Title

Fecal Immunologic Test Results and Diagnostic Colonoscopy in a Mexican Population at Average Risk for Colorectal Cancer

Journal

Cancer Prevention Research, 13(11)

ISSN

1940-6207

Authors

Manzano-Robleda, Maria Del Carmen
Espinosa-Tamez, Priscilla
Potter, Michael B
et al.

Publication Date

2020-11-01

DOI

10.1158/1940-6207.capr-20-0076

Peer reviewed

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

Fecal Immunologic Test Results and Diagnostic Colonoscopy in a Mexican Population at Average Risk for Colorectal Cancer

Maria Del Carmen Manzano-Robleda[1,5], Priscilla Espinosa-Tamez[2], Michael B. Potter[3], Martin Lajous[2,4], Katherine Van Loon[3], Li Zhang[3], Alejandro Jimenez-Peña[1,5], Julio Sánchez Del Monte[1,5], Alejandro Mohar[5], and Angélica Hernández-Guerrero[1,5]

ABSTRACT

Colorectal cancer is preventable and treatable by screening and early detection. Fecal immunochemical tests (FIT) for average risk individuals is an effective strategy for screening. Incidence and mortality in Mexico is increasing and large-scale screening programs do not yet exist. The aim of this study was to evaluate the feasibility of FIT-based colorectal cancer screening program in Mexico City. For more than 15 months, average risk individuals in Mexico City were invited to participate at Mexico's Instituto Nacional de Cancerologia (INCan, Mexico City, Mexico). Participants received an FIT kit for stool collection, results ≥20 ng/mL were referred for high quality colonoscopy. Participants' results were classified according to the most advanced clinical finding as: adenocarcinoma, high-risk adenomas, low-risk adenomas, serrated lesions, hyperplastic polyps, and no polyps. Sequential analyses were performed to assess the positive predictive value (PPV) of FIT. A total of 810 participants were eligible, 737 (91.0%) returned the FIT and 112 (15.2%) had an abnormal result. Of these participants, 87 (77.7%) completed colonoscopy. Clinical findings of participants included: seven (8.1%) adenocarcinomas, 18 (20.7%) high-risk adenomas, 23 (26.4%) low-risk adenomas, one (1.2%) serrated lesions, 14 (16.1%) hyperplasic polyps, and 24 (27.6%) no polyps. The PPV of FIT using the ≥20 ng/mL was 8.1% for cancer and 20.7% for high-risk adenomas. In conclusion, colorectal cancer screening with FIT is feasible at INCan in Mexico City, where resources are available. Further studies are needed to determine feasibility of colorectal cancer screening in other settings, as well as optimal hemoglobin detection cut-off points to maximize the population benefits of colorectal cancer screening with FIT in Mexico.

Introduction

Colorectal cancer is preventable and treatable by screening and early detection (1), yet it remains a leading cause of cancer-related mortality. Globally, the majority of colorectal cancer–related deaths occur in low- and middle-income countries (2). Colorectal cancer incidence is also rapidly increasing in Latin America, particularly in urban areas (3, 4). In Mexico, the colorectal cancer–related mortality rate has increased on average 3.1% every year since 2010, and colorectal cancer is currently the leading cause of cancer-related death in Mexico City (2, 5, 6).

The International Agency for Research on Cancer recommends biennial fecal immunochemical tests (FIT) for adults ages 50–75, followed, when necessary, by diagnostic colonoscopy and treatment as a cost-effective approach to reduce colorectal cancer–related mortality (7). However, colorectal cancer screening is only justifiable in settings with sufficient resources for endoscopic diagnosis and subsequent endoscopic, surgical, and/or oncologic treatment (8).

Resources to support colorectal cancer diagnosis and treatment are expanding in Mexico, making it possible to consider the introduction of FIT-based screening programs. Currently, however, Mexico does not have established colorectal cancer screening guidelines, and there is limited literature on the feasibility and performance of FIT-based programs in the country. The aim of this study was to evaluate the feasibility of a FIT-based colorectal cancer screening program at the Instituto Nacional de Cancerologia (INCan) in Mexico City.

Materials and Methods

Study population

Between October 2017 and January 2019, we invited average-risk women and men ages 50–74 years to participate in a colorectal cancer screening program at Instituto Nacional de Cancerología del México, also known as INCan. INCan is a

[1]Servicio de Endoscopía, Instituto Nacional de Cancerología, Mexico City, Mexico. [2]Centro de Investigación en Salud Poblacional, Instituto Nacional de Salud Pública, Mexico City, Mexico. [3]University of California, San Francisco, San Francisco, California. [4]Department of Global Health and Population, Harvard T.H. Chan School of Public Health, Boston, Massachusetts. [5]Instituto Nacional de Cancerología, Mexico City, Mexico.

Corresponding Author: Angélica Hernández-Guerrero, Instituto Nacional de Cancerología, Mexico City 14080, Mexico. Phone: 555-628-0400; E-mail: aihernandez1@yahoo.com

Cancer Prev Res 2020;13:959–66

doi: 10.1158/1940-6207.CAPR-20-0076

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

tertiary care referral center that provides specialized cancer care to patients living in Mexico City and beyond.

Different strategies were used to invite individuals to participate in the program. Recruitment strategies included: eligible hospital employees or dependents (family members) of hospital employees, publicity (flyers/posters) in the community, and radio, television, and internet campaigns.

Following an institutional review board (IRB) amendment in November 2018, we expanded eligibility to the general population in Mexico City. We recruited participants through radio and magazine advertising campaigns as well as outreach activities in community-based health centers. Individuals who contacted research personnel to request participation in the study were interviewed for eligibility.

We defined average-risk individuals as those women and men ages 50–74 years without a personal history of gastrointestinal bleeding, colonic adenomas or colorectal cancer, inflammatory bowel disease, genetic predisposition to colorectal cancer (i.e., Lynch syndrome or familial adenomatous polyposis), and without a known diagnosis of colorectal cancer in a first-degree relative. Participants with a history indicating increased risk (personal history of gastrointestinal bleeding, colonic adenomas or colorectal cancer, inflammatory bowel disease, genetic predisposition syndromes like Lynch syndrome or familial adenomatous polyposis, and diagnosis of colorectal cancer in a first-degree relative) were excluded and advised to contact their primary care physician to discuss further diagnostic evaluation.

Eligible participants provided written informed consent in Spanish, Mexico's primary language. The study was approved by the IRBs at INCan (Mexico City, Mexico) and at the University of California, San Francisco (San Francisco, CA). All procedures performed were in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Participant interview

Eligible participants were interviewed by study personal to collect demographic information, including: age, place of birth, current residence, family and personal history of disease, physical activity, smoking, alcohol consumption, and weekly consumption of fruits, vegetables, red unprocessed, and processed meats. Clinical personnel conducted a physical examination of each participant, which included measurement of height and weight.

FIT features, distribution, collection, and processing

Eligible participants received an FIT Kit (OC FIT-CHEK, Polymedco) for sample collection and a brochure with instructions for collection and storage of the sample at home. We asked participants to keep their FIT kit at 4°C after stool collection and personally return it to INCan within 48 hours after completion. If the participant did not return the FIT during the specified period, up to five phone calls were made as a reminder to return the test for analysis; however, the period for returning the FIT was not a restriction for inclusion. As long as the FIT was returned within 48 hours of specimen collection, the participant was included in the study. All samples were labeled with the participant name, date of birth, and date of collection. FITs were processed at INCan's clinical laboratory with adherence to the manufacturer's instructions. Fecal hemoglobin concentrations can be reported in different units; for the purpose of our study, we used nanograms of hemoglobin per milliliter of buffer (ng/mL). All participants that returned their FIT were required to schedule an appointment to receive the results in person. In our study, all participants with a FIT concentration of ≥20 ng/mL (4 μg/g feces) were considered as abnormal and referred for a diagnostic colonoscopy (9). This lower cutoff was selected to understand the prevalence of premalignant lesions that can be detected using different levels of hemoglobin. Individuals with FIT result of <20 ng/mL were advised to repeat colorectal cancer screening with FIT in 2 years as the standard of care (7). The cost of the FIT kit, processing, and interpretation was $370 Mexican pesos ($20 USD) per patient. The kits were donated by a nonprofit organization at no cost to health system or program participants.

Colonoscopies and pathology

Participants referred for colonoscopy met with trained personnel for counseling regarding colorectal cancer risk, the purpose of colonoscopy, and the specific steps to be taken for bowel preparation with a divided dose of 4 L of water with Macrogol 3350 (Nulytely) prior to the procedure. These instructions were supported with printed materials and videos available in Spanish. As part of the precolonoscopy evaluation, a complete blood count and coagulation tests were performed. All endoscopic procedures were performed in the Early Detection Clinic of the Endoscopic Unit at INCan by certified endoscopists and/or supervised clinical fellows using Olympus CF190 colonoscopes with an Endocuff and a water pump. Colonoscopy quality was assessed by recording the quality of bowel preparation using the Boston Bowel Preparation Scale (BBPS), successful exploration of the cecum, withdrawal time ≥6 minutes, and number of patients with at least one adenoma detected (10, 11).

During the procedure, endoscopists classified findings as: tumor, ≥1 polypoid lesion, diverticular disease, hemorrhoidal disease, or a normal colonoscopy. Polypoid lesions were further classified according to location, size, number, and surface pattern with digital chromoendoscopy using the NICE classification (12). Polypoid lesions found during colonoscopy were biopsied with the following techniques according to their size: cold forceps for 1–4 mm, cold snare for 5–9 mm, or hot snare for ≥10 mm. Tissues removed during colonoscopy were placed in a formaldehyde solution and sent for pathology review in separate containers. After macroscopic tissue review, samples were formaldehyde fixed, dehydrated with ethyl alcohols and xylene (xylol), and paraffin embedded at 60°C. Hematoxylin and eosin slides were obtained from 4-μm thick paraffin block cuts and independently reviewed by two gastrointestinal

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

pathologists. Final pathology reports for each lesion biopsied were correlated with clinical findings, and final diagnostic reports were made available to the clinical team within 7 days after colonoscopy.

Each patient was classified according to the most advanced clinical finding (endoscopic and pathologic) as: (i) invasive adenocarcinoma, ii) adenocarcinoma *in situ*, (iii) high-risk adenomas, (iv) low-risk adenomas, (v) hyperplastic polyps, or (vi) no polyps. Serrated lesions were categorized independently. Colonoscopy without polyps, without diverticula, without hemorrhoids, and without any other mucosal lesions was considered normal colonoscopy. When individuals with FIT ≥100 ng/mL presented normal colonoscopy, diagnostic esophagus-gastro-duodenoscopy (EGD) was performed.

Low-risk adenomas, high-risk adenomas, hyperplastic polyps, and serrated lesions were defined as recommended by the American Society of Gastrointestinal Endoscopy guidelines (13). Patients with ≥3 or more adenomas, adenoma with high-grade dysplasia, adenoma with villous histology, or tubular adenoma ≥10 mm were classified as having high-risk adenomas. Patients with one or two tubular adenomas <10 mm were classified as having low-risk adenomas. Hyperplastic polyps where defined as small (<10 mm) in the rectum or sigmoid colon. Patients with sessile serrated polyps or the traditional serrated adenomas were classified separately as having serrated lesions.

Diagnostic colonoscopy findings were provided to participants at discharge from the Endoscopy Unit on the same day of the procedure. Pathology results were provided 1 week after the colonoscopy at an in-person visit. During these visits, participants received follow-up recommendations for future management based on National Comprehensive Cancer Network guidelines (14).

Because colon cancer screening is not currently covered by insurance systems in Mexico, patients who underwent a diagnostic colonoscopy were required to pay for the procedure at a subsidized rate of $2,500 Mexican pesos ($135 USD).

Data collection and analysis

Patient-reported lifestyle data were categorized as follows: physically active (yes, ≥150 minutes per week or no, <150 minutes per week), level of smoking [never smoker, low smoker (<6 pack-years), moderate (6–15 pack-years), or severe (>15 pack-years)], level of alcohol consumption (yes, >50 g per day for women or >70 g per day for men or none); and level of red unprocessed and processed meat (none, 1–2 times per week, or 3–5 times per week). Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. BMI of <18.5 kg/m^2 was defined as underweight, 18.5–<25 kg/m^2 as normal, ≥25–<30 kg/m^2 as overweight, and ≥30 kg/m^2 as obese.

Variables yielding continuous data were summarized with means and SDs. Categorical data were reported using frequencies and percentages.

Participants who underwent colonoscopy and had biopsies sent for pathology review were classified as described above. To explore the positive predictive value (PPV) of different ng/mL cutoffs, sequential analyses were performed to determine the number and type of lesions that would have been found using a cutoff of ≥20 ng/mL, ≥50 ng/mL, and ≥100 ng/mL buffer. All analyses were performed using SAS version 9.4 (SAS Institute).

Results

There were 892 women and men who contacted research personnel to participate in the study. We excluded 82 potential participants for the following reasons: 60 had history of colorectal cancer in a first-degree relative, 17 did not meet age criteria, and five did not complete the enrollment interview. Thus, our final study population included 810 average-risk women and men, as summarized in **Fig. 1**.

The mean age of participants was 59.1 years (SD = 6.3 years). Most participants were women (n = 566, 69.9%), and the prevalence of obesity was 25.3%. Of the 810 participants, 737 (91.0%) returned the FIT kit for analysis. The distribution of characteristics of study participants and the participant recruitment strategy is reported in **Table 1**.

An abnormal FIT threshold set at ≥20 ng/mL yielded an abnormal rate of 15.2% (112/737). Sequential sensitivity analyses showed that using a cut-off point of ≥50 ng/mL would yield a 9.6% abnormal rate (71/737), and using a cut-off point of ≥100 ng/mL would yield an abnormal rate of 5.7% (42/737). The distribution of FIT results in ng/mL can be observed in **Fig. 2**.

Among the 112 participants with abnormal FIT results, 91 (81.2%) returned for colonoscopy, and 87 (77.7%) had a complete colonoscopy. Of the 21 who did not undergo colonoscopy, 12 were lost to follow-up, five never returned to receive FIT results despite phone reminders, two declined the procedure, and two reported that the colonoscopy would be performed at another healthcare facility. Colonoscopy could not be completed in 4 patients due to impassable angles secondary to benign conditions in the sigmoid colon and were, therefore, excluded from the analysis. In all 87 completed colonoscopies, the cecum was explored and colonoscope withdrawal time was ≥6 minutes. Of these, 86 (98.8%) had adequate bowel preparation (BBPS ≥ 6). The patient with inadequate bowel preparation was offered a repeat surveillance colonoscopy within 1 year.

Endoscopist impressions of clinical findings prior to biopsy and pathology reporting were recorded as follows: five (5.7%) with a tumor, 71 (81.6%) with at least one polypoid lesion, 22 (25.3%) with diverticular disease, 25 (28.7%) with hemorrhoidal disease, and five (5.7%) with a normal colonoscopy. Clinical findings are summarized on **Table 2**.

At least one adenoma was detected in 52% of the participants that underwent to colonoscopy. Adenocarcinoma was found in seven (8.1%) individuals (one *in situ* and six invasive) and 18 (20.7%) individuals had high-risk adenomas. Using ≥20 ng/mL cutoff, the PPV was 8.1% for cancer and 20.7% for high-risk adenomas. For the ≥50 ng/mL cutoff, these PPVs were 12.1%

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

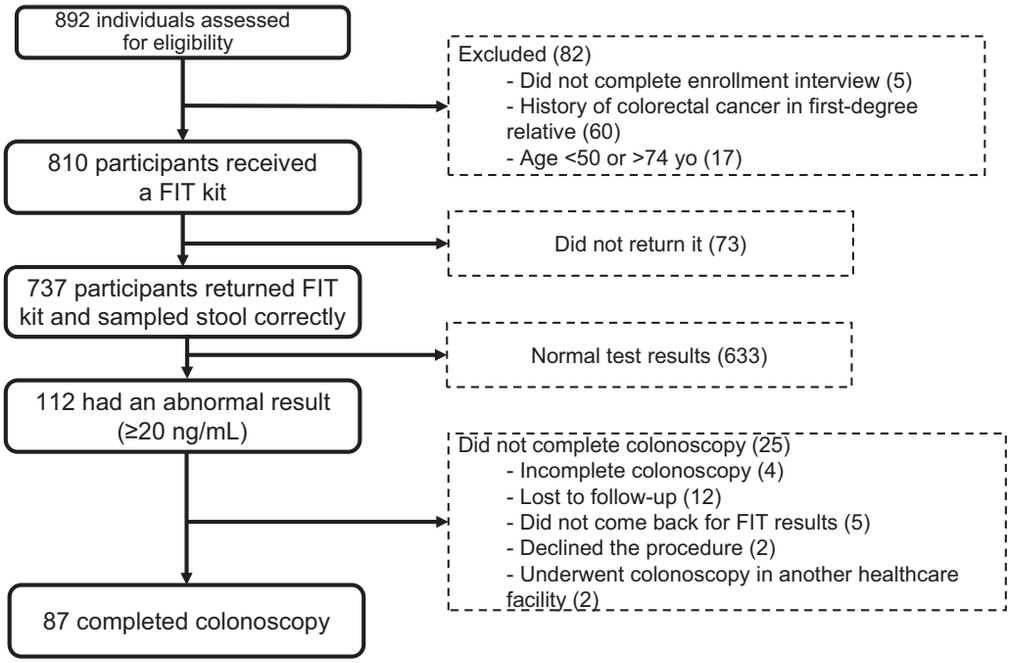

Figure 1.
Diagram showing the flow of participants through stages of the study.

and 22.4% and at the cutoff of ≥100 ng/mL the PPVs were 21.2% and 30.3%, respectively.

Individuals with no polyps had benign conditions, which are reported in **Table 2**. Participants with normal colonoscopy and FIT ≥100 ng/mL underwent EGD. Erosive gastropathy and bulboduodenitis was found in 1 patient and normal EGD in the other patient.

Stage of the disease was completed in 6 of the 7 patients with cancer: one stage 0 (Tis), two stage I (T1N0M0), two stage IIa (T3N0M0), and one stage IIIa (T3N1M0). These 6 patients with cancer received treatment at INCan. Two received endoscopic treatment, two surgical, one systemic, and one received surgical and systemic treatment. One patient was diagnosed with cancer at INCan through colonoscopy and pathology review of biopsies, but chose to receive oncologic staging and care at other hospital. Patients with benign conditions were sent for follow-up with a gastroenterologist outside INCan. None of the participants experienced complications during diagnostic colonoscopy.

Laboratory tests were performed in every participant preprocedure. None of the participants had abnormal coagulation tests. Only one individual had anemia, in that case, the anemia was mild and that individual was subsequently diagnosed with adenocarcinoma.

Discussion

In this FIT-based colorectal cancer screening program at INCan, a high proportion of enrolled participants completed FIT screening, reflecting a high willingness of the population to participate. The number of early-stage cancers detected with different hemoglobin concentration thresholds was identical, suggesting that a cut-off point of 100 ng/mL may be appropriate in the initial phases of a national screening program where resources for diagnostic follow-up will likely be limited.

This program resulted in a high detection of individuals with at least one adenoma and also identified cases of adenocarcinoma in curable or treatable stages, as would be expected from a high-quality endoscopy program focusing on diagnostic evaluation of individuals with abnormal FIT.

These results are comparable with similarly structured programs in Latin America, including a recently published study from Veracruz, Mexico (15–17). Together, these findings show that high-quality colorectal cancer screening programs are feasible in Latin America. We acknowledge that achieving and maintaining high rates of screening, diagnostic evaluation, and follow-up will pose considerable challenges, especially when the target of such programs is expanded to the entire average-risk population (15, 16, 18–22). However, public and private health systems in Mexico are currently exploring investments to make comprehensive colorectal cancer screening programs more widely accessible.

Many characteristics of our intervention likely contributed to the very high participation rates. First, a significant proportion of recruited participants were Hospital employees or relatives of employees (27%). This population is more likely

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

Table 1. Characteristics of 810 study participants.

	N (%)
Age (SD)	59.1 (6.3)
Gender	
Male, *n* (%)	244 (30.1)
Female, *n* (%)	566 (69.8)
State of residence in Mexico	
Mexico City	542 (66.9)
Mexico (State)	77 (9.5)
Puebla (State)	143 (17.7)
Other	48 (5.9)
Mean BMI (±SD), kg/m^2	27.3 (4.8)
Underweight, *n* (%)	9 (1.1)
Normal, *n* (%)	248 (30.6)
Overweight, *n* (%)	334 (41.2)
Obese, *n* (%)	205 (25.3)
Family history of colorectal cancer[a], *n* (%)	
Positive history	30 (3.7)
Negative history	780 (96.2)
Read and processed meat consumption, *n* (%)	
None	51 (6.3)
1–2 times per week	488 (60.3)
3–5 times per week	271 (33.4)
Current tobacco smoking[b], *n* (%)	
None	686 (84.7)
Low	43 (5.3)
Moderate	48 (5.9)
Severe	33 (4.1)
Regular alcohol intake[c], *n* (%)	
Yes	39 (4.8)
No	771 (95.1)
Regular physical activity[d], *n* (%)	386 (47.6)
Comorbidities	
Hypertension	147 (18.1)
Diabetes	148 (18.3)
Cancer	24 (3)
Participant recruitment strategy, *n* (%)	
Flyers/posters in the community	412 (50.9)
Hospital (employees/dependents)	219 (27)
Radio/television	169 (20.9)
Internet	9 (1.1)
No answer	1 (0.1)

[a]Other than first-degree relatives.
[b]Yes (low <6 pack-years, moderate 6–15 pack-years, and severe>15 pack-years) or no.
[c]Women >50 gram and men >70 gram.
[d]Yes (>150 minutes per week) or no.

to be exposed to cancer awareness campaigns and highly motivated to finish the screening process. Second, we provided personalized attention to participants at the time of recruitment and delivery of the test with emphasis on the importance of returning the FIT and performing a diagnostic colonoscopy when abnormal results were found. Up to five reminder phone calls were made by a research assistant to participants who failed to complete FIT, return for FIT results, or complete colonoscopy. The resources required to provide such follow-up were not trivial and must be considered, especially as colorectal cancer programs expand and begin to target less motivated people or individuals with less knowledge of cancer.

Another important consideration addressed by this research is the cut-off point to be used to define an abnormal FIT that will require referral to colonoscopy. Using the 20 ng/mL cut-off point for colonoscopy led to nearly three times as many colonoscopies as would have been the case had a cut-off point of 100 ng/mL been selected. While the 20 ng/mL cut-off point also detected more high-risk adenomas than either the 50 or 100 ng/mL thresholds, the number of early-stage cancers detected at these three thresholds was the same. Thus, for a population-based screening program, a higher threshold for colorectal cancer screening should be considered to reduce the risk of straining or exhausting available diagnostic endoscopy resources (23). However, use of a higher cutoff would require adherence to repeated screening with FIT at shorter intervals (e.g., at least every 2 years), because high-risk adenomas with malignant potential may otherwise go unnoticed and untreated with less frequent screening. Final determination of the appropriate cutoff for colorectal cancer screening in Mexico will require further analysis and should ultimately need to consider the characteristics of the specific target population, such as the colonic lesions prevalence and available colonoscopy capacity. More studies to assess available health care resources for screening are needed to determine the optimal population cohorts to be screened and appropriate screening thresholds. An evaluation of endoscopy capacity is very important when considering a screening program. In Mexico, this evaluation is currently underway.

In this study, no other disease or cancer was found during physical examination previous to FIT delivery, while precolonoscopy laboratory studies only detected anemia in 1 patient with adenocarcinoma, which did not contraindicate the endoscopic procedure. These findings suggest that, at least for the screening population, preendoscopy physical examination and laboratory evaluation could be omitted. These preprocedure studies, which are currently performed in some units in Mexico, may be unnecessary or a barrier to timely colonoscopy.

The main limitation of this study is that INCan is a national cancer hospital in Mexico City, and study participants likely had higher than average baseline awareness of and interest in colorectal cancer prevention and screening. In addition, the diagnostic and treatment resources at INCan meet international quality standards and may not be representative of care standards at other settings in Mexico. Another important limitation is that, for this study colonoscopies had to be paid by the individual, this may have contributed to the number of patients who refused the endoscopic procedure or led to study participation by individuals who were disproportionately wealthier than the general population in Mexico.

However, this study remains important, as it is one of the first in Mexico to demonstrate the feasibility of implementing a high-quality colorectal cancer screening program using procedures and standards that can serve as a model for future population-based screening efforts.

In addition, the inclusion of individuals with a very low FIT cutoff (20 ng/mL = 4 μg/g) allowed a more detailed knowledge

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

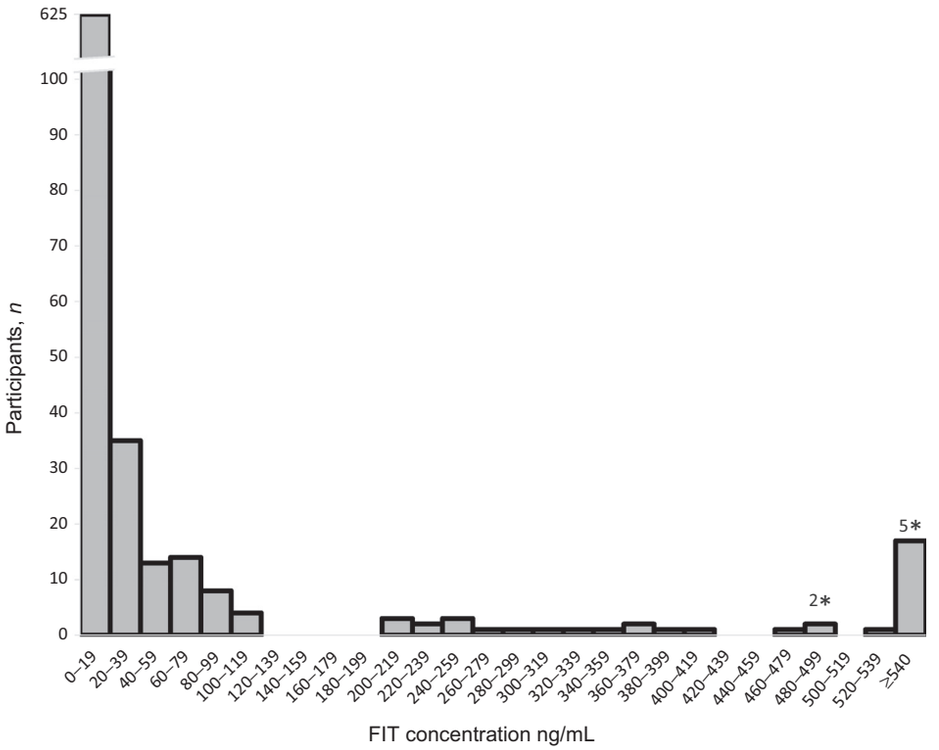

Figure 2.
FIT hemoglobin distribution in 737 men and women (* cases of adenocarcinoma).

of the colonic lesions in average-risk individuals. The treatable malignant and premalignant lesions detected by the INCan program allows a better understanding of the incidence and prevalence of colorectal cancer and its precursors in the population screened.

In conclusion, this research provides a model for a high-quality colorectal cancer screening program that could reduce colorectal cancer–related incidence and mortality, both of which are currently rising rapidly in Mexico City. Given the high proportion of significant lesions detected after abnormal FIT, it is imperative to identify and devote resources to tracking abnormal results and to assure timely diagnostic colonoscopy is performed when needed. While it will be challenging to replicate and scale-up comprehensive colorectal cancer screening programs for the general population, the INCan screening program is an important first step in demonstrating feasibility. To address the growing burden of colorectal cancer in Mexico, additional research is needed to develop, evaluate, and disseminate effective and widely accessible colorectal cancer screening programs in diverse community settings.

Table 2. Clinical Classification of participants with abnormal FIT after biopsy, according to cut-off values for FIT positivity (20, 50, or 100 ng/mL).

	Participants with FIT ≥ 20 ng/mL ($n = 87$)		Participants with FIT ≥ 50 ng/mL ($n = 58$)		Participants with FIT ≥ 100 ng/mL ($n = 33$)	
	n	**PPV (%)**	***n***	**PPV (%)**	***n***	**PPV (%)**
Invasive adenocarcinoma	6	6.9	6	10.3	6	18.2
Adenocarcinoma *in situ*	1	1.1	1	1.7	1	3
High-risk adenoma(s)	18	20.7	13	22.4	10	30.3
Low-risk adenoma(s)	23	26.4	16	27.6	5	15.2
Hyperplastic polyp(s)	14	16.1	5	8.6	2	6.1
No polyps	24[a]	27.6[b]	17[c]	29.3[b]	9[d]	27.3[b]
Serrated lesion(s)[e]	1	1.2	—	—	—	—

[a]Normal colonoscopy $n = 5$, diverticular and/or hemorrhoidal disease $n = 9$, and inflammatory colitis $n = 10$.
[b]Just percent, not PPV.
[c]3, 6 and 8.
[d]2, 4, and 3, respectively.
[e]This serrated lesion was <10 mm and with no dysplasia.

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

Disclosure of Potential Conflicts of Interest

L. Zhang reports personal fees from Unity and Dendreon outside the submitted work. A. Jimenez-Peña reports non-financial support from FUTEJE during the conduct of the study. No potential conflicts of interest were disclosed by the other authors.

Authors' Contributions

M. Del Carmen Manzano-Robleda: Conceptualization, investigation, methodology, writing-original draft, writing-review and editing. **P. Espinosa-Tamez:** Software, formal analysis, investigation, methodology, writing-original draft. **M.B. Potter:** Conceptualization, supervision, methodology, writing-original draft, writing-review and editing. **M. Lajous:** Conceptualization, resources, formal analysis, supervision, investigation, methodology, writing-original draft, writing-review and editing. **K. Van Loon:** Conceptualization, supervision, funding acquisition, writing-original draft. **L. Zhang:** Data curation. **A. Jimenez-Peña:** Data curation. **J. Sánchez Del Monte:** Conceptualization. **A. Mohar:** Conceptualization, resources. **A. Hernández-Guerrero:** Conceptualization, resources, supervision.

Acknowledgments

We want to thank the Fundación Fomento Teresa de Jesus, I.A.P. (FUTEJE) for donating the FIT to carry out this study. M.D. Manzano-Robleda was the recipient of a Global Cancer Fellowship from the UCSF Helen Diller Family Comprehensive Cancer Center.

The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked *advertisement* in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

Received February 19, 2020; revised May 2, 2020; accepted July 6, 2020; published first July 12, 2020.

References

1. Potter MB. Strategies and resources to address colorectal cancer screening rates and disparities in the United States and globally. Annu Rev Public Heal 2013;34:413–29.
2. (IHME) I for HM and E. GBD compare data visualization; 2017. Available from: http://vizhub.healthdata.org/gbd-compare.
3. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018;68:394–424.
4. Arnold M, Sierra MS, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global patterns and trends in colorectal cancer incidence and mortality. Gut 2017;66:683–91.
5. Gómez-Dantés H, Cahuana-Hurtado L, Silverman-Retana O, Montero P, Lamadrid-Figueroa H, González-Robledo MC, et al. La carga del cáncer en México, 1990–2013. Salud Publica Mex 2016;58:118–31.
6. Gomez-Dantes H, Fullman N, Lamadrid-Figueroa H, Cahuana-Hurtado L, Darney B, Avila-Burgos L, et al. Dissonant health transition in the states of Mexico, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2016;388:2386–402.
7. Lauby-Secretan B, Vilahur N, Bianchini F, Guha N, Straif K. The IARC perspective on colorectal cancer screening. N Engl J Med 2018;378:1734–40.
8. Lambert R, Sauvaget C, Sankaranarayanan R. Mass screening for colorectal cancer is not justified in most developing countries. Int J Cancer 2009;125:253–6.
9. Fraser CG, Allison JE, Halloran SP, Young GP. A proposal to standardize reporting units for fecal immunochemical tests for hemoglobin. J Natl Cancer Inst 2012;104:810–4.
10. Rex DK, Schoenfeld MSEd PS, Cohen J, Pike IM, Adler DG, Brian Fennerty M, et al. Quality assurance in Endoscopy Committee Quality indicators for colonoscopy. Gastrointest Endosc 2015;81:31–53.
11. Lai EJ, Calderwood AH, Doros G, Fix OK, Jacobson BC. The Boston Bowel Preparation Scale: a valid and reliable instrument for colonoscopy-oriented research. Gastrointest Endosc 2009;69:620–5.
12. Hewett DG, Kaltenbach T, Sano Y, Tanaka S, Saunders BP, Ponchon T, et al. Validation of a simple classification system for endoscopic diagnosis of small colorectal polyps using narrow-band imaging. Gastroenterol Endosc 2012;143:599–607.
13. Lieberman DA, Rex DK, Winawer SJ, Giardiello FM, Johnson DA, Levin TR. Guidelines for colonoscopy surveillance after screening and polypectomy: a consensus update by the US Multi-Society Task Force on colorectal cancer. Gastroenterology 2012;143:844–57.
14. Provenzale D, Gupta S, Ahnen DJ, Blanco A, Bray T, Chung D. NCCN clinical practice guidelines in oncology. Colorectal cancer screening, version 1.2018. Available from: https://www.nccn.org/professionals/physician_gls/pdf/colorectal_screening.pdf.
15. Fenocchi E, Martinez L, Tolve J, Montano D, Rondan M, Parra-Blanco A, et al. Screening for colorectal cancer in Uruguay with an immunochemical faecal occult blood test. Eur J Cancer Prev 2006;15:384–90.
16. Teixeira CR, Bonotto ML, Lima JP, Figueiredo LF, Conrado L, Frasca C. Clinical impact of the immunochemical fecal occult blood test for colorectal cancer screening in Brazil. Ann Gastroenterol 2017;30:442–5.
17. Remes-Troche JM, Hinojosa-Garza G, Espinosa-Tamez P, Meixueiro-Daza A, Grube-Pagola P, Van Loon K, et al. Faecal immunochemical test-based colorectal cancer screening in Mexico: an initial experience. Fam Pract 2020;37:321–4.
18. Crosby RA, Stradtman L, Collins T, Vanderpool R. Community-based colorectal cancer screening in a rural population: who returns fecal immunochemical test (FIT) kits? J Rural Heal 2017;33:371–4.
19. Nielson CM, Vollmer WM, Petrik AF, Keast EM, Green BB, Coronado GD. Factors affecting adherence in a pragmatic trial of annual fecal immunochemical testing for colorectal cancer. J Gen Intern Med 2019;34:978–85.
20. Jensen CD, Corley DA, Quinn VP, Doubeni CA, Zauber AG, Lee JK, et al. Fecal immunochemical test program performance over 4 rounds of annual screening. Ann Intern Med 2016;164:456.
21. Gong Y, Peng P, Bao P, Zhong W, Shi Y, Gu K, et al. The implementation and firstround results of a communitybased colorectal cancer screening program in Shanghai, China. Oncologist 2018;23:928–35.
22. Parente F, Boemo C, Ardizzoia A, Costa M, Carzaniga P, Ilardo A, et al. Outcomes and cost evaluation of the first two rounds of a colorectal cancer screening program based on immunochemical fecal occult blood test in northern Italy. Endoscopy 2012;45:27–34.
23. Castells A. Choosing the optimal method in programmatic colorectal cancer screening: current evidence and controversies. Therap Adv Gastroenterol 2015;8:221–33.

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

Published OnlineFirst July 12, 2020; DOI: 10.1158/1940-6207.CAPR-20-0076

Cancer Prevention Research

Fecal Immunologic Test Results and Diagnostic Colonoscopy in a Mexican Population at Average Risk for Colorectal Cancer

Maria Del Carmen Manzano-Robleda, Priscilla Espinosa-Tamez, Michael B. Potter, et al.

Cancer Prev Res 2020;13:959-966. Published OnlineFirst July 12, 2020.