=11)	10.0	1 (0.3)	10 (3.0)	0.01
Haematochesia (n=100)	75.0	58 (19.2)	42 (12.7)	0.02
Constipation (n=14)	36.5	5 (1.7)	9 (2.7)	0.37
Abdominal pain (n=14)	4.0	1 (0.3)	13 (3.9)	0.002
Weight loss (n=15)	31.0	4 (1.3)	11 (3.3)	0.10
Melena (n=12)	26.0	4 (1.3)	8 (2.4)	0.32
History of polyps (n=26)	221.0	21 (7.0)	5 (1.5)	0.0006
Obstruction (n=22)	0.0	1 (0.3)	21 (6.3)	<0.0001
Other lower GI symptoms (n=24)	47.0	10 (3.3)	14 (4.2)	0.55
Flex sigmoidoscopy positive (n=12)	43.5	5 (1.7)	7 (2.1)	0.68
Barium enema positive (n=24)	16.5	6 (2.0)	18 (5.4)	0.02
Colon cancer screening (n=23)	203.0	18 (6.0)	5 (1.5)	0.003
Anaemia (n=59)	69.0	32 (10.6)	27 (8.1)	0.29
Ileocolitis/fissure/Crohn disease (n=3)	2.0	0 (0.0)	3 (0.9)	0.25
Surgical indications (ano-rectal stricture, diverticulitis/abscess, etc.) (n=33)	114.0	19 (6.3)	14 (4.2)	0.24

Data shown are for 367 patients diagnosed as having colorectal cancer in one tertiary care centre from June 2001 to June 2007.

significantly associated with wait times of <60 days. Conversely, other clues such as positive FOBT, haematochesia and history of polyps were associated with >60-day wait times. Longer wait times were also more likely for referrals that requested colonoscopy for 'screening' despite the presence of other diagnostic clues.

The use of CPOE-generated referrals has potential for overcoming several types of communication failures between the PCP and specialist. Breakdowns in referral communication due to inadequate or absent information transmission have been previously described in healthcare systems without CPOE-generated referral requests.^{10 18–20} In one study from Brigham and Women's Hospital in Boston prior to the use of computerised referral requests, almost 68% of specialists reported not receiving any information from the PCP prior to the referral visit.¹⁸ Other studies have described communication breakdowns where the consultant and the PCP do not agree for the reason for referral.²¹ An added benefit of using CPOE is provision of templates or checkboxes to the referring physician when requesting a colonoscopy. This information can potentially be used to generate a likelihood score for CRC from an evidence-based algorithm, which can rationally inform colonoscopy scheduling.

We found that several diagnostic clues were associated with shorter wait times to diagnostic colonoscopy, suggesting the presence of some prioritisation mechanism to schedule procedures. However, seemingly logical prioritisation strategies may not be supported by current evidence. For example, a recent meta-analysis concluded that most 'alarm' features such as anaemia, change in bowel habits and weight loss have poor sensitivity and specificity for the diagnosis of CRC.²² Shorter wait times for referrals documenting obstruction and abdominal pain occurred because the majority (74.3%) of these were emergent inpatient referrals. Additionally, clues suggesting the presence of a tumour, such as abnormal imaging or mass, were associated with short wait times. Contrary to what we expected, clues that signified bleeding, such as positive FOBT and haematochesia, were associated with a wait time longer than 60 days.

Consistent with previous literature, we found patient non-adherence to play a significant role in timeliness of diagnostic colonoscopy procedures.^{3 23 24} Our findings underscore the need for future efforts to improve adherence to diagnostic colonoscopies. This is especially important in systems with constrained endoscopic capacity, where there may be lengthy delays before procedures can be rescheduled. Most of the work on improving patient adherence is mostly focused on screening colonoscopy^{25 26} and could potentially be applied to diagnostic procedures, where the yield of the procedure is expected to be higher.

Our findings suggest that timeliness may relate to 'how you ask' through CPOE.²⁷ For instance, we observed longer wait

Table 3 Association between referral request characteristics and time to colonoscopy using univariate quantile regression for all patients (n=367) diagnosed as having colorectal cancer in one tertiary care centre from June 2001 to June 2007

Independent variable	n (%)	Median time			p Value
		Days	Coefficient	SE	
Model 1					
Provisional diagnosis (clue codes)					
1 clue	166 (45.2)	54.5	Referent		
2 clues	145 (39.5)	83.0	28.8448	12.1326	0.02
3 clues	46 (12.5)	36.5	-15.2789	17.7847	0.39
4+ clues	10 (2.7)	4.0	-50.1552	34.7546	0.15
Model 2					
Inpatient					
Yes	84 (22.9)	2.0	Referent		<0.0001
No	283 (77.1)	84.0	82.0000	5.4216	
Model 3					
Urgency marked					
Routine	184 (50.1)	107.5	Referent		
Next available	16 (4.4)	84.0	-18.8797	9.7942	0.05
<30 days	44 (12.0)	69.0	-37.7064	6.3060	<0.0001
<1 week	123 (33.5)	3.0	-104.471	4.3765	<0.0001
Model 4					
Specialty of provider					
Primary care	277 (75.5)	70.0	Referent		
Non-primary care	90 (24.5)	14.0	-56.0000	13.3429	<0.0001
Model 5					
Non-electronic contact					
Inpatient contact	84 (22.9)	2.0	-97.0000	5.3366	<0.0001
Outpatient contact	42 (11.4)	20.0	-75.8811	7.0426	<0.0001
No contact	241 (65.7)	99.0	Referent		
Model 6					
Patient adherent to 1st referral					
Yes	313 (85.3)	41.0	Referent		<0.0001
No	53 (14.4)	308.0	267.0000	15.5598	

Table 4 Potential predictors of wait times between referral and performance of colonoscopy in 367 patients diagnosed as having colorectal cancer during June 2001 to June 2007: results of multivariable quantile regression

Independent variable	N (%)	Median time	Coefficient	SE	p Value
No of clues					
1 clue	166 (45.2)	54.5	Referent		
2 clues	145 (39.5)	83.0	1.0000	3.3057	0.76
3 clues	46 (12.5)	36.5	-21.0000	4.8109	<0.0001
4+ clues	10 (2.7)	4.0	0.0000	9.4250	1.00
Inpatient					
Yes	84 (22.9)	2.0	Referent		
No	283 (77.1)	84.0	55.6704	6.5823	<0.0001
Urgency marked					
Routine	184 (50.1)	107.5	Referent		
Next available	16 (4.4)	84.0	-32.4893	7.4358	<0.0001
<30 days	44 (12.0)	69.0	-37.0555	4.8338	<0.0001
<1 week	123 (33.5)	3.0	-21.0000	5.5868	0.0002
Specialty of provider					
Primary care	277 (75.5)	70.0	Referent		
Non-primary care	90 (24.5)	14.0	-1.0000	3.8892	0.80
Non-electronic (verbal) contact					
Inpatient referrals (always require additional verbal contact)	84 (22.9)	2.0	-760.000	17.7711	<0.0001
Outpatient verbal contact	42 (11.4)	20.0	-60.0000	5.8490	<0.0001
No contact	241 (65.7)	99.0	Referent		
Patient adherent to first referral					
Yes	313 (85.3)	41.0	Referent		
No	53 (14.4)	308.0	231.0000	4.3617	<0.0001

times when providers inappropriately listed 'screening' as the reason for the diagnostic colonoscopy despite the presence of other diagnostic clues in the patient's record. Similarly, using an unqualified diagnosis of 'anaemia' was associated with a longer lag time than when 'iron-deficiency anaemia' was used. Consultants may find it cumbersome to perform additional chart reviews to look for clues other than those provided in the referral request. Thus, effective electronic communication using CPOE requires providers to receive proper training on how best to use referral templates. Obligatory fields in referral templates may also help but do not guarantee the accuracy of information. Work on use and acceptability of templates for gastroenterology referrals at this institution is ongoing. Future research, preferably using prospective studies, is also needed to confirm our findings in other healthcare systems that use CPOE.

According to a recent Cochrane review, interventions to improve outpatient referrals from primary care to secondary care are needed, and only a limited number of rigorous evaluations exist to inform policy.²⁸ To our knowledge, this is the first study that evaluates how characteristics of CPOE-generated referral content affect the timeliness of referral completion. Our study involved several satellite clinics, a large study sample and a large number of referring providers. Providers in the VA are trained and well versed with CPOE, which has been used in most VA facilities since before 2002.

Our study had several limitations. The study population included only patients who were eventually diagnosed as having CRC. Therefore, the findings may not apply to the vast majority of requests for colonoscopy in which CRC is not found, and any selection bias resulting from our methods is difficult to detect. Additionally, the study population (predominantly male veterans) and the VA setting may make our findings less generalisable to other practices, especially those that do not use electronic referrals. We also did not collect data on clinical outcomes related to delays in CRC diagnosis. Previous studies of

the association between diagnostic delays and CRC outcomes have yielded conflicting results.^{29–31} Although the precise definition of a meaningful delay is unclear, delays in care are relevant facets of patient safety and satisfaction.

In conclusion, we found that several referral characteristics were associated with lag times for diagnostic colonoscopy in CRC patients, including the type as well as the frequency of diagnostic clues provided to the consultants (more than one clue is better than one or no clues), flagging of urgency and documenting verbal discussions with consultants to expedite referrals. In systems with limited endoscopic capacity, attention to these aspects of diagnostic information transmitted through CPOE based referrals may help reduce delays in CRC diagnosis.

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Competing interests None.

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