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EDITORIAL

Colorectal cancer screening in Europe

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Abstract

Colorectal cancer (CRC) is the second most frequent malignant disease in Europe. Every year, 412 000 people are diagnosed with this condition, and 207 000 patients die of it. In 2003, recommendations for screening programs were issued by the Council of the European Union (EU), and these currently serve as the basis for the preparation of European guidelines for CRC screening. The manner in which CRC screening is carried out varies significantly from country to country within the EU, both in terms of organization and the screening test chosen. A screening program of one sort or another has been implemented in 19 of 27 EU countries. The most frequently applied method is testing stool for occult bleeding (fecal occult blood test, FOBT). In recent years, a screening colonoscopy has been introduced, either as the only method (Poland) or the method of choice (Germany, Czech Republic).

Key words: Colorectal cancer; Europe; Fecal occult blood test; Screening colonoscopy; Screening programs

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INTRODUCTION

Colorectal cancer (CRC) poses a serious health problem in countries with a Westernized lifestyle. Over the last decade, a whole range of new technologies have been introduced in clinical practice to diagnose and treat the disease, with therapeutic modalities extending to advanced stages of the disease. Nevertheless, prevention undoubtedly remains the key to reducing morbidity and mortality. The introduction of national or transnational population-wide screening programs is a priority for the healthcare policy of individual states, and this is also being addressed at the highest level by European Union (EU) administrators. The approach of individual countries to screening programs varies significantly because of differences in health insurance systems and budgets. This summary article focuses on a brief description and comparison of these programs.

EPIDEMIOLOGY

CRC is the second most frequent malignant disease in developed countries. The incidence of CRC is generally higher for men, and the risk of the disease increases with age, as the majority of cases are diagnosed in patients more than 50 years of age[1]. European countries rank highest in the global statistics, both in terms of incidence and mortality. In 1998 to 2002, the incidence of CRC in the USA for men and women was 38.6 and 28.3, respectively; in Europe, it was 38.5 and 24.6 [world age standardization (ASR-W)], as calculated per 100 000 inhabitants[2]. However, mortality over the same period of time was much higher in Europe than in the US, both for men and women: in the USA, the figures were 13.5 and 9.2, respectively, while in Europe, they were 18.5 and 10.7 (ASR-W), as calculated per 100 000 inhabitants[3]. A detailed comparison of data for European countries is made difficult because of the absence of a unified data

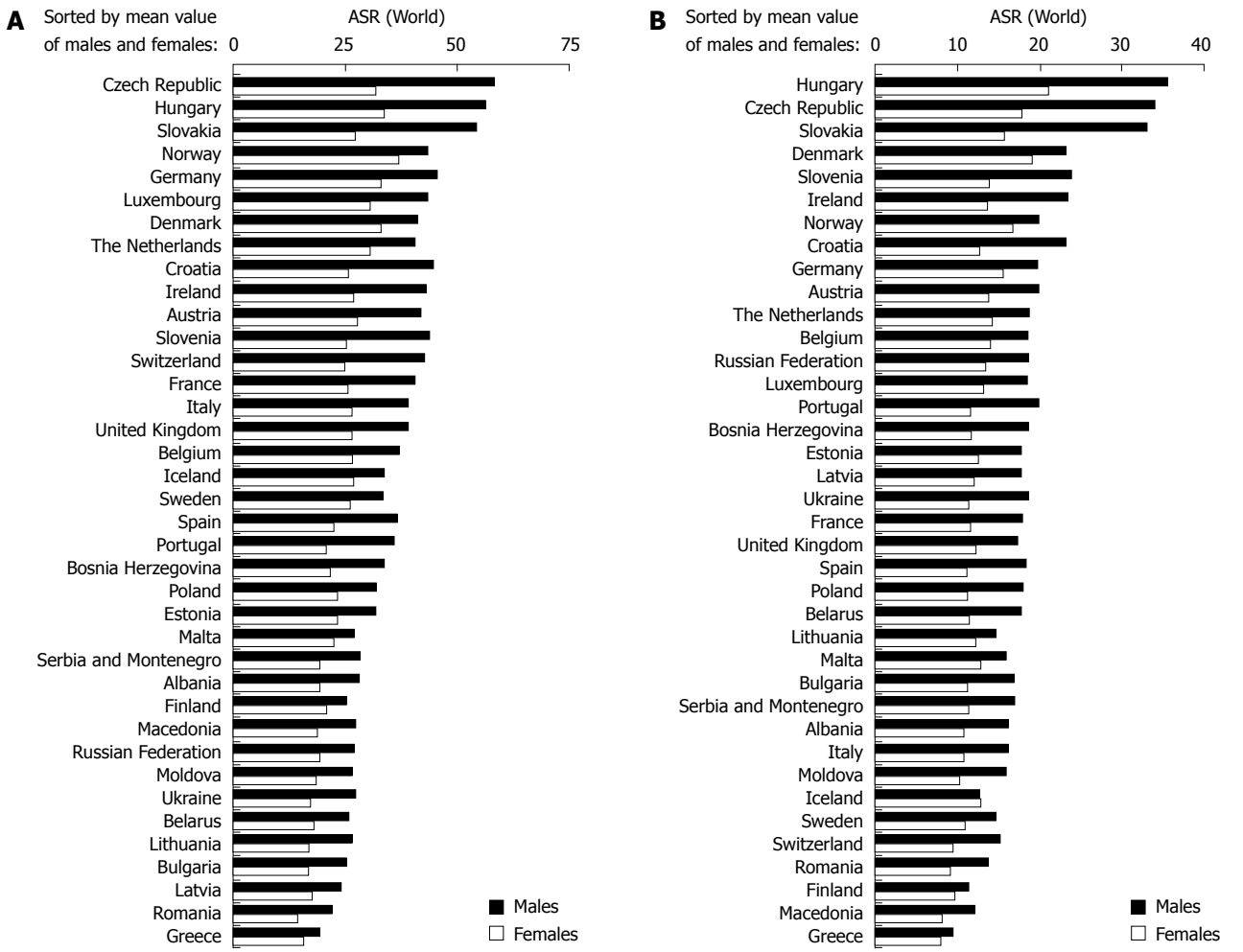

Figure 1 Epidemiology of colorectal cancer in European countries. A: Incidence in international comparison-European countries; B: Mortality in international comparison-European countries. Adapted from: Ferlay J, Bray F, Pisani P, Parkin DM. GLOBOCAN 2002: Cancer incidence, mortality and prevalence worldwide. IARC Cancer Base No. 5 version 2.0. Lyon: IARC press, 2004. Available from: URL: http://www-dep.iarc.fr/, section CI5 I-VIII (Detailed). Last accessed on August 8, 2009.

Table 1 Colorectal cancer incidence in European countries in 2006

Parameter	Incidence
Countries with the highest incidence	> 70/100 000 men (ASR-E): Hungary (106), Czech Republic (94.4), Slovakia (87.1), Switzerland (79.1), Germany (70.2)
	> 45/100 000 women (ASR-E): Switzerland (55.6), Norway (51.2), Hungary (50.6), Denmark (48), Czech Republic (46), Germany (45.1)
Countries with the lowest incidence	< 40/100 000 men (ASR-E): Albania (13.6), Greece (31), Bosnia Herzegovina (34.6), Republic of Moldova (38.7), Finland (39.2)
	< 26/100 000 women (ASR-E): Greece (21.3), Albania (21.4), Romania (25.1), Spain (25.4)

Adapted from: Ferlay J, Autier P, Boniol M, Heanue M, Colombet M, Boyle P. Estimates of the cancer incidence and mortality in Europe in 2006. *Ann Oncol* 2007; 18: 581-592. ASR-E: European age standard.

source. Not all countries maintain sophisticated population and cancer registers, and it is sometimes necessary to obtain input data by projecting aggregated data. In this outline, figures available from international studies summarizing global and European epidemiologic data have been used[4,5]. A detailed comparison of countries within Europe using the ASR-W of incidence and mortality is presented in Figure 1. Most recent epidemiologic data on CRC for 2006 recalculated to the European age standard are given in Tables 1 and 2.

CRC comprises 12.9% of all newly-diagnosed carcinomas in the European population (men 12.8%, women 13.1%) and account for 12.2% of deaths caused by malignancy. CRC is the second most frequent malignancy, after breast carcinoma (13.5% of all malignancies) and bronchogenic carcinoma (12.1% of all malignancies). It has been estimated that in 2006, 412 000 people were diagnosed with CRC in Europe, and 207 400 of them die of the disease[6]. The average incidence has shown a tendency to increase in recent years (2001-2005), with a year-on-year growth of 0.5%. Available data on time trends of CRC incidence and mortality are shown in Figures 2 and 3. A detailed analysis of individual diagnoses confirms that malignant disease of the colon is the most frequent, accounting for 57% of all cases (> 35 cases/10^5 inhabitants), followed by malignant diseases of the rectum

Table 2 Colorectal cancer mortality in European countries in 2006

Parameter	Mortality
Countries with the highest mortality	> 40/100 000 men (ASR-E): Hungary (54.4), Czech Republic (51), Slovakia (43.3), Croatia (40.7) > 20/100 000 women (ASR-E): Hungary (26.7), Slovakia (24.4), Czech Republic (24.1), Denmark (24.1), Norway (21.4)
Countries with the lowest mortality	< 20/100 000 men (ASR-E): Albania (7.3), Greece (15.5), Finland (17.9), Switzerland (19.1), Cyprus (19.3), Bosnia Herzegovina (19.5) < 12/100 000 women (ASR-E): Albania (9.9), Greece (10.8), Finland (11.3), Switzerland (11.6)

Adapted from: Ferlay J, Autier P, Boniol M, Heanue M, Colombet M, Boyle P. Estimates of the cancer incidence and mortality in Europe in 2006. *Ann Oncol* 2007; 18: 581-592.

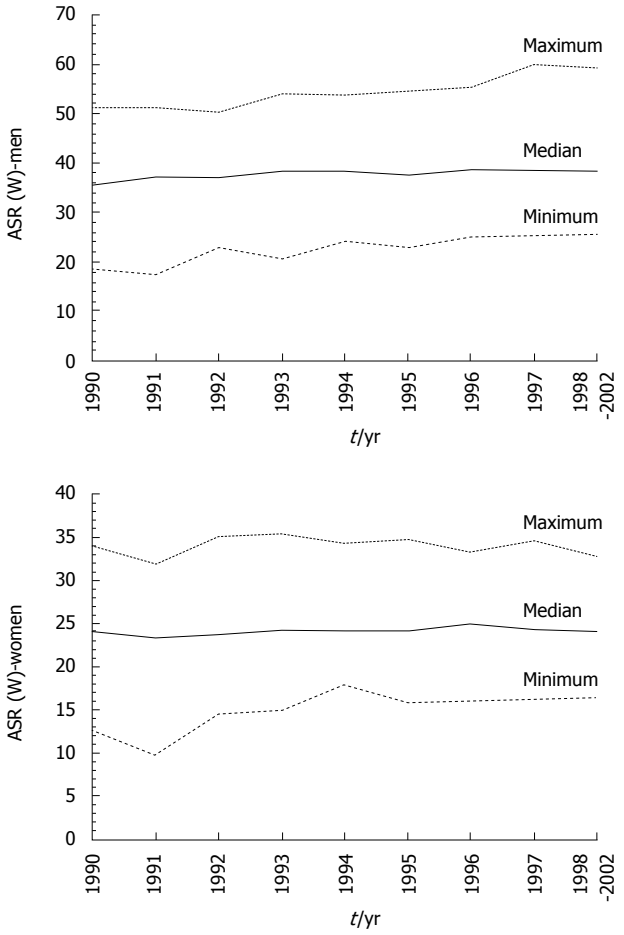

Figure 2 Incidence trends of colorectal cancer in Europe. Thirty nine cancer registries in 1990-1996, 37 cancer registries in 1997, 96 cancer registries in 1998-2002. Adapted from: Parkin DM, Whelan SL, Ferlay J, Storm H. Cancer Incidence in Five Continents, Vol. I to VIII. IARC CancerBase No. 7, Lyon, 2005. Available from: URL: http://www-dep.iarc.fr/, section CI5 I-VIII (Detailed). Last accessed on August 8, 2009; Curado MP, Edwards B, Shin HR, Storm H, Ferlay J, Heanue M, Boyle P, editors. Cancer Incidence in Five Continents, Vol. IX. IARC Scientific Publications No. 160, Lyon: IARC, 2007. Available from: URL: http://www-dep.iarc.fr/ section CI5 IX. Last accessed on August 8, 2009.

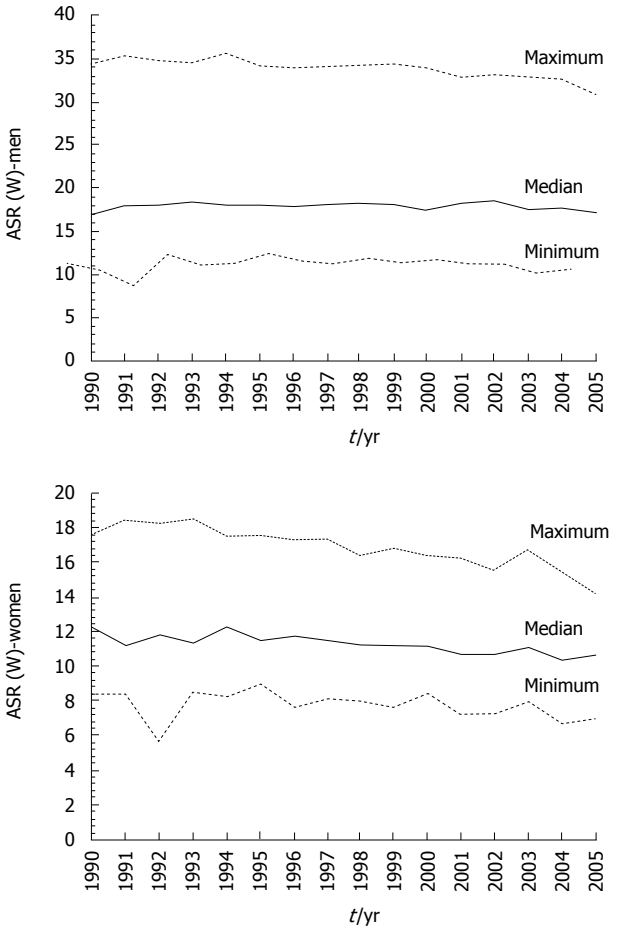

Figure 3 Mortality trends of colorectal cancer in Europe. As available in WHO database, countries with cancer registry (Cancer Incidence in Five Continents, Vol. IX). Adapted from: CancerMondial - WHO, International Agency for Research on Cancer, 2008. Available from: URL: http://www-dep.iarc.fr/; World Health Organization (2006), mortality database http://www.who.int/whosis/whosis/, United Nations, World Population Prospects, the 2006 revision. Available from: URL: http://www-dep.iarc.fr/. Last accessed on August 8, 2009.

and rectosigmoid (> 22 cases/10^5 inhabitants) and tumors of the anus and anal channel (> 1.0 cases/10^5 inhabitants) (Table 3). According to recently published data, CRC-related mortality has stabilized or shown a slight decrease over recent years.

The most extensive population study monitoring the relative survival rate (RSR) is the EUROCARE program[7], which takes registers of patients suffering from malignant diseases as a basis. Data have been gathered and evaluated since 1978. The most recent version, EUROCARE-4, uses comparative analyses of data from the year 1995 to 1999, while data are also available for the years 2000 to 2002[8]. Data from the European population carcinoma register are also used in the CONCORD study[9], which focuses on a systematic comparison of statistical data between Europe and Northern America. Apart from these two studies, data from population registers of carcinoma have been published for some European countries. Data available regarding the 5-year RSR show high variability across European countries, with borderline values in the Czech Republic (50%) on the one hand and Germany

Table 3 Epidemiology of colorectal cancer in the Europe (96 individual cancer registries, 1998-2002)

Parameter incidence	Sex	C18-C21	Individual diagnoses		
			C18	C19-C20	C21
Crude incidence (cases/100.000 inhabitants)	Men	63.9	37.1	26.0	0.8
	Women	53.7	34.8	17.6	1.3
	All	58.6	35.9	21.7	1.1
ASR-E	Men	58.0	33.5	23.7	0.8
	Women	36.8	23.4	12.4	1.0
	All	45.8	27.6	17.3	0.9
ASR-W	Men	38.5	22.0	15.9	0.5
	Women	24.6	15.5	8.4	0.7
	All	30.6	18.3	11.7	0.6
Mean age (yr)	Men	69.1	69.7	68.2	65.4
	Women	71.3	71.9	70.4	67.7
	All	70.1	70.8	69.1	66.8
Ratio (males: females) (based on No. of cases)		1.1:1	1.0:1	1.4:1	0.6:1

Adapted from: Curado MP, Edwards B, Shin HR, Storm H, Ferlay J, Heanue M, Boyle P, editors. Cancer Incidence in Five Continents, Vol. IX. IARC Scientific Publications No. 160, Lyon: IARC, 2007. Available from: URL: http://www-dep.iarc.fr/ section CI5 IX. Last accessed on August 8, 2009. ASR-W: World age standardization.

(60%) on the other hand[7-16] (Table 4). Several studies have confirmed a favorable time trend in the 5-year RSR; however, these results have to be interpreted carefully with respect to the hidden reasons leading to such positive conclusions. Evaluation of survival rate based on clinical studies of CRC is, unfortunately, rather rare, and therefore, it is impossible to make a representative evaluation of this indicator. This fact should be seen as a challenge when improving population registers of malignant diseases.

SCREENING METHODS

CRC screening focuses on asymptomatic individuals more than 50 years of age. Age is a low (average) risk factor for sporadic CRC, that is, carcinoma in patients with negative family or case history of CRC or chronic inflammatory bowel disease; this type of carcinoma accounts for 70 to 95% of all CRC cases. Three groups of screening methods are currently used as indicated in Table 5.

Guaiac-based fecal occult bleeding test (gFOBT) is at present the most frequently used method in screening programs. It detects the peroxidase reaction of hemoglobin, which causes the detection paper impregnated with guaiac resin to turn blue. Dietetic provisions are necessary to exclude false-positive results. A recent study showed limited sensitivity of this test for both, advanced adenomas (11%) and carcinomas (13%)[17]. With the use of gFOBT, a decrease in mortality for CRC by 15 to 33% has been proved[18].

Immunochemical fecal occult bleeding test (iFOBT) reacts exclusively to human hemoglobin, so no dietetic restrictions are necessary. Taking and assessing the stool samples are easier than is the case with gFOBTs, which may explain a higher participation rate in the target group. A wide range of qualitative and quantitative tests is presently available, with varying levels of sensitivity and specificity. The advantage of quantitative tests is the possibility to set cut-off limits; the most frequently used values are 75 or 100 ng/mL. The disadvantage of iFOBT is its cost; however, the price is now approaching that of gFOBT, particularly for qualitative tests[19].

New screening methods include tests which examine the stool for the presence of abnormal DNA. Studies published to date focused on the characteristics of the test rather than the reduction in CRC incidence or mortality. Generally, these tests have higher sensitivity but lower specificity than gFOBT. The major obstacle to their implementation in screening programs is price[20].

Flexible sigmoidoscopy (FS) is an endoscopic examination with maximum reach to the splenic flexure. On the basis of the information available, this is a promising screening test, although the studies published to date do not show sufficient statistical significance to determine reduction in CRC mortality. The recommended interval varies from 3 to 5 years. The risk of serious complications is 0% to 0.03%[21].

Unlike FS, colonoscopy also detects lesions in the proximal colon. Its biggest advantage is the possibility of removing pathological lesions within a single examination. It is more sensitive in detecting both adenomas and carcinomas, although limited information is available on reducing CRC incidence and mortality, and on the recommended interval between examinations. The risk of serious adverse events is higher than for FS, at 3 to 5 events per 1000 colonoscopies[22]. To date, no prospective, randomized, multicenter study has been published supporting a reduction in CRC incidence and mortality with the use of screening colonoscopy. Nevertheless, its implementation in screening programs is one of the most widely discussed topics and the American College of Gastroenterology recommends screening colonoscopy as a preferred screening test[23]. On the other hand, no study addressing reductions in the incidence and mortality rates through stool analyses would have been completed without the "gold standard" of colonoscopy.

Computed tomographic colonography (CTC) shows lesions in the colorectum by reconstructing two- and three-dimensional images. To date, no studies have been published assessing reduction in CRC incidence or mortality. The majority of studies have focused on comparing the characteristics of this method with colonoscopy. For larger polyps (over 10 mm), the sensitivity of the methods is comparable; for smaller polyps (less than 5 mm), flat and depressed adenomas, the sensitivity is much higher for optical colonoscopy. Results of studies assessing the effect in terms of reduction in incidence and mortality, cost-effectiveness, and the potential risk of radiation are awaited[24].

Double contrast barium enema shows the entire colorectum, although with significantly lower sensitivity and specificity than colonoscopy or CTC. The percentage of undetected carcinomas is up to 22%. The test is no longer widespread and available, but still has a purpose in countries lacking sufficient resources for other examinations[25].

CRC screening is a complex process which, to function properly, requires the coexistence of a number of factors, such as a functioning invitation-reminder system,

Table 4 Five-year relative survival rate (RSR) for colorectal cancer for selected European countries

Country	Diagnoses	Assessment period	Five-year RSR (%)	Change in time (%)	Stage-specific estimates
EUROCARE pool[7]	C18-C21	1995-1999	53.5	4.2	NA
EUROCARE pool[8]	C18-C21	2000-2002	56.2	NA	NA
England & Wales[10,11]	C18	1996-1999	47.6 M; 47.4 F	5.6 M; 5.6 F	NA
	C19-C20	1996-1999	48.7 M; 51.3 F	7.4 M; 8.1 F	NA
Germany[12]	C18-C21	2000-2002	60.8	NA	85.4 L; 58.1 R; 10.7 M
Finland[13]	C18-C20	2000-2004	57.9	2.4	NA
Norway[14]	C18-C21	2000-2004	59.2	3.6	NA
Slovenia[15]	C18-C21	2000-2004	46.9	8.0	NA
Sweden[16]	C18	2000-2002	58.1 M; 59.7 F	1.8 M; 2.6 F	NA
	C19-C21	2000-2002	57.5 M; 59.1 F	2.5 M; -1.7 F	NA

M: Estimate for males; F: Estimate for females; NA: Not available; L: Localized; R: Regional; M: Metastatic; NA: Not available. Numbers in brackets represents source of data available at references section.

Table 5 Screening methods

Type of method	Method
Stool tests	For presence of occult blood (FOBT)
	Guaiac-based (gFOBT)
	Immunochemical (iFOBT)
	For presence of abnormal DNA
Endoscopic examinations	Flexible sigmoidoscopy (FS) colonoscopy
Radiologic examinations	Computed tomographic colonography (CTC)
	Double contrast barium enema (DCBE)

media campaigns targeted at the general public, the development of recommendations for general practitioners, patient compliance, sufficient funding, stratification of risks, and last but not least the selection of the most suitable screening test. Of the above described tests, only the fecal occult blood tests meet the WHO criteria for screening. As published recently, most CRC screening strategies lead not only to a reduction in CRC incidence and mortality, but also to better control of the costs of CRC treatment, especially with increased chemotherapy costs for advanced CRC[26].

GENERAL ONCOLOGY PREVENTATIVE PROGRAMS IN EUROPE

In 1985, the Europe Against Cancer program was initiated, which aimed at a reduction of 15% in the number of deaths caused by tumors (from 1 000 000 to 850 000) by 2000. The program was implemented, thanks to the cooperation of professional and lay public, charities and anti-smoking groups, healthcare media, and healthcare workers. The project focused on three major areas: prevention, screening, and education. Results published show that although the planned goal was not achieved, the mortality due to tumors was reduced by 10% in the EU. In some countries (Austria and Finland), the desired reduction of 15% was achieved, while in others (Portugal and Greece), the mortality reduction was much lower[27]. The experience gained in this program served as a basis for the Recommendations of the Council of the EU for screening programs following comprehensive European quality assurance guidelines. In December 2003, these recommendations were unanimously approved by the health ministers of the individual EU states. European guidelines for quality assurance of breast and cervical cancer screening have been developed by experts and published by the European Commission; quality assurance guidelines for CRC screening are currently under preparation[28].

CRC SCREENING IN EUROPE

In 2008, the Report on the Implementation of the Council Recommendation on Cancer Screening[29], which provides the most comprehensive available data, was published; giving the definitions of program screening as requiring public responsibility by law or official regulation and supervision in contrast to "wild" screening outside of any program. In program screening, the screening test, the examination interval and the eligible group of persons should be specified. Organized screening should generally include a regional or national team responsible for the implementation, quality assurance and reporting of results. Comprehensive guidelines, rules and a quality assurance structure should be available. Population-based screening requires the identification and personal invitation of each person in the eligible target population (by an office or special agency). According to this report CRC screening is running or being established in 19 of 27 EU countries. The target group contains approximately 136 million individuals suitable for CRC screening (aged 50 to 74 years). Of this number, 43% individuals come from 12 countries where CRC population screening is performed or being prepared on either national or regional levels; 34% come from 5 countries where national population screening has been implemented (Finland, France, Italy, Poland, and United Kingdom). In 7 EU countries, national non-population based screening is carried out, which covers 27% of the target population. In 2007, gFOBT (which in 2003 was the only test recommended by the Council of the European Union) was used as the only screening method in twelve countries (Bulgaria, Czech Republic, Finland, France, Hungary, Latvia, Portugal, Romania, Slovenia, Spain, Sweden, and United Kingdom). Colonoscopy was the only screening method used in Poland. In six countries, two types of tests were used: iFOBT and FS in Italy, and gFOBT and

Table 6 Colorectal cancer screening programs in 2007

	Program		Test type	Screening interval	Age eligible national population	
	Type	Status		years or times in LT	Age (yr)	Persons (× 1000)
Austria	NonPB	Natw	FOBT	1 or 2	> 50	2210
	NonPB	Natw	CS	10	> 50	2210
Belgium	No Prog					2880
Bulgaria	NonPB	Natw	FOBT	1	> 31	2340
Cyprus	PB	Natw-plan	FOBT	1 in LT	50	10
	PB	Natw-plan	CS	1 in LT	55	10
Czech Republic	NonPB	Natw	FOBT	2	> 50	3010
Denmark	No Prog					1540
Estonia	No Prog					370
Finland	PB	Natw-roll ong	FOBT	2	60-69	570
France	PB	Natw-roll ong	FOBT	2	50-74	16600
Germany	NonPB	Natw	FOBT	1 and 2	> 50	24500
	NonPB	Natw	CS	10 (2 in LT)	55-74	18800
Greece	NonPB	Natw	FOBT	5	> 50	3180
	NonPB	Natw	CS	5	> 50	3180
Hungary	PB	Natw-pilot	FOBT	2	50-70	2630
Ireland	No Prog					940
Italy	PB	Natw-roll ong	FOBT	2	50-69 (70-75)	13800
	PB	Reg-roll ong	FS	1 in LT	58 or 60	80
Latvia	NonPB	Natw	FOBT	1	> 50	630
Lithuania	No Prog					870
Luxembourg	No Prog					120
Malta	No Prog					120
Netherlands	No Prog					4460
Poland	PB	Natw-roll ong	CS	10	50-65	7500
Portugal	PB	Natw-plan	FOBT	2	50-70	2520
Romania	PB	Natw-plan	FOBT	2	50-74	5800
Slovak Republic	NonPB	Natw	FOBT		> 50	1360
	NonPB	Natw-plan	CS	10	> 50	1360
Slovenia	PB	Natw-plan	FOBT	2	50-69	490
Spain	PB	Reg-pilot	FOBT	2	50-69	210
Sweden	PB	Reg-plan	FOBT	2	60-69	220
UK	PB	Natw-roll ong	FOBT	2	(50) 60-69 (74)	7600
Dual prog/test						-25630
Subtotal						106490
Excluded pop.						29500
Total						135990

PB: Population based; Prog: Program; Natw: Nationwide; Reg: Regional; Plan: Planning; Roll ong: Rollout ongoing; Pilot: Piloting; CS: Colonoscopy; LT: Lifetime. dual prog/test: Individuals entered twice due to screening programs of different implementation or using different screening tests. excluded pop.: Individuals excluded from national target populations due to regional or national variations in the age group targeted for screening, or due to lack of screening programs in some regions of countries with regional implementation status. Adapted from: von Karsa L, Anttila A, Ronco G, Ponti A, Malila N, Arbyn M, Segnan N, Castillo-Beltran M, Boniol M, Ferlay J, Hery C, Sauvaget C, Voti L, Autier P. Cancer screening in the European Union. Report on the implementation of the Council Recommendation on cancer screening - First Report. ISBN 978-92-79-08934-3. European Communities (publ.) Printed in Luxembourg by the services of the European Commission, 2008. Available from: URL: http://ec.europa.eu/health/ph_determinants/genetics/documents/cancer_screening.pdf. Last accessed on August 4, 2009.

colonoscopy in Austria, Cyprus, Germany, Greece, and Slovak Republic. In the remaining eight states (Belgium, Denmark, Estonia, Ireland, Lithuania, Luxembourg, Malta, and the Netherlands), CRC screening has not been implemented yet. The age limit for the target population varies across EU countries (Table 6). In 2007, it was estimated that a total of 12 million individuals participated in CRC screening.

In the United Kingdom, a screening program was announced in 2004 and initiated in 2006, with the prospect of national coverage in 2009. It has been designed in two stages, with gFOBT examinations at 2-year intervals and colonoscopy for positive tests. In 2007, compliance was 52%. The program is carried out through regional centers falling under one of five national hubs. The role of general practitioners is less significant here[30].

In France, a screening program was initiated in 2003, based on gFOBT tests at 2-year intervals with colonoscopy for positive results. The role of general practitioners as coordinators is of crucial importance. The major advantage of the French program is its good organization, with a call-recall system comprising central management at national level and individual steps taken by centers in individual departments. Asymptomatic individuals aged from 50 to 74 are mailed gFOBT tests, with a reminder at three-monthly intervals for nonparticipants. Compliance in referred districts achieved 42%, and the overall positive test rate was 2.7%[31].

In Italy, a nation-wide campaign was initiated in 2005; the implementation was entrusted entirely to 21 regional centers, including choice of the testing method. With state financial support, screening has been initiated in 11 regions to date, mostly in the industrial areas of northern Italy. In the Piedmont region, FS is the method of choice, in other regions immunochemical FOBT, with colonoscopy for positive tests. Compliance in iFOBT and FS programs was 44.6% and 51.4%, respectively. Positivity rate of iFOBT was 5.3% at first and 3.9% at repeat screening[32].

In Spain, no screening program has taken place as yet. The main obstacle to its implementation is the highly heterogeneous healthcare system, in terms of organization and insurance coverage in individual self-governing units. Catalonia, for instance, considers implementation of country-wide screening in 2010, while in other regions only limited pilot studies have been held so far.

In Finland, a structured screening program was initiated in 2004. The target population, aged from 60 to 69 years (106 000 individuals), was randomized into two groups. Individuals in the screening group were mailed a gFOBT test at intervals of 2 years. The Finnish program shows a high level of compliance of the target population (70.8%), particularly for females[33].

In the Netherlands, the optimum screening strategy is still being developed. It will be based on the results of studies currently taking place at major academic workplaces, comparing the effect of endoscopic procedures, various types of FOBTs, and fecal DNA analysis.

Poland is the only state at the moment using colonoscopy as the only screening method, without the alternative of FOBT. An opportunistic screening program was initiated in 2000, and by 2005, this had grown to 57 centers across Poland. The program is financed by the Ministry of Health, independent of the overall healthcare system. The target population (asymptomatic individuals aged 55-66 years) is recruited through general practitioners. High emphasis is placed on the quality control of colonoscopies, with complications reported for 0.1% of procedures, and no patient mortality. The advantage of the program is thorough monitoring and evaluation, including monitoring of interval cancers[34].

Germany was the first country to introduce a population screening program (in 1976) based on annual gFOBT for individuals more than 44 years of age. Starting from 2002, it has been offering participants a choice between colonoscopy at 55 years of age and FOBT at annual intervals between 50 and 55 years of age. After 55 years of age, examinations are carried out at 2-year intervals. If the test results are positive, colonoscopy is indicated. Those who undergo a screening colonoscopy with no neoplasia detected at the initial examination are recommended reexamination in 10 years time if the first colonoscopy was carried out before they were 65 years. The positive feature of the screening and data gathering in Germany is the emphasis on staging the disease at the time of its diagnosis. Recent cost analyses have proven that this type of screening is cost-efficient[35].

In the Czech Republic, CRC screening has many years of tradition[36,37]. The country was the second in the world to start screening nation-wide, in 2000. In the initial years, gFOBT was the first method offered to asymptomatic individuals more than 50 years of age by their general practitioners at preventative medical checks, followed by colonoscopy if tests were positive. From 2000 to 2008, 1 685 289 gFOBTs were carried out, of which 63 296 were positive (3.76%). In 2006, a central database for online data input was established. Between 2006 and 2008, 17 813 colonoscopies were carried out, indicated as a result of a positive FOBT; carcinoma was diagnosed in 1047 (5.9%) individuals, and 5362 (30.1%) adenomas were removed by endoscopic polypectomy. The participation of the target group, however, was only 20%[38]. In order to achieve a higher compliance rate, screening colonoscopy was added to current FOBT screening as an alternative method, in the same intervals as in the German program. Both, gFOBT and iFOBT are offered as well. The implementation of the newly designed program is supported by an intensive media campaign (http://www.kolorektum.cz/index-en.php).

The first study which focused on monitoring the effect of colonoscopy screening on reducing CRC incidence and mortality is NordICC (The Nordic-European Initiative on Colorectal Cancer), which is currently underway in northern states of Europe (Norway, Sweden, and Iceland), Poland, and the Netherlands. It will involve a minimum of 66 000 individuals aged 55 to 64 years. Individuals in the screening group will undergo a screening colonoscopy once in a lifetime. The primary objective is to compare incidence and mortality against the control group (with no screening) after 10 years[39].

CONCLUSION

CRC presents a serious public healthcare issue for the population of Europe. Understandably, the number of countries introducing population screening has been growing constantly. Although epidemiologic data differ in various European countries, implementation of screening programs in accordance with the principles spelled out in the Council Recommendation on Cancer Screening of 2 December 2003 may be expected to have a favorable effect on the burden of this disease in the population. Countries in the EU may benefit from unified policy, knowhow and central oncology registers, while economically less developed countries may draw on special funding for the development of preventative programs. At the same time, varying epidemiologic situations, economic conditions, and different systems of health insurance and organization of healthcare are factors that may limit the implementation of a unified screening program. Therefore, to respond to the needs of the member countries, the EU should consider adopting the recommendation of the World Gastroenterology Organization for CRC screening, possibly even in a modified form[40]. This is a cascade concept in which recommendations for individual countries are graded into six levels, depending on the resources available (financial

Table 7 Cascade concept

Level	Average risk	High risk
1	Colonoscopy in 10 years interval, from 50 years of age	Special procedure, for individual groups
2	Colonoscopy once in a lifetime, at 50 years of age	Special procedure, for individual groups
3	Flexible sigmoidoscopy in 5 years interval, from 50 years of age; colonoscopy to follow if positive	Special procedure, for individual groups
4	Flexible sigmoidoscopy once in a lifetime, at 50 years of age; colonoscopy to follow if positive	Special procedure, for individual groups
5	Flexible sigmoidoscopy once in a lifetime, at 50 years of age; colonoscopy to follow only if advanced adenoma is detected	Same as individuals with average risk, if resources are not available for colonoscopy
6	FOBT in annual interval after 50 years of age; if positively tested, colonoscopy or double contrast barium enema	Same as individuals with average risk, if resources are not available for colonoscopy

Adapted from: World Gastroenterology Organization/International Digestive Cancer Alliance. Practice Guidelines: Colorectal cancer screening. Available from: URL: http://www.worldgastroenterology.org/colorectal-cancer-screening.html. Last accessed on August 4, 2009.

and professional) (Table 7). In the case of lack of funds, FOBT at intervals of 1 or 2 years for individuals with average risk is a realistic possibility. This open concept best fulfils the simple recommendation by Sydney Winawer, Co-Chair of IDCA (International Digestive Cancer Alliance): "The best screening test is the one that gets done...and gets done well. Do what you can with what you have".

In most European countries, fortunately, the majority of the population is covered by some form of health insurance, meaning that economic aspects need not critically affect the availability of screening programs. Although at the end of 2007, CRC screening was still not running or being established in 8 of 27 EU member states, some of which rank among the most developed economies of the world, additional programs are currently under development. Given the substantial burden of the disease, implementation and continuous improvement in CRC screening programs should remain high on the healthcare agenda in Europe.

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