Colorectal cancer (CRC) is responsible for a substantial proportion of new malignancies and is associated with an increasing number of deaths worldwide. Numerous international CRC screening programs have been initiated in response to this growing public health concern. This report reviews 20 established CRC screening programs in terms of population screening contact strategies, screening modalities, and screening participation rates. Most screening programs use a mailed patient contact strategy, a mailed contact plus screening kit strategy, or an office-visit contact strategy to encourage screening. Few programs use a multi-level contact strategy. CRC screening rates tend to be highest in mixed method, multi-level contact programs that include delivery of a fecal occult blood test (FOBT) kit. Research is needed to systematically evaluate the impact of different screening strategies in all international CRC screening programs and to determine how to maximize participation within and across different programs.

Acknowledgements: We would like to thank Finlay Macrae, MBBS, MD, FRACP, FRCP, AGAF; Ron Schoengold, BS, MS, RAC; Julius Spicak, MUDr, CSr; Martti Färkkilä, MD; Arkkila Perttu, MD; Thierry Ponchon, MD, PhD; Thomas Rösch, MD; Marcis Leja, MD; Andrzej Nowak, PhD; and Jaw-Town, MD, PhD for providing details about CRC screening programs in their countries.
Reductions in the incidence of CRC by 20 percent and 17 percent were initially observed for annually and biennially FOBT screened individuals, respectively. Several large-scale randomized clinical trials evaluated FS as a screening tool and showed FS to be a safe and effective screening method. A randomized clinical trial evaluating FS screening in Norway reported an 80% reduction in CRC incidence rates with a 13-year follow-up. In terms of CS screening, the US National Polyp Study reported a reduction in the incidence of CRC among patients who had a complete CS where all adenomas were removed. Several recent trials are consistent with these findings. Additional cohort studies have shown that CS with polypectomy reduces the incidence of CRC by 76 to 90%. Numerous CRC screening programs have been implemented around the world. The programs differ in a substantial number of respects that are likely to influence screening rates, including contact approaches used to encourage screening and the screening methods. In this report, we have characterized 20 established international CRC screening programs in terms of these basic features. Furthermore, we report overall screening rates for each program. Finally, we address the potential for increasing CRC screening rates in the programs.

METHODS
Benson, et al. identified 35 CRC screening programs and 12 pilot screening programs in 24 countries and the International Colorectal Cancer Screening Network (ICRC) included 25 countries with screening activities. Powers, et al. included 17 countries with established CRC screening programs in another review. A report by the European Cancer Observatory (ECO), which focused on Europe, identified 19 CRC screening programs. We inspected these reviews and searched the literature and the Internet to obtain current information about international CRC screening efforts. This effort resulted in the identification of 20 CRC screening programs in 18 countries that have reported information in sufficient detail to allow for characterization of program contact approaches, screening modalities, and participation rates.

Presentation of the programs, shown in Table 1, is organized in terms of how programs contact persons in the target population (i.e., mailed contacts, mailed contacts with screening kit, and office contact) to extend an invitation to screen. This categorization scheme includes direct contact with potential participants by mail and at the time of an office visit to a medical clinic. This scheme reflects approaches identified by the US CDC’s Guide to Community Preventive Services as potentially effective methods for encouraging CRC screening. Furthermore, we indicate the type of screening modality promoted in each program, and present screening rates reported by the programs. Figure 1 summarizes and graphically displays the population screening data from these programs.

Korea
The Korean National Cancer Screening Program (NCSP), which encompasses breast, cervical, colon, stomach, and liver cancer screening, was established in 2004. The colon cancer screening program provides free cancer screening to persons who are 50 or more years of age, are covered by national health insurance, and are eligible for screening. Annually, persons in this defined population are informed about FOBT screening by mail and are encouraged to visit participating hospitals or clinics to have a screening test. In 2008, the NCSP reported a CRC screening rate of 21 percent.

Israel
Israel’s largest Health Maintenance Organization (HMO) began screening with FOBT in the early 1990s. In this program, HMO clinics send a screening invitation to eligible patients who are 50 to 74. Only those who respond to this invitation are sent an FOBT kit. After initial screening, an FOBT kit is sent annually to participants who have had a normal FOBT result. Additionally, patients may be encouraged by their primary care physician to request an FOBT kit. In 2008, Israel reported a CRC screening rate that ranged from 10 to 17 percent.

Italy
Between 2005 and 2006, the Italian government launched a public education effort on cervical, colon, and breast cancer prevention. Regional governments and health units assumed responsibility for the planning and implementation of CRC screening program.
These efforts vary considerably from region to region. Most programs use FOBT as the primary mode of screening; but in recent years, some regions have begun to offer flexible sigmoidoscopy (FS) screening, or a combination of FOBT and FS screening. In the seven programs that use FS as a first level test, persons in their population registry who are 58 or 60 years of age are sent a screening invitation for a once-only test with a trained endoscopist. Three of these programs also offer FOBT to those who refuse the FS invitation. In 2008, these programs reported close to a 27 percent participation rate.

Japan
Japan’s colorectal cancer screening program was established in 1992. The program targets approximately 35 million persons who are 40 or older, covered by a national health insurance program, and eligible to screen. Local screening facilities initiate contact annually with population members by sending correspondence that invited recipients to visit a local clinic to obtain a reduced-cost FOBT kit. By 2002, about 17 percent of the screening-eligible population had completed a CRC screening test.

Canada
Canada’s programs vary by region, with established programs in Ontario and Manitoba and pilot programs underway in the remaining provinces. Ontario’s program, Colon CancerCheck was established in 2007. The program advertises widely through mass media and mailings to encourage individuals over 50 years of age to screen every two years. FOBT kits are made available through primary care practices, pharmacies, or through TeleHealth Ontario. By 2008, Ontario had almost 30 percent screening by FOBT, and 48 percent of population was up-to-date with any screening modality. Manitoba’s program, Colon Check Manitoba, uses a public relations campaign and mailings to encourage citizens 50 to 74 to obtain annual FOBT screening from their primary care physician or to request the kit directly through a toll free telephone number. In 2008, Manitoba reported an 18.1 percent screening rate.

Programs Using Mailed Contact and Screening Kit
Programs included in this section include those that make direct contact with individuals who are determined to be eligible for CRC screening, and place a screening kit in the hands of potential respondents.

Croatia
Croatia’s program was established by the Ministry of Health and Social Welfare in 2007. In addition to a mass media campaign coordinated with non-governmental entities, the Croatian National Program for CRC screening sends a screening invitation and an FOBT kit biennially to all 50 to 74 year-old men and women in their national population registry. Completed tests are returned to a central laboratory. Since the start of the program in late 2007 through early 2010, approximately 20 percent of the distributed tests were completed and returned.

Finland
Finland established a national CRC screening program in 2004. This program is unique, in that it is based on a randomized, delayed intervention design. Specifically, the program randomly selects an intervention group comprised of 60 to 69 year-old from a central population registry of 190 participating municipalities, covering 40% of the eligible population. On a biennial basis, the program sends intervention group members a screening invitation and an FOBT kit. At six years following program initiation, the control group will be invited to screen in the same fashion. By 2009, the intervention group had a 71 percent screening rate. Screening results for the control group have not yet been reported.

France
France’s national program was established in 2002 and expanded to national coverage of 50 to 74 year old citizens in 2008. The program established monitoring centers that are responsible for program implementation within specified districts. Individuals in the national health registry who are eligible for CRC screening receive biennial mailed screening invitations from local monitoring centers. Initially, recipients are directed to visit their primary care physician for a free in-office FOBT. If the test is not completed within three months of invitation, the program sends a reminder with an FOBT kit. By the end of 2011, the program had achieved an overall 34 percent screening rate. Additionally, colonoscopies were performed in 87 percent of the patients with positive FOBTs.

(continued on page 24)
As previously discussed, Italy’s cancer prevention program gives regional governments the responsibility for implementation. By the end of 2008, 12 regions of Italy Despite regional variation in the programs, the majority of programs have chosen to use FOBT as the primary mode of screening. On a biennial basis, most programs send an FOBT kit to screening-eligible individuals in their population registry who are between 50 and 69 years of age. This initial contact is followed by the delivery of mailed reminders for non-responders. Negative results are also delivered by mail. In 2008, approximately 48 percent of Italians offered an FOBT participated, with higher rates in northern regions.

In Spain, the National Health System (NHS) has encouraged the development of regional CRC screening programs. The first regional program began as a pilot in Catalonia in 2000, while other regions (Valencia, Murcia, Basque Country, Cantabria, and the Canary Islands) subsequently developed programs of their own. On a biennial basis, each regional program sends a CRC screening invitation to persons in their health registry who are 50 to 69 years of age and are eligible for CRC screening. Respondents who return a postage-paid request received a mailed FOBT kit. Those who do not respond receive a reminder letter six weeks after the initial invitation. In 2007, the overall screening rate for the program was about 34 percent.

The UK Colorectal Cancer Screening Program was initiated in 2006 for 60-69 year old citizens in England. In 2010, the program was expanded to reach individuals who were 50 to 75 years of age. On a biennial basis, five designated screening “hubs” invite people in the local health registry to screen using FOBT. Initially, the program sends a screening invitation, a contact that is followed one week later by a mailed FOBT kit. Non-responders receive a second invitation after one month. By the second screening round in 2007, the program reportedly achieved a 54 percent screening rate.

The Scottish Bowel Screening program was initiated in 2007. Program roll out was completed by 2009. Eligible 50 to 74 year olds were identified from the Community Health Index, a nation-wide population registry. On a biennial basis, the program mails a screening invitation, along with an FOBT kit to registry participants. Screening rates from the beginning of the program to 2010 have been close to 54 percent.

The National Bowel Cancer Screening Program began its national roll out in 2006. The program mails a CRC screening invitation letter and an Immunochemical FOBT kit to individuals in the national healthcare insurance database who are turning 50, 55, and 65 years of age. A colorectal cancer registry was developed to track of positive test follow up. In 2009, approximately 46 percent of individuals who were sent a screening invitation had completed FOBT screening.

Programs included in this section rely on providers in the health system to offer CRC screening to individuals who are determined to be eligible for CRC screening.

Beginning in 2005, Latvia offered nationwide FOBT screening annually to individuals in who are 50 years of age and older. Since 2007, primary care physicians have received reimbursement for performing in-office FOBTs. Access to screening was provided by primary care physicians in the health system. Two years after implementation, the program reported a 7 percent screening rate. In 2010, about 8 percent of the target population had been screened and pilot research conducted using single sample mailed FITs achieved close to a 45 percent uptake.

Taiwan established a CRC screening program in 1995 as part of its national health insurance system. The program encourages primary care physicians to offer annual FOBT screening to insured patients who are 50-69 years of age. Additionally, the program attempts to increase uptake through media and hospital promotion campaigns. Between 2010 and 2011, the CRC screening rate in Taiwan was reported to be 33 percent.

In late 2001, the Czech Republic established a new Council on CRC Screening that was empowered to
# Table 1. International Colorectal Cancer Screening Program Features and Screening Rates

<table>
<thead>
<tr>
<th>Contact Strategy</th>
<th>Country</th>
<th>Testing Modality</th>
<th>Operational Characteristics</th>
<th>Screening Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mailed Contacts</td>
<td>Canada - Manitoba</td>
<td>Biennial FOBT</td>
<td>Invitation for those 50-74 years of age to request screening at primary care practices or by calling toll-free number of program.</td>
<td>18% (2008)</td>
</tr>
<tr>
<td></td>
<td>Canada - Ontario</td>
<td>Biennial FOBT</td>
<td>Invitation for those ≥ 50 years of age to request screening at primary care practices, pharmacies, or through TeleHealth Ontario.</td>
<td>30% (2010)</td>
</tr>
<tr>
<td></td>
<td>Israel</td>
<td>Annual FOBT</td>
<td>Invitation for HMO members 50-74 years of age to request FOBT. FOBT kit sent annually thereafter.</td>
<td>14% (2008)</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>Periodic FS</td>
<td>Regional variations using FOBT, FS, or a combination. FS programs send invitation to those 58 to 60 years old to visit a local endoscopist.</td>
<td>FS- 28% (2008)</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>Annual FOBT</td>
<td>Invitation for national health insurance registrants ≥ 40 years of age to obtain reduced-cost kits at local health centers.</td>
<td>17% (2002)</td>
</tr>
<tr>
<td></td>
<td>Korea</td>
<td>Annual FOBT</td>
<td>Invitation for national health insurance registrants ≥ 50 years of age to obtain screening kit at local hospital or clinics.</td>
<td>21% (2008)</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>Periodic FOBT</td>
<td>National health insurance participants receive an invitation letter and FOBT kit around their 50, 55, or 65th birthday.</td>
<td>38% (2010)</td>
</tr>
<tr>
<td></td>
<td>Croatia</td>
<td>Biennial FOBT</td>
<td>Invitation and an FOBT kit sent to individuals 50-74 years of age in national population registry.</td>
<td>20% (2010)</td>
</tr>
<tr>
<td></td>
<td>England</td>
<td>Biennial FOBT</td>
<td>Local screening hubs send invitation to those 50-75 years of age in regional registry and FOBT kit a week later. Reminders sent one month later.</td>
<td>54% (2007)</td>
</tr>
<tr>
<td></td>
<td>Finland</td>
<td>Biannual FOBT</td>
<td>Randomized, delayed intervention design. Intervention invitation to selected eligible individuals in registry 60-69 years old and FOBT kit.</td>
<td>71% (2009)</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td>Biennial FOBT</td>
<td>Eligible individuals in regional registry 50-74 years old are sent an invitation to complete screening in GPs' office. Reminder and FOBT send if not completed within three months of initial invitation.</td>
<td>34% (2011)</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>Biennial FOBT</td>
<td>Regional variations using FOBT, FS, or a combination. FOBT programs send invites to 50-69 year olds from regional registry with reminders for non-responders.</td>
<td>FOBT- 48% (2008),</td>
</tr>
<tr>
<td></td>
<td>Scotland</td>
<td>Biennial FOBT</td>
<td>Invitation and FOBT sent to eligible persons in national registry 50-74 years of age.</td>
<td>54% (2010)</td>
</tr>
<tr>
<td></td>
<td>Spain</td>
<td>Biennial FOBT</td>
<td>Eligible persons in regional registry 50-69 years of age receive a personalized letter with kit request card. Reminder sent six weeks later.</td>
<td>34% average, regional rates from 17-59% (2007)</td>
</tr>
<tr>
<td>Office Visit</td>
<td>Czech Republic</td>
<td>Annual FOBT or Periodic CS</td>
<td>Mass media campaign to encourage individuals 50-54 years of age to visit a primary care provider to obtain FOBT and those &gt;55 to get a CS referral or biennial FOBT.</td>
<td>20% (2008)</td>
</tr>
<tr>
<td></td>
<td>Germany</td>
<td>Annual FOBT, Biennial FOBT or Periodic CS</td>
<td>Primary care providers are encouraged to screen individuals 50-55 years of age annually by FOBT or give those &gt;55 a CS referral or biennial FOBT at office visits.</td>
<td>FOBT: 19 % , CS: 3-4% (2009)</td>
</tr>
<tr>
<td></td>
<td>Latvia</td>
<td>Annual FOBT</td>
<td>Test performed at primary care physician office for those 50 or more years of age.</td>
<td>8% (2010)</td>
</tr>
<tr>
<td></td>
<td>Poland</td>
<td>Periodic CS</td>
<td>Primary care physicians are encouraged to refer eligible patients 50 to 66 years of age to screening center for CS.</td>
<td>105,000 screened (2000-06), Estimated &lt;2%</td>
</tr>
<tr>
<td></td>
<td>Taiwan</td>
<td>Annual FOBT</td>
<td>Primary care physicians are encouraged to offer screening at office visit to members of the national health insurance 50-69 years of age.</td>
<td>33% (2010-2011)</td>
</tr>
<tr>
<td></td>
<td>USA (Veterans Administration)</td>
<td>Annual FOBT</td>
<td>Provider receives computer prompt at patient visit to refer/recommend screening for patients 51 to 75 years of age.</td>
<td>80% (2010)</td>
</tr>
<tr>
<td>Mailed Contacts, Screening Kit &amp; Office Visit</td>
<td>USA - California (Kaiser Permanente)</td>
<td>Annual FOBT</td>
<td>Letter is sent with an FOBT kit to health system members 50 or more years of age. Reminder by mail, email or phone. Physicians receive an automated prompt at visit to recommend screening.</td>
<td>70-78% (2010)</td>
</tr>
</tbody>
</table>
coordinate regional collaboration between primary care physicians and gastroenterologists. This Council helped to sponsor a mass media campaign to increase awareness about CRC screening, as well as to expand the country’s endoscopic capabilities. The current campaign encourages eligible patients to request a screening test or a referral for testing at the time they visited their primary care physician. Plans are underway to expand the program to include a mailed screening invitation. From its inception through 2009, the program used biennial FOBT screening. Since 2009, patients 50-54 years of age are offered an annual FOBT and the choice of biennial FOBT screening or CS screening every 10 years over age 55. In 2008, the overall screening rate was about 20 percent.

**Germany**

Germany initiated a CRC screening program in 1971. The original program relied on primary care physicians to offer FOBT screening individuals 45 years of age and older as part of annual physical examination. In 2002, CS was added as a screening option for citizens. The current screening program encourages primary care physicians to perform annual FOBT for patients 50 to 55 years of age and to offer the choice of either biennial FOBT or CS screening every 10 years after age 55. In 2009, the FOBT screening rate was reported to be 19 percent and the CS rate was 3 to 4 percent.

**Poland**

Poland launched its National Colorectal Cancer Screening Program in 2000. This program is unique, in that CS is the primary screening option. In the program, primary care physicians refer eligible patients 50 to 66 years of age to a government-supported screening center for CS. By 2005, there were 58 endoscopy centers participating in the program. Each center is responsible for logistics, data management, coordination with referring primary care physicians, as well as scheduling screening procedures. Between October 2000 and the end of 2006, 105,000 people underwent CS as part of the program. While the actual CRC screening rate in Poland is are not readily available from the program, the number of screening examinations cited above may be extrapolated to be less than two percent.

**United States Veterans Health Administration**

With 153 hospitals, 909 outpatient clinics, 135 nursing homes and over 5.5 million people served in 2008, the Veterans Health Administration (VHA) is the largest integrated healthcare provider in the United States. VHA also has a long-standing commitment to CRC screening. Their electronic medical records allow for providers throughout the VA system to receive reminders to screen patients, providing screening test (FOBT annually) or endoscopy in accordance with regional policy. In 2000, the system-wide screening rate was 68 percent. A recent article reported that over 80 percent of veterans had screened in the recommended time interval. The majority of screened veterans used colonoscopy (76%) and FOBT (24%).

**Programs Using Mixed Method, Multi-Level Contact**

Screening programs in the USA vary widely. One health care system, Kaiser Permanente, a large managed health care organization began screening with FS in 1994 and expanded to include the use of FOBT in 2007. Every subscriber eligible for CRC screening is sent a letter annually from the individual’s primary care physician that explains the importance of regular screening accompanied by an FOBT kit and instructions for completing and returning the test. Reminder letters are sent after 6 weeks, and those who fail to respond to this follow up may receive any of a variety of additional reminders, including phone calls, secure e-mail communications, and at physician appointments. Primary care physicians also receive a prompt during office visits to remind eligible patients to screen. Screening rates in 2010 were close to 70 percent overall with 78 percent participation among Medicare recipients 65 or more years of age. (continued on page 28)
Finally, most CRC screening efforts in the United States rely on efforts by primary care physicians to recommend and refer older adult patients for preventive care. Screening tests tend to vary by health care provider and by health care system, but generally follow the recommendations of the US Preventative Task Force or the American Cancer Society. States including Colorado, New Jersey, New York, Maryland, and Delaware have launched CRC screening programs to help. In 2010, the Centers for Disease Control and Prevention (CDC) reported the screening rate in the USA overall was 65 percent. Screening rates in Colorado, New Jersey, New York, Maryland, and Delaware were reported as approximately 66, 66, 70, 73 and 71 percent respectively. 54

DISCUSSION

Overall, most CRC screening programs have been designed to encourage FOBT screening in target populations. Several programs have recently incorporated FS and CS as options; and one program offers CS exclusively. CRC screening rates tend to be highest in programs that (1) use mixed method, multi-level contacts with persons in the target population, and (2) send FOBT kits at the time of initial contact or to non-responders. Screening rates tend to be relatively low in programs that encourage population members to seek out opportunities to be screened and those that rely on health care providers to initiate the CRC screening process.

In a recent review, the European Cancer Observatory pointed out that simply providing information about CRC screening is unlikely to achieve high screening rates in a given target population of older adults. 15 They also observed that screening rates can be increased by delivering FOBT kits directly to population members. Importantly, they also concluded the effectiveness of programs which rely on an office visit strategy alone to achieve high rates of screening is likely to be limited. Findings reported by Benson et al. 11 by Power et al. 14 and from the review of international screening programs outlined above are broadly consistent with these conclusions. Thus, it may be hypothesized that a mixed method, multi-level approach that reduces structural barriers to screening (e.g., make information about screening broadly available and ensure that the opportunity to screen is readily accessible at the population level), employs personally tailored contacts with persons in target populations, and engages primary care providers in the screening process is likely to be the most effective approach to maximizing CRC screening rates. 55

More work is needed to develop metrics to systematically evaluate screening program population contact methods. In addition, attention is needed to standardize definitions used to identify screening program target populations and parameters used to report CRC screening adherence. A coordinated effort is also needed to identify proven approaches for increasing screening participation, and to adapt those methods, for use in existing programs. Furthermore, research should focus on the assessment of such approaches in international CRC screening programs. Finally, planning should begin to develop a global strategy for determining the magnitude of effect that introducing such changes could have on screening use, mortality, and related costs.

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