Efficacy of an educational intervention on family physicians' risk assessment and management of colorectal cancer

J. C. Carroll • S. Blaine • J. Permaul • E. Dicks •
E. Warner • M. J. Esplen • H. Rothenmund •
K. Semotiuk • G. Worrall • J. McLaughlin

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Abstract We developed a point-of-care tool indicating risk categories for colorectal cancer (CRC) based on family history (FH) and management recommendations tailored to risk. The study objective was to determine if this CRC Risk Triage/Management Tool would enable family physicians (FPs) to appropriately triage and make screening and genetics referral recommendations for patients with CRC FH. Baseline questionnaires were mailed to a random sample of FPs in Ontario and Newfoundland, Canada. Participants were asked to use the tool for 3 months and then complete a follow-up questionnaire. The primary outcomes were correct responses to questions regarding CRC risk category, screening method, starting age, frequency, and decision to refer to genetics, for eight

clinical vignettes. The study was completed by 75/121 (62 %) participating FPs. Most (77 %) agreed they routinely recommended fecal occult blood testing for average risk patients age ≥ 50 . This did not change significantly following the intervention. There was a significant increase in confidence in CRC risk assessment (52 % pre; 88 % post; $p < 0.001$), correct management recommendations for patients with CRC FH (51 % pre; 84 % post; $p < 0.001$), and improvement in total mean scores on outcome measures for all vignettes. Most (90 %) agreed the tool would improve practice. Receipt of the CRC Risk Triage/Management Tool was associated with improvement in FPs' CRC risk assessment, screening, and genetics referral recommendations for clinical vignettes. This

J. C. Carroll (✉)
Department of Family and Community Medicine,
Mount Sinai Hospital, University of Toronto,
60 Murray St., Toronto, ON M5T 3L9, Canada
e-mail: jcarroll@mtsinai.on.ca

S. Blaine
Department of Family and Community Medicine,
University of Toronto, STAR Family Health Team,
O'Loane Medical Clinic,
700 O'Loane Ave., Stratford, ON N5A 6S6, Canada

J. Permaul
Ray D. Wolfe Department of Family Medicine,
Granovsky Gluskin Family Medicine Centre,
Mount Sinai Hospital, 60 Murray St., Toronto,
ON M5T 3L9, Canada

E. Dicks
Memorial University of Newfoundland and Labrador,
230 Elizabeth Ave., St. John's, NL
P.O. Box 4200, A1C 5S7, Canada

E. Warner
Division of Medical Oncology, Sunnybrook Odette Cancer Centre,
University of Toronto, 2075 Bayview Ave., Toronto, ON M4N 3M5,
Canada

M. J. Esplen
University of Toronto/University Health Network, Princess Margaret
Hospital, 610 University Ave., Toronto, ON M5T 2M9, Canada

H. Rothenmund
Hereditary Colorectal Cancer Registry, Jewish General Hospital,
3755 Côte-Sainte-Catherine Road, Montreal, QC H3T 1E2, Canada

K. Semotiuk
Zane Cohen Centre for Digestive Diseases, Familial GI Cancer
Registry, Mount Sinai Hospital, 60 Murray St., Toronto, ON M5T
3L9, Canada

G. Worrall
Memorial University of Newfoundland & Labrador,
PO Box 241, Glovertown, NL A0G 2L0, Canada

J. McLaughlin
Public Health Ontario, Toronto, Canada

J. McLaughlin
Dalla Lana School of Public Health, University of Toronto,
Toronto, Canada

J. McLaughlin
Samuel Lunenfeld Research Institute,
60 Murray St., Toronto, ON M5T 3L9, Canada

demonstrates the value of point-of-care tools and illustrates a process for development, evaluation, and dissemination of tools needed by FPs if potential impacts of genomic advances are to be achieved.

Keywords Colorectal cancer · Primary care · Family history · Risk assessment · Education

Introduction

In Canada, colorectal cancer (CRC) is the second leading cause of cancer death in males and the third most common cause of cancer death in females; it is the third most common cancer diagnosis overall (Canadian Cancer Society et al. 2013). A significant risk factor for CRC is having a family history (FH) of the disease (Ouakrim et al. 2013) with inherited genetic risk factors playing a role in the etiology of CRC in between 15 and 30 % of cases (Vasen et al. 2007). About 5 % of CRC is thought to be caused by hereditary syndromes such as Lynch syndrome (previously called hereditary non-polyposis colorectal cancer) (~5 %) and familial adenomatous polyposis (<1 %) (Cremin et al. 2009; Leddin et al. 2004). The remaining 10–25 % of familial cases of CRC may be due to undiscovered genetic factors and/or non-genetic factors that are shared by relatives (Cremin et al. 2009). Family history of CRC, particularly in a first-degree relative, is associated with increased CRC risk as much as two- to fourfold (Ouakrim et al. 2013). This risk is even higher if more than one relative is affected or if a relative was diagnosed under age 50 (Cremin et al. 2009; Leddin et al. 2004). Those with Lynch syndrome have a lifetime risk of CRC ranging between 30 and 74 % (Dunlop et al. 1997; Hampel et al. 2005; Jenkins et al. 2006) with average age at diagnosis between 44 and 61 years (Cremin et al. 2009; Hampel et al. 2005).

Screening for CRC has been shown to decrease CRC mortality for average risk as well as high-risk individuals (Atkin et al. 2010; Hardcastle et al. 1996; Hewitson et al. 2008; Kronborg et al. 1996; Mandel et al. 1993; Schoen et al. 2012). The American College of Physicians (ACP) recommends that clinicians assess risk for CRC in all adults, and that *average-risk* individuals screen for CRC using fecal occult blood testing (FOBT) annually, flexible sigmoidoscopy every 5 years, or optical colonoscopy every 10 years, beginning at age 50 and continuing until age 75 (Qaseem et al. 2012). The Canadian Association of Gastroenterologists (CAG) recommends screening *average-risk* individuals with FOBT at least every 2 years, or flexible sigmoidoscopy every 10 years from age 50 to 74 (Leddin et al. 2010).

Risks for CRC include age, race, and FH (Qaseem et al. 2012). For *high-risk* individuals, including, but not limited to, those with colorectal cancer in a first-degree relative,

especially before age 50, the ACP recommends screening with optical colonoscopy starting at age 40 or 10 years younger than the age at which the youngest affected relative was diagnosed with CRC (Qaseem et al. 2012). The CAG has a more detailed FH algorithm. For individuals with Lynch syndrome, they recommend colonoscopy beginning at age 20 every 1–2 years. For other high-risk individuals (one first-degree relative with cancer or adenomatous polyp at age <60 or 2 or more first-degree relatives with polyp or CRC at any age), colonoscopy every 5 years should begin at age 40 or 10 years earlier than the youngest diagnosis of polyp or cancer. The CAG also identifies a moderate-risk group with one first-degree relative with cancer or adenomatous polyp at age >60 or 2 or more second-degree relatives with polyps or cancer. For these individuals, average-risk screening is recommended but beginning at age 40. Referral of high-risk individuals for genetic assessment (which may include genetic testing) enables appropriate augmented screening for those individuals and family members who are found to be at increased risk or who carry known mutations that predispose to CRC, and offers reassurance and return to average-risk screening for those who have been found not to have inherited the family mutation.

Up-to-date CRC screening for patients at average risk has been reported at less than 20 % in several studies across Canada (Strumpf et al. 2010; Zarychanski et al. 2007). Data from the 2008 Canadian Community Health Survey showed that 32 % (range 16–47 %) of Canadians aged 50–74 reported being screened with either FOBT in the previous 2 years or sigmoidoscopy/colonoscopy in the previous 5 years (Canadian Cancer Society et al. 2011). A recent meta-analysis of screening participation for people at increased risk of CRC due to FH (at least one first-degree relative with CRC) showed a pooled colonoscopy-based screening participation (at least once) of only 40 % (Ouakrim et al. 2013).

Although primary care providers (PCPs) have recognized their expanding role in providing genetic services (Carroll et al. 2003; Watson et al. 2001), they have reported a lack of knowledge and confidence in their ability to deal with hereditary cancers and other genetic disorders (Carroll et al. 2003; Emery et al. 1999; Watson et al. 2001). A recent study identified genetics knowledge and family history as important educational needs in primary care genetics (Houwink et al. 2011). A Delphi study on prioritization of genetics education for general practitioners included “evaluating indications for referral to a clinical genetics center” and “taking and interpreting a family history” in the top 10 genetic educational needs (Houwink et al. 2012). Core competencies for primary care providers in genetics have been approved by the European Society of Human Genetics and support the need for education to help practitioners identify patients who may have a genetic condition, among others (Skirton et al. 2010).

In an effort to improve FPs' ability to assess CRC risk based on FH, and to provide appropriate screening recommendations and referral for genetic assessment, we developed a point-of-care tool indicating categories of CRC risk based on FH on one side of a laminated card, and screening and management recommendations tailored to the level of risk on the other side (Mount Sinai Hospital Family Medicine Genetics Website 2013). We then sought to determine the efficacy of this tool in improving practice among family physicians.

Method

Study population Our goal was to recruit a convenience sample of 100 physicians (75 from Ontario and 25 from Newfoundland). Based on a 15 % anticipated response rate seen in similar studies (McIsaac et al. 2002), a random sample of English-speaking FPs actively practicing in the provinces of Ontario (ON $n=485$) and Newfoundland-Labrador (NL $n=175$) was provided by the College of Family Physicians of Canada. Study invitation letters were mailed with a return postcard for indicating agreement to participate. Participation involved completing a questionnaire before and 3 months after receiving the CRC Risk Triage/Management Tool and inviting patients to participate in a companion study assessing their evaluation of an information booklet and their experiences with CRC screening. This paper is only reporting on the physician arm of the study. Ontario was chosen for this study as there are published criteria for referral to genetics for a FH of CRC with genetic testing funded if criteria are met (Predictive Cancer Genetics Screening Committee 2001). Newfoundland was selected as genetic mutations associated with increased risk of CRC are significantly more common among CRC diagnoses in NL (Canadian Cancer Society et al. 2011; Woods et al. 2005).

Tool development The CRC Risk Triage/Management Tool was created by a multidisciplinary team to be used in the clinic at point-of-care to respond to patient questions about a FH of CRC and to help assess risk, make screening recommendations and appropriate genetics referral based on FH of CRC. The tool was based on a literature review of FH risk factors for CRC and management guidelines, as well as provincial genetic testing criteria (Leddin et al. 2004; Predictive Cancer Genetics Screening Committee 2001). It consists of a laminated card with FH risk categories on one side enabling a risk assessment of "high risk of hereditary/familial CRC," "moderate risk of hereditary/familial CRC," "low risk of hereditary/familial CRC but still at increased risk of CRC," and "population risk." The reverse side gives screening recommendations for each level of risk, as well as recommendations for when to refer to a genetics or hereditary cancer clinic.

Intervention Participating FPs were initially asked to complete a questionnaire containing demographic information, questions about awareness of guidelines for CRC screening and genetics clinic referral (Ontario physicians only), FH and CRC screening practices, and confidence in assessing risk of CRC and making management recommendations for patients with a FH of CRC. They were also asked to complete the risk assessment for eight clinical vignettes which reflected the full spectrum of FH-related CRC risk (from population risk to high risk of hereditary CRC), and to indicate what screening they would recommend for these individuals, and whether they would refer to genetics (Table 1). A follow-up reminder letter was sent 3 weeks later to non-responding physicians. Following receipt of the completed questionnaire by the study coordinator, physicians were then sent an information package which included the CRC Risk Triage/Management Tool (Mount Sinai Hospital Family Medicine Genetics Website 2013), an article on Hereditary CRC and CRC screening, a copy of a patient information booklet, and a list of provincial genetics referral centers. They were encouraged to use the CRC Risk Triage/Management Tool for the next 3 months to help them in assessment of CRC risk and management decisions with their patients. Following this 3-month period, they received a follow-up questionnaire, asking the same vignette questions and some additional questions about the usefulness of the tool. In addition, they were asked if they had referred to the CRC Risk Triage/Management Tool when completing vignette questions in the previous or current questionnaire. Three weeks later, a reminder letter was sent to physicians who did not complete the follow-up questionnaire. Physicians who completed the study received an honorarium of \$300 to compensate them for their time completing the study documents.

Outcomes Our primary outcomes were the mean change in score (sum of "correct" responses) for the following: CRC risk category, screening method, age to start screening, frequency

Table 1 Design of clinical vignettes

Vignette	CRC risk level	Features of family history contributing to CRC risk
1	Moderate	CRC at young age
2	Moderate	Associated cancers in Lynch syndrome (HNPCC)
3	Moderate	Three or more relatives affected with CRC
4	Low	Second-degree relatives affected
5	Low	One 1st-degree relative with CRC under 50 but over 35
6	Population	Over 50 years of age, no FH
7	High	Classic criteria of Lynch (HNPCC) syndrome
8	High	Amsterdam criteria (Cremin et al. 2009; Vasen et al. 2007)

of screening, and decision to refer to genetics for the eight clinical vignettes. “Correct” answers to the questions for each vignette were based entirely on information within the CRC Risk Triage/Management Tool. A correct answer template was created and questionnaires were scored and entered into the database. An example of a vignette with correct answers is shown in Table 2. Secondary outcomes included decisional difficulty around CRC risk assessment, confidence in primary care genetic skills, and responses to usefulness of the tool.

Analysis The data were entered into Excel spreadsheets by two independent data entry clerks; the datasets were compared

for errors and cleaned. IBM SPSS 20.0 was used for data analysis. Frequency distributions and means analysis were used for descriptive analysis of the data. McNemar’s tests and paired *t* tests were used to assess pre vs. post-comparisons on questionnaires based on physicians’ ability to correctly triage risk; to select the correct surveillance method, surveillance age, and surveillance frequency; and to make the correct genetics referral recommendations. A mean score was tabulated for each of the primary outcome measures (correct answers for eight vignettes) and compared pre- and post-receipt of the Risk Triage/Management Tool using paired *t* tests. A *p* value of <0.05 was considered significant. For each

Table 2 Example of CRC clinical vignette

A healthy 44-year old woman seeks advice about the following family history. Her mother was diagnosed as having colon cancer at age 54 and is still alive, her mother’s father died of duodenal cancer at age 54 and her mother’s sister was diagnosed with endometrial cancer at age 48 and is still alive.

a. What is the patient’s risk? (*check one*)

- ☐ **High risk for hereditary or familial colorectal cancer.**
- ☐ Moderate risk for hereditary or familial colorectal cancer.
- ☐ Low risk for hereditary or familial colorectal cancer but at increased risk for colorectal cancer.
- ☐ Population based risk for colorectal cancer.

b. On the scale 1 to 7, how difficult was it for you to make this risk assessment? (*circle one*)

	1	2	3	4	5	6	7	
Not at all Difficult								Extremely Difficult

c. What colorectal cancer surveillance method would you recommend?

NOTE: Although there may be more than one correct answer for method of surveillance, please select only ONE choice and then ensure that your answers to questions d-f are consistent with your response to this question.

- ☐ None
- ☐ Fecal occult blood testing (FOBT)
- ☐ Flexible sigmoidoscopy
- ☐ Barium enema and digital rectal examination
- ☐ **Colonoscopy**
- ☐ Other, please describe _____

d. What age should colorectal cancer surveillance begin for this patient?

- ☐ now
- ☐ **age 40**
- ☐ age 50
- ☐ age 60
- ☐ other age _____

e. How often would you recommend this method of colorectal cancer surveillance?

- ☐ Annually
- ☐ **1-2 years**
- ☐ 3-5 years
- ☐ 5-10 years
- ☐ Other _____

f. Would you offer referral to a familial cancer or genetics specialist?

- ☐ **Yes**
- ☐ No

“Correct” answers are in bold text

Fig. 1 Study flow diagram

vignette, respondents were asked to rate their difficulty making an assessment of risk of CRC on a scale of 1 to 7, with 1 being not at all difficult and 7 being extremely difficult. An overall score for perceived decisional difficulty was calculated by adding the individual vignette scores to give a total (maximum=56).

Total scores across the eight vignettes were calculated for risk triage, surveillance, and genetics referral; logistic regression models were used to look for predictors of improved change in these scores. Dummy variables were created and entered as independent variables into the model for age (<45 vs. ≥45), sex (M/F), province (ON/NL), years in practice (<15 vs. ≥15), work setting (group/solo), practice location (urban/rural), involvement in undergraduate/postgraduate education (Y/N), completion of continuing education in hereditary CRC in last 2 years (Y/N), use of the CRC triage/management tool in practice (Y/N), and use of the CRC triage/management tool to respond to the clinical vignettes (Y/N).

Ethics approval for this study was received from the Mount Sinai Hospital Research Ethics Board and the Memorial University Human Investigation Committee.

Results

Of the 660 family physicians invited, 121 (18 %) agreed to participate in this study (Fig. 1). Results are reported for the 75/121 (62 %) of physicians who completed both questionnaires 1 and 2. The demographics of these 75 participants are reported in Table 3. The mean age of participating family physicians was 44 years with 41 % female. About one third (33 %) of the respondents were from NL. The majority were in group practices. The only demographic difference between

the Ontario and NL physicians was that a higher percentage of NL physicians (79 %) were in community group practice compared with Ontario (45 %, $p=0.006$). Reasons for non-participation were provided by 101/539 (19 %) of physicians; 60 % indicated they had no time, 30 % reported their practice was not suitable, and 10 % cited other reasons (Fig. 1).

Table 4 shows the responses to questions regarding screening for CRC and assessment and management of those at risk for hereditary CRC. The vast majority of participating FPs (56/73, 77 %) “agreed” or “strongly agreed” that they routinely recommended FOBT screening for patients who are 50 years of age or older and are at population risk of CRC. This did not significantly change following receipt of the CRC Risk Triage/Management Tool. However, there was a significant increase in confidence in assessment of risk of hereditary CRC (38/73, 52 % pre; 64/73, 88 % post, $p<0.001$) and confidence in management recommendations for patients with a FH of CRC (37/73 51 % pre; 61/73 84 % post, $p<0.001$). Awareness of provincial criteria for referral to genetics also increased significantly for Ontario physician respondents (10/73 20 % pre, 26/73 54 % post, $p=0.001$). Almost all respondents agreed that they routinely asked their patients about FH of cancer.

Table 5 shows the difference between the total mean scores for all eight vignettes on the primary outcome measures pre and post the receipt of the CRC Risk Triage/Management Tool. There was a significant improvement in all outcome measures: correctly assessing risk of CRC, correctly indicating screening method, frequency and age to start, and correctly indicating whether or not a referral to genetics was indicated.

Compared to Newfoundland respondents, Ontario respondents were significantly more likely to agree/strongly agree

Table 3 Family physician demographics (*N*=75)

	Number	Percent
Age	Mean (SD)=44.4 (9.6) years	Range 29.0–64.0 years
Sex:		
Male	44	58.9
Female	31	41.1
Years in practice	Mean (SD)=14.9 (10.5) years	Range 0.5–38.0 years
Province:		
Ontario	51	68.0
Newfoundland	24	32.0
Work setting ^a :		
Community group practice	42	56.0
Community solo practice	14	18.7
Academic teaching unit	8	10.7
Practice location:		
Urban	40	53.3
Rural	22	29.3
Mixed rural/urban	13	17.3
No. of hours of direct patient care/week	Mean (SD)=38.4 (11.2) h	Range 14.0–80.0
No. of patients see in typical week:		
<25 patients/week	1	1.3
25–74 patients/week	9	12.0
75–124 patients/week	20	26.7
125–149 patients/week	21	28.0
≥150 patients/week	24	32.0
Involved in undergraduate/postgraduate medical education:		
Yes	40	53.3
No	35	46.7
Completed CE in hereditary CRC in past 2 years:		
Yes	9	12.0
No	66	88.0

^a Multiple responses possible

that they were aware of the recommendations for CRC screening (OR=5.2 95 % CI=1.0,26.7, *p*=0.049) and that they routinely recommended FOBT screening for average-risk patients 50 years of age or older (OR=5.7, 95 % CI=1.6,20.6, *p*=0.008). The majority (64 %) of the respondents stated they used the CRC Risk Triage/Management Tool to respond to the vignettes. Using the tool was a significant predictor of improvement in CRC risk assessment (OR=6.4, 95 % CI=1.5,27.5, *p*=0.012) and referral to genetics questions on the vignettes (OR=8.5, 95 % CI=1.5,46.6, *p*=0.014).

Table 6 shows respondents' feedback on the different components of the CRC Risk Triage/Management Tool. The vast

majority (90 %) agreed that the CRC Risk Triage/Management Tool would improve their practices, and agreed that they felt more confident in their ability to assess a patient's risk of CRC (74 %) and manage patients with a family history of CRC (87 %). The majority (88 %) agreed that they would continue to use the CRC Risk Triage/Management Tool and would recommend it to colleagues (80 %). In the 3-month period since receiving the tool, 23/73 (31.9 %) said they had used it frequently in practice, 34/73 (47.2 %) rarely, and 15/73 (20.8 %) had never used it.

Discussion

We were able to demonstrate that receiving the CRC Risk Triage/Management Tool could possibly be associated with significant improvement in FPs' ability and confidence in CRC risk assessment, screening recommendations, and genetics referral recommendations for clinical vignettes representing a full range of CRC risk. Most participating FPs stated they would continue to use the tool and recommend it to colleagues.

These findings contribute to studies demonstrating the value of educational interventions in hereditary cancer (Blazer et al. 2004; Carroll et al. 2009, 2011; Houwink et al. 2013, 2014a, b; Schroy et al. 2005; Watson et al. 2001). Watson showed improved referral decisions for patients with a FH of breast/ovarian cancer, using mailed information including a laminated summary card with simple referral guidelines, a booklet with more detailed information, and two patient leaflets (Watson et al. 2001). Schroy et al. (2005) showed that a mixed educational program incorporating both a didactic lecture and interactive case-based seminar increased knowledge about familial CRC risk in internal medicine residents but was ineffective in changing resident behavior such as clinical risk assessment. However, their intervention's impact on knowledge declined over time highlighting the need for practical, available tools (Schroy et al. 2005). Houwink showed that an online genetics Continuing Professional Development module resulted in sustained improvement of genetics knowledge in general practitioners. (Houwink et al. 2013). However, skills such as referral to a specialist and knowledge of benefits and limitations of genetic testing did not improve significantly. A further trial by Houwink et al. was able to show that a 4-h oncogenetics training intervention was able to significantly improve key consultation skills at 3-month follow-up (Houwink et al. 2014a, b). Others have proposed CRC risk assessment tools but with limited evaluation in practice (Freedman et al. 2009; Kastrinos et al. 2009). Printed educational materials have typically been shown to have small beneficial effects on professional practice (Farmer et al. 2008; Grimshaw et al. 2004).

Table 4 Family physicians' awareness of and confidence in screening and management of CRC (*N*=75)

Questionnaire statement	Agree/strongly agree PRE <i>N</i> (%)	Agree/strongly agree POST <i>N</i> (%)	<i>p</i> value (Fisher's exact)
I am aware of the Periodic Health Examination Task Force recommendations for CRC screening	62 (83.8)	66 (88.0)	NS
I am aware of the provincial criteria for referral to a genetics or familial cancer clinic for counseling about hereditary CRC (Ontario physicians only)	11 (21.6)	27 (54.0)	0.001
I routinely ask my patients if they have a family history of cancer	70 (93.3)	70 (93.3)	NS
I routinely recommend FOBT screening for patients who are 50 years of age or older and are at population risk of CRC	58 (77.3)	62 (82.7)	NS
I feel confident assessing the risk of hereditary CRC	39 (52.0)	66 (88.0)	<0.001
I feel confident in my management recommendations for patients with a family history of CRC	38 (51.4)	63 (84.0)	<0.001

There were no significant improvements in awareness of the Periodic Health Examination Task Force recommendations for CRC screening and for routinely recommending FOBT screening for patients at population risk of CRC. This may have been partly on the basis of small sample size or because some providers may have been recommending routine colonoscopy screening rather than FOBT. The vast majority (93 %) of providers routinely asked about family history of cancer at baseline, which did not change following the intervention, perhaps indicating a ceiling effect.

This is one step in a program of research to develop and evaluate tools that can be used at the "point-of-care" to enhance primary care providers' skills in taking family histories and identifying those at increased genetic risk. It was important to determine if our tool was acceptable to FPs and could potentially improve outcomes. More work is needed prior to recommending its use and widely disseminating it as a knowledge translation tool. Our findings lend preliminary support for this type of tool. We think such brief and user-friendly tools will be particularly valuable for clinicians to help them flag the less common high-risk hereditary cancer FH patients among the many they see daily with any cancer FH, as well as

assisting them with management guidelines. It may be possible to adapt this tool to other topics where genetics plays a role, such as cardiovascular diseases, diabetes, and other hereditary cancers. A previous study of family physicians using a similar tool for hereditary breast cancer was shown to be useful in identifying those at increased risk and making appropriate genetics referrals on vignettes (Carroll et al. 2011).

The overall participation rate to the study invitation was low (18 %), and it is likely that these were more interested FPs, so it will be important to follow-up with a broader dissemination and evaluation strategy. As well, our study was multifaceted and involved not only a pre/post survey but FPs were also asked to use the CRC tool for 3 months and were expected to recruit five patients for the patient study, so there was a fair time commitment. Our participation rate is in keeping with similar studies inviting participation of FPs in

Table 5 "Correct" responses to primary outcome measures before and after receiving the CRC Risk Triage/Management Tool

Outcome	Mean score PRE	Mean score POST	SD of mean difference	<i>p</i> value
CRC risk assessment ^a	3.4	5.8	2.2	<0.001
Surveillance method ^a	6.6	7.4	1.1	<0.001
Surveillance starting age ^a	6.6	7.1	1.5	0.020
Surveillance frequency ^a	3.1	5.0	2.2	<0.001
Total surveillance ^b	16.8	19.9	2.9	<0.001
Referral to genetics ^a	5.1	6.5	2.0	<0.001

^a Following each outcome is the mean score of total correct answers to the vignettes (total possible score=8)

^b Total surveillance is mean of sum of surveillance method, starting age and frequency (total possible score=24)

Table 6 Participants' feedback on the CRC Risk Triage/Management Tool

Features of the CRC Risk Triage/Management Tool	Agree/strongly agree <i>N</i> (%)
Overall the CRC Risk Triage Tool was easy to use	51/73 (69.9)
Using the CRC Risk Triage Tool, I feel confident in my ability to assess a patient's risk of CRC	52/72 (72.2)
I will continue to use the CRC Risk Triage Tool	60/70 (85.7)
I will recommend the CRC Risk Triage Tool to colleagues	52/71 (73.2)
Overall the CRC Management Recommendation Tool was easy to use	62/72 (86.1)
Using the CRC Risk Management Recommendation Tool, I feel confident in my ability to manage patients with a family history of CRC	62/71 (87.3)
I will continue to use the CRC Risk Triage/Management Tool	61/69 (88.4)
I will recommend the CRC Risk Management Recommendation Tool to my colleagues	57/71 (80.3)
This CRC Risk Triage/Management Tool will improve my practice	64/71 (90.1)
I would like similar Risk Triage/Management Tools for other hereditary cancers	64/71 (90.1)

education and intervention studies (27 %, McIsaac et al. 2002; 14 %, Carroll et al. 2011; 13 %, Houwink et al. 2013; 4 %, Houwink et al. 2014a, b), and in surveys containing vignettes (17.5 %, Buchbinder et al. 2013). We have also only shown that the tool works with clinical vignettes. It will be important in future studies to determine if actual CRC screening and genetic referral rates improve in practice when using this tool; however, the challenge for following these outcomes is that patients at “moderate” or “high” risk of hereditary CRC are seen infrequently in most FPs’ practices. It is also important to note that a provincial CRC screening program was launched in Ontario in 2008 and only recently in parts of Newfoundland (July 2012). Provider awareness of CRC screening may increase as a result of educational initiatives and increased public awareness resulting from these programs.

Further work is needed including educational interventions to raise awareness of CRC screening recommendations, particularly for those at population risk of CRC who are seen commonly in general practice, and to facilitate family history taking to identify those at increased risk. The next step in this program of research is to disseminate the tool more widely and determine if it is effective in triaging risk of CRC and making appropriate recommendations for screening and genetics referral with patients in community primary care practice. If effective, it would be relatively easy to distribute point-of-care tools such as this, to primary care providers, either by electronic or regular mail and/or website, to assist with genetic risk assessment and management of complex medical conditions for which there is a genetic component. Of course, the most powerful application of such a tool would be the direct incorporation of its algorithm into the primary care electronic medical record. Houwink et al. have proposed a “roadmap to stepwise integration of genetics in family medicine” with education and training needed first, followed by improvements in the recording of family history in the electronic health record with algorithms to identify and alert practitioners to those at risk who satisfy referral or enhanced screening or management criteria (Houwink et al. 2013).

Limitations of the study include the lack of a control group, and the short 3-month follow-up. There is no way to know if the tool contributed to the improved outcome or if another educational or environmental influence occurred over the same time period. We do know that the majority of participants stated that they used the tool in answering the vignettes, so it is likely it played a role in their improved outcomes. A second phase of this study has recently been completed with a 2-year follow-up questionnaire to FP and patient participants in order to extend and complete the evaluations that were initiated in this study. This follow-up study captures patients’ self-reported CRC screening behaviors, and will also give some information regarding FPs’ retention of knowledge and skills in CRC risk assessment and management, and implementation of the tool into practice.

Conclusion

Receipt of a point-of-care Colorectal Cancer Risk Triage/Management Tool was associated with improvement in FPs’ CRC risk assessment, screening recommendations, and genetics referral recommendations based on clinical vignettes. This demonstrates the value of point-of-care tools for FPs and, furthermore, illustrates a process for the development, evaluation, and dissemination of such tools, which is much needed by FPs if the potential impacts of genomic advances are to be achieved.

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Conflict of interest June Carroll, Sean Blaine, Joanne Permaul, Elizabeth Dicks, Ellen Warner, Mary Jane Esplen, Heidi Rothenmund, Kara Semotiuk, Graham Worrall, and John McLaughlin declare that they have no conflict of interest.

Compliance with ethics guidelines All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000(5). Informed consent was obtained from all physicians for being included in the study.

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