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SHORT COMMUNICATION

A centrally generated primary care physician audit report does not improve colonoscopy uptake after a positive result on a fecal occult blood test in Ontario's ColonCancerCheck program

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ABSTRACT

Background Timely follow-up of fecal occult blood screening with colonoscopy is essential for achieving colorectal cancer mortality reduction. In the present study, we evaluated the effectiveness of centrally generated, physician-targeted audit and feedback to improve colonoscopy uptake after a positive fecal occult blood test (FOBT) result within Ontario's population-wide ColonCancerCheck Program.

Methods This prospective cohort study used data sets from Ontario's ColonCancerCheck Program (2008–2011) that were linked to provincial administrative health databases. Cox proportional hazards regression was used to estimate the effect of centralized, physician-targeted audit and feedback on colonoscopy uptake in an Ontario-wide FOBT-positive cohort.

Results A mailed physician audit and feedback report identifying individuals outstanding for colonoscopy for 3 or more months after a positive FOBT result did not increase the likelihood of colonoscopy uptake (hazard ratio: 0.95; 95% confidence interval: 0.79 to 1.13). Duration of positive FOBT status was strongly inversely associated with the hazard of follow-up colonoscopy (*p* for linear trend: <0.001).

Conclusions In a large population-wide setting, centralized tracking in the form of physician-targeted mailed audit and feedback reports does not improve colonoscopy uptake for screening participants with a positive FOBT result outstanding for 3 or more months. Mailed physician-targeted screening audit and feedback reports alone are unlikely to improve compliance with follow-up colonoscopy in Ontario. Other interventions such as physician audits or automatic referrals, demonstrated to be effective in other jurisdictions, might be warranted.

Key Words Fecal occult blood test, colonoscopy, colorectal cancer, screening, program evaluation

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INTRODUCTION

Fecal occult blood test (FOBT) screening depends on follow-up colonoscopy. As of 2011, only 74.6% of participants with a positive FOBT in Ontario's ColonCancerCheck program proceeded to colonoscopy within 6 months. That proportion fell short of early results from European population-wide screening programs and the ColonCancerCheck program targets based on Canadian consensus[1].

To increase follow-up colonoscopy uptake, ColonCancerCheck introduced patient- and physician-targeted strategies, two of which have already been evaluated[2]. The Screening Activity Report (SAR) provides primary care physicians (PCPs) with periodic summaries of screening

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participation and identifies FOBT-positive patients in their practice who remain outstanding for colonoscopy. In the present study, we evaluate the effectiveness of the SAR in improving colonoscopy uptake after a positive FOBT result.

METHODS

Our study was approved by the institutional review board at Sunnybrook Health Sciences Centre, Toronto, Ontario. All data were sourced from Ontario health administrative databases, which were linked using unique encoded identifiers and analyzed at the Institute for Clinical Evaluative Sciences[2].

The population-based prospective cohort comprised all screening-age Ontarians (50–74 years) who received a positive FOBT result from 1 September 2008 through 31 December 2010. Participants were excluded if they had a previous diagnosis of colorectal cancer, or if they received a colonoscopy between 31 December 2010 and 1 April 2011.

The main exposure was inclusion in a SAR, based on whether the ordering PCP participated in a patient enrolment model (PEM) practice. Practitioners participating in the Ontario PEM are remunerated using a blended capitation and fee-for-service model that requires patient rostering. In Ontario, PEM and traditional models (the latter almost exclusively fee-for-service without stipulation for patient rostering) coexist. The 2011 SARs were mailed to PEM-participating PCPs in February and March of that year, with 97% being mailed during 8–23 March. Physicians practicing in a traditional model did not receive a SAR. Only positive FOBT results that were outstanding before the end of 2010 were included in the SAR.

The primary outcome was time to colonoscopy. Table I presents the covariates by dichotomous SAR exposure. Definitions of those variables have been provided elsewhere[2].

Cox proportional hazards models were used to estimate crude and multivariable-adjusted main effects on the hazard of follow-up colonoscopy within 6 months of 1 April 2011.

RESULTS

Over the 6-month follow-up, 15.1% of the 9661 participants who were FOBT-positive for 3 or more months received a follow-up colonoscopy. Approximately half those colonoscopies occurred within the first 2 months. Participants included in a SAR (n = 8799) tended to be older and of higher socioeconomic status (Table I). They were also more likely to have higher continuity of care from their ordering PCP. The SAR-included participants were moderately more likely to have had a colonoscopy in the preceding 2 years. Conversely, prior colonoscopies among the SAR-excluded participants (n = 862) were proportionally more remote.

Crude and adjusted effects indicate that the hazard of colonoscopy was not meaningfully different for SAR-exposed participants (Table II). Duration of positive FOBT status was observed to be strongly inversely associated with hazard of follow-up colonoscopy (p for linear trend: <0.001).

DISCUSSION

Our findings indicate that the first ColonCancerCheck SAR did not meaningfully improve colonoscopy uptake for patients who had been FOBT-positive for 3 or more months.

Previous evaluations of physician-targeted approaches have incorporated multifaceted interventions. In the United States, Veteran Affairs centres and a large Seattle-based health cooperative found that electronic reminders prompting physician feedback[3–5], in addition to other infrastructure upgrades[4], improved colonoscopy uptake after an abnormal FOBT. Another U.S. study found that physician reminders, combined with practice-tailored education, improved the same outcome[6]. Localized U.S. settings have supported the effectiveness of automated referrals[7,8]. Given that the foregoing reports were not examples of population-wide screening, comparisons with Ontario's ColonCancerCheck and European programs might be of limited utility.

The literature evaluating physician- or participant-targeted interventions and aiming specifically to improve colonoscopy uptake after a positive FOBT in population-wide settings has been sparse. However, prior evaluations of two ongoing interventions in Ontario's ColonCancerCheck have demonstrated that interventions targeting participants are more effective[2].

The present evaluation is the first to consider a mailed, physician-targeted intervention that provides practice-specific screening status updates about FOBT-positive patients in a population-wide setting. Our findings should be interpreted with a view to two main limitations. First, residual confounding is a possibility. The SAR-included participants might have differed from the SAR-excluded ones by unmeasured factors beyond inclusion in the SAR, either related to having a PEM-participating PCP or associated with follow-up colonoscopy. A second limitation is that the intervention effect could be assessed only for participants who had been FOBT-positive for 3 or more months. Poorer follow-up with increasing duration of FOBT positivity, as supported by our findings (Table II), suggests that those who do not proceed to colonoscopy directly are less likely to do so, perhaps regardless of intervention type or target.

Although clinical data for ColonCancerCheck screening participants have been found to be 93% accurate, and although pilot evaluations have indicated that Ontario PCPs are highly supportive of the SAR audit-feedback strategy[9], refinement of the SAR based on PCP feedback is ongoing. In subsequent iterations of the SAR, the lag between a positive FOBT result and issuance of the PCP report was substantially reduced. Finally, although no formal validation has yet been performed, we have no reason to doubt the accuracy of the SAR.

CONCLUSIONS

Mailed physician-targeted audit and feedback reports alone are unlikely to improve compliance with follow-up colonoscopy in Ontario for ColonCancerCheck participants who have remained FOBT-positive for 3 or more months. Other possible interventions include physician audits soliciting response or automatic referrals (demonstrated

TABLE I Distribution of sociodemographic and clinical factors for the cohort of individuals participating in the Ontario-wide ColonCancerCheck program between 1 April 2008 and 31 December 2010 who had a positive fecal occult blood test (FOBT+) and who did not have colonoscopy follow-up before 1 April 2011

Characteristic at index FOBT+	Screening activity report				*p* value[a]
	Included (*n*=8799)		Excluded (*n*=862)		
	(*n*)	(%)	(*n*)	(%)	
Age group					
50–59 Years	3512	39.9	383	44.4	0.027
60–69 Years	3696	42.0	343	39.8	
70–74 Years	1591	18.1	136	15.8	
Sex					
Women	4129	46.9	387	44.9	0.254
Men	4670	53.1	475	55.1	
Urban SES quintile or rural					
Urban 1	1529	17.4	180	20.9	<0.001
Urban 2	1767	20.1	202	23.4	
Urban 3	1600	18.2	162	18.8	
Urban 4	1602	18.2	134	15.5	
Urban 5	1373	15.6	100	11.6	
Rural	928	10.5	84	9.7	
LHIN[b]					
1	750	8.5	24	2.8	<0.001
2	342	3.9	31	3.6	
3	857	9.7	36	4.2	
4	914	10.4	117	13.6	
5	108	1.2	9	1.0	
6	385	4.4	34	3.9	
7	342	3.9	44	5.1	
8	406	4.6	36	4.2	
9	837	9.5	85	9.9	
10	1142	13.0	157	18.2	
11	464	5.3	53	6.1	
12	700	8.0	64	7.4	
13	185	2.1	14	1.6	
14	1367	15.5	158	18.3	
ADG score[c]					
0 or 1	977	11.1	93	10.8	0.710
2 or 3	2333	26.5	221	25.7	
4 or 5	2338	26.5	241	28.0	
6 or 7	1536	17.4	160	18.6	
≥8	1615	18.4	147	17.1	
Usual provider continuity index[d]					
Low	2913	33.1	347	40.3	<0.001
High	5886	66.9	515	59.7	
Prior colonoscopy					
No	6846	77.8	690	80.0	0.017
0–2 Years	434	4.9	24	2.8	
2–5 Years	1519	7.3	148	17.2	

TABLE I Continued

Characteristic at index FOBT+	Screening activity report				*p* value[a]
	Included (*n*=8799)		Excluded (*n*=862)		
	(*n*)	(%)	(*n*)	(%)	
FOBT+ flaps[e]					
1	6723	76.4	668	77.5	0.754
2	1353	15.4	128	14.8	
3	723	8.2	66	7.7	
Duration of FOBT+ status					
0–6 Months	2698	30.7	264	30.6	0.425
7–12 Months	1651	18.8	146	16.9	
13–23 Months	2878	32.7	302	35.0	
≥24 Months	1572	17.9	150	17.4	
Repeat FOBT[f]					
Yes	1397	15.9	154	17.9	0.129
No	7402	84.1	708	82.1	

[a] Chi-square test for trend.
[b] Ontario health region, ranked in ascending order by colonoscopy rates for 2007 fiscal year.
[c] Number of Johns Hopkins ADGs ascertained from physician billing and inpatient hospitalization records during the 12 months preceding the index FOBT+ result.
[d] "High" indicates that 75% or more of primary care services in the 2 years preceding the index FOBT+ were performed by the same physician.
[e] Each FOBT kit collects 2 samples from each of 3 consecutive spontaneously passed stools, placed on 3 flaps. Of the 2 samples per flap, 1 or more positives define a positive test flap; of all 6 samples, 1 or more positives define a FOBT+ result.
[f] Repeat FOBT within 6 months of the index FOBT+.
SES = socioeconomic status; LHIN = local health integration network; ADG = aggregated diagnosis groups.

TABLE II Crude and multivariable-adjusted hazard ratios for the effects of inclusion in a screening activity report and duration of positive fecal occult blood test (FOBT+) status on hazard of follow-up colonoscopy, 1 April to 1 October 2011

Variable	Analysis			
	Crude		Adjusted[a]	
	HR	95% CI	HR	95% CI
Screening activity report				
Excluded	1.00		1.00	
Included	0.98	0.82 to 1.17	0.95	0.79 to 1.13
FOBT+ duration				
≥2 Years	1.00		1.00	
0–0.5 Years	5.80	4.71 to 7.13	5.92	4.80 to 7.30
0.5–1 Years	2.19	1.73 to 2.78	2.26	1.78 to 2.86
1–2 Years	1.58	1.26 to 1.98	1.62	1.29 to 2.04

[a] Adjusted for all covariates listed in Table I.

to be effective in localized U.S. settings in addition to participant-targeted correspondence). However, some of these inventions could be onerous, particularly for population-wide screening programs of comparable scope to Ontario's ColonCancerCheck, given that the requisite infrastructure is not already in place.

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CONFLICT OF INTEREST DISCLOSURES

We have read and understood *Current Oncology*'s policy on disclosing conflicts of interest, and we declare that we have none.

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REFERENCES

1. Paterson WG, Depew WT, Pare P, *et al.* on behalf of the Canadian Association of Gastroenterology Wait Time Consensus Group. Canadian consensus on medically acceptable wait times for digestive health care. *Can J Gastroenterol* 2006;20:411–23.
2. Stock D, Rabeneck L, Baxter NN, *et al.* Mailed participant reminders are associated with improved colonoscopy uptake after a positive FOBT result in Ontario's ColonCancerCheck program. *Implement Sci* 2015;10:35.
3. Larson MF, Ko CW, Dominitz JA. Effectiveness of a provider reminder on fecal occult blood test follow-up. *Dig Dis Sci* 2009;54:1991–6.
4. Singh H, Kadiyala H, Bhagwath G, *et al.* Using a multifaceted approach to improve the follow-up of positive fecal occult blood test results. *Am J Gastroenterol* 2009;104:942–52.
5. Miglioretti DL, Rutter CM, Bradford SC, *et al.* Improvement in the diagnostic evaluation of a positive fecal occult blood test in an integrated health care organization. *Med Care* 2008;46(suppl 1):S91–6.
6. Myers RE, Turner B, Weinberg D, *et al.* Impact of a physician-oriented intervention on follow-up in colorectal cancer screening. *Prev Med* 2004;38:375–81.
7. Van Kleek E, Liu S, Conn LM, Hoadley A, Ho SB. Improving the effectiveness of fecal occult blood testing in a primary care clinic by direct colonoscopy referral for positive tests. *J Healthc Qual* 2010;32:62–9.
8. Humphrey LL, Shannon J, Partin MR, O'Malley J, Chen Z, Helfand M. Improving the follow-up of positive Hemoccult screening tests: an electronic intervention. *J Gen Intern Med* 2011;26:691–7.
9. Tinmouth, J, Ritvo P, McGregor SE, *et al.* ColonCancerCheck primary care invitation pilot project: family physician perceptions. *Can Fam Physician* 2012;58:e570–7.