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Recommendations From the International Colorectal Cancer Screening Network on the Evaluation of the Cost of Screening Programs

Sujha Subramanian, PhD, **Florence K. L. Tangka, PhD**, **Sonja Hoover, MPP**, **Marion Nadel, PhD**, **Robert Smith, PhD**, **Wendy Atkin, PhD**, and **Julietta Patnick, FFPH on behalf of on Behalf of the International Colorectal Cancer Screening Network**

RTI International, Waltham, Massachusetts (Dr Subramanian and Ms Hoover); Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia (Drs Tangka and Nadel); Department of Cancer Control, American Cancer Society, Atlanta, Georgia (Dr Smith); Department of Surgery and Cancer, Imperial College London, London, England (Dr Atkin); and University of Oxford, Oxford, United Kingdom (Ms Patnick)

Abstract

Worldwide, colorectal cancer is the fourth leading cause of death from cancer and the incidence is projected to increase. Many countries are exploring the introduction of organized screening programs, but there is limited information on the resources required and guidance for cost-effective implementation. To facilitate the generating of the economics evidence base for program implementation, we collected and analyzed detailed program cost data from 5 European members of the International Colorectal Cancer Screening Network. The cost per person screened estimates, often used to compare across programs as an overall measure, varied significantly across the programs. In addition, there were substantial differences in the programmatic and clinical cost incurred, even when the same type of screening test was used. Based on these findings, several recommendations are provided to enhance the underlying methodology and validity of the comparative economic assessments. The recommendations include the need for detailed activity-based cost information, the use of a comprehensive set of effectiveness measures to adequately capture differences between programs, and the incorporation of data from multiple programs in cost-effectiveness models to increase generalizability. Economic evaluation of real-world colorectal cancer–screening programs is essential to derive valuable insights to improve program operations and ensure optimal use of available resources.

Keywords

colorectal cancer; economic assessment; screening programs

Correspondence: Sujha Subramanian, PhD, RTI International, 1440 Main St, Ste 310, Waltham, MA 02451 (ssubramanian@rti.org).

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Colorectal cancer in men and women accounts for more than 1.2 million cases worldwide. Overall, about 608 000 deaths occur annually because of colorectal cancer, which makes it the fourth most common cause of death from cancer.[1,2] Colorectal cancer is preventable and early detection is possible; several fecal-based tests and endoscopic procedures are available to address the growing global burden related to the mortality and morbidity from colorectal cancer.[3,4]

Numerous countries are exploring the introduction of organized screening.[5] Cost and cost-effectiveness assessment are becoming increasingly important in initiating and sustaining cancer-screening programs as countries attempt to identify the most efficient allocation of limited health care resources.[6,7] Although there is substantial literature on specific screening tests for colorectal cancer and modeling studies on projected cost-effectiveness of screening, very limited information is available on the cost of implementing colorectal cancer–screening programs.[8–10]

Cost-effectiveness models can provide an overview of the anticipated cost and benefits of a program when implemented, but “real-world” challenges can impact both the resource use and the effectiveness of colorectal cancer–screening programs. For instance, the screening uptake may not be as high as projected, and additional resources may be required to recruit eligible individuals to participate in the screening program. In addition, there may be delays or quality issues related to the diagnostic procedures that may impact the overall effectiveness of the program. Some of the barriers can be anticipated, but additional challenges are likely to appear as programs scale up screening. Therefore, assessment of the costs upon implementation of screening programs is essential to identify the most cost-efficient approaches that can be operationalized in the real world. Lessons learned should be shared across programs to develop the economics evidence base for colorectal cancer–screening program implementation. This will ensure optimal allocation of resources to maximize screening among the eligible population.

International Colorectal Cancer Screening Network Study

To facilitate the generating of the economics evidence base for guiding the implementation and expansion of colorectal cancer-screening programs, the International Colorectal Cancer Screening Network fielded a survey in 2010 to catalog economic evaluations that have been performed. All 14 programs surveyed were interested in assessing the cost-effectiveness of their program operations, but there were only a handful of programs that had undertaken any economics data collection. None had performed a comprehensive activity–based cost assessment. On the basis of these findings, the International Colorectal Cancer Screening Network selected 5 diverse European programs that were willing and able to derive detailed cost data from program operations to participate in a follow-on study to assess cost and effectiveness in a comparative evaluation of real-world program implementation. The 5 countries that participated in this study were Croatia, Italy, Latvia, Portugal, and Slovenia.

We created a standardized tool to collect detailed cost and screening data using well-established methods for collecting data for cancer-screening program evaluation.[11–13] Programs reported information on the total funds they received and expended during their

respective reporting periods (fiscal year 2010) in addition to any in-kind contributions. Programs also provided details on programmatic costs (eg, program management, patient recruitment, and quality assurance), total clinical costs (resources expended on screening tests, diagnostic procedures, and office visits related to the screening process), and the unit costs of each screening and diagnostic procedure. In addition, programs supplied details on the number of individuals screened and types of screening tests used. We utilized the information provided to calculate total cost expended and the proportion spent on programmatic cost versus clinical cost. Finally, we also divided the cost by the number of screens to derive the cost per screen.

All funding received and costs incurred were collected in the local currency of the reporting country. To facilitate the comparison of cost data across the programs, all costs were converted to international dollars (Int. $) using the purchasing power parity for each country.[14] The purchasing power parity is the number of units of a country's currency required to buy the same amounts of goods and services in that particular country as the US dollar would buy in the United States. Thus, the international dollar is a hypothetical currency to standardize costs across countries using a common reference point, the US dollar. The US dollar as the reference currency is equal to 1. This is a standard approach to report cost information in a common currency in health care and one that is advocated by the World Health Organization. We used 2010 estimates for the Organization for Economic Co-operation and Development countries and 2005 estimates from the World Bank for Croatia and Latvia (as this is the latest available data for these non–Organization for Economic Co-operation and Development countries).

Comparative Assessment of the Cost of Colorectal Cancer Programs

Table 1 describes the program characteristics for each of the 5 programs that provided detailed cost and effectiveness data. Most of the programs were already established (as opposed to starting up) and were administered by the health department. Three of the programs were nationwide, while the remainder were based either in a city or in a region. All programs used a guaiac-based test or fecal immunochemical tests; only 2 programs also used sigmoidoscopy or colonoscopy as additional primary screening tests. Four of the programs began screening at 50 years of age while 1 had a start age of 58 years, and the screening intervals ranged from 12 to 48 months. Additional details on the program-screening outcomes are provided in the Supplemental Digital Content Appendix, available at http://links.lww.com/JPHMP/A192.

Table 2 presents total programmatic costs, clinical costs, and costs per screen for each of the programs. Total costs ranged from Int. $186 119 in Portugal to Int. $5 153 287 in Slovenia. Programmatic costs comprised 8.0% to 31.6% of total funding; the programmatic costs ranged from Int. $37 475 in Portugal to Int. $1 630 450 in Slovenia. Clinical costs comprised the majority of total funding, ranging from 68.4% of funding in Slovenia to 92.0% in Latvia. The total number of screens were the highest in Croatia and Slovenia with more than 70 000 screens and lowest in Portugal with less than 7000 screens. The majority of the screening tests in all programs were performed using fecal-based tests. There was wide variation in total cost per individual screened ranging from Int. $8.40 to Int. $65.29. There was

substantial variation even when only cost per case was considered for the programmatic component, which ranged from Int. $0.67 to Int. $20.66. The proportion of cost expended on specific programmatic activities including management, data collection, and quality assurance (data not shown in tables) also differed across the programs.

In addition, there were large differences in the clinical cost even when programs offered the same screening test. For example, the 2 programs that used guaiac-based tests reported clinical cost per screen of Int. $30.24 and Int. $7.72. The unit cost of the screening tests provided by the programs does reveal large variations even after adjustments for purchasing power parity (data not shown in the tables). The cost of guaiac-based tests was reported to be between Int. $0.71 and Int. $14.20, while fecal immunochemical tests ranged from Int. $4.70 to Int. $22.00. Colonoscopies ranged from Int. $85.22 to Int. $498.00 without biopsies and Int. $106.53 to Int. $648.00 with biopsies. In comparison, sigmoidoscopy costs varied from Int. $71.01 to Int. $161.00 without biopsies and Int. $92.33 to Int. $311.00 with biopsies. Bowel preparation costs ranged from Int. $1.16 to Int. $20.69 and office visit fees ranged from Int. $2.13 to Int. $53.33.

Lessons Learned and Recommendations

The cost per screen, often used to compare across programs as an overall measure,[15,16] can vary significantly across programs. The programmatic costs can differ on the basis of the priorities and focus areas of the programs. Differences in interventions planned by programs–for instance, focused outreach activities to increase screening compliance or provider education to improve quality of diagnostic follow-up–will impact the cost during any given fiscal period. The 3 programs with the highest program cost, Croatia, Italy, and Slovenia, all reported performing outreach or recruitment activities for the reporting period, which could explain their higher costs. In addition, Italy and Slovenia also offered patient navigation support. The results from this study also reveal that there can be substantial differences in the clinical cost among programs using the same screening tests. Some of these differences could be due to the clinical services paid by the program versus those provided “free-of-charge” through the existing health care infrastructure. We also identified substantial differences in the cost of the screening tests, and, therefore, the market dynamics within a country or even region can result in substantial variation in the price of tests and other services.

These findings highlight the importance of performing detailed cost assessments of programs during implementation. Programs may need to implement interventions to address challenges faced during implementation and the cost-effectiveness of these interventions and the program delivery overall needs to be assessed. In addition, given variation in the unit cost of clinical services across programs, program operations that may be cost-effective in one setting may not necessarily be cost-effective in another setting. Therefore, one-size-fits-all approach to cost-effectiveness assessment will not be adequate, and embedding economic evaluation within the framework of program implementation is essential. Accurate and valid economic assessment of program operations should be performed to improve future program implementation by identifying the most efficient allocation of available resources, and best practices should be assessed and shared across programs.[17,18]

From a methodological perspective, the overall cost per screen measure does not adequately capture potential differences in the effectiveness of specific program activities and the magnitude of costs spent on individual activities. More in-depth and detailed assessments are required to understand the complex interplay between resources expended on program activities and the impact of overall effectiveness of the program operations. Multiple factors can impact both cost and effectiveness in the real-world setting, and, therefore, a comprehensive economic assessment is required to adequately capture the interplay between resources used and the benefits derived. Therefore, an in-depth economic evaluation is necessary for accurate comparison and assessment across programs.

The International Colorectal Cancer Screening Network has several recommendations to enhance the underlying methodology and validity of comparative economic assessments of colorectal cancer–screening programs. First, detailed activity-based costs using standardized categories[19] should be collected to critically assess resources expended by programs. There may be differences in the types of activities and services paid for directly by the program versus other entities on the basis of the level of integration within the existing health care infrastructure (eg, diagnostic tests may be provided without direct charge to the program). Given these potential differences, activity-based costs are essential to ensure meaningful comparisons across programs. Second, data on screening outcomes should be comprehensive to allow for adequate comparison of the benefits of program operations in order to assess effectiveness of the resources utilized. Indicators should include participation or adherence rates, and also quality indicators, such as completeness of colonoscopies (cecal intubation rate).[3,20] Third, cost-effectiveness models on program implementation should include a broad range of scenarios and sensitivity analysis, and cost and effectiveness data from multiple programs should be incorporated to increase generalizability of the findings. Standardized clinical service cost (eg, unit cost of screening tests) can be utilized to increase the comparability of the clinical expenditures. Fourth, economic evaluation should include both quantitative and qualitative assessment to identify potential differences between program operations so that underlying nuances can be taken into account to increase validity of the comparative assessments.

Economic evaluation of colorectal cancer–screening programs can offer valuable insights to improve future program operations and should, therefore, be included as an important component in overall program planning. In this study, we have outlined key issues that should be considered in reporting and comparing cost-effectiveness data across colorectal cancer–screening programs to systematically assess differences and identify “best practices” that can inform successful implementation of programs globally.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1

Characteristics of the Programs That Participated in the Activity-Based Economic Evaluation Study

Country	Pilot or Start-up Phase[a]	Location of Program	Funding Source	Administered by Regional Affiliates	Primary Screening Test Used	Screening Interval for FIT or gFOBT, mo	Age Range, y
Croatia	Yes	Nationwide	State budget/National Health Insurance	Yes	High-sensitivity gFOBT	48	50–75
Italy	No	City/town	Regional health service	No	FIT/sigmoidoscopy[b]	24	58–69
Latvia	No	Nationwide	State budget	No	Standard-sensitivity gFOBT	12	50+
Portugal	No	Region	Regional and national health administration	No	Standard sensitivity gFOBT/colonoscopy[c]	24	50–70
Slovenia	No	Nationwide	The Health Insurance Institute of Slovenia	No	FIT	24	50–68

Abbreviations: FIT, fecal immunochemical test; gFOBT, guaiac-based test.

[a] Start-up is defined as a program that was operational for less than 2 years at the time of data submission.

[b] Sigmoidoscopies are performed only once.

[c] Few one-time colonoscopies were performed but majority of tests were gFOBTs.

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TABLE 2

Programmatic Costs, Clinical Costs, and Cost per Screen (International $)

	Cost of Screening Program			Screens Performed			Cost per Screen[a]	
Program	**Total Cost Int. $**	**Programmatic Cost (%)**	**Clinical Cost (%)**	**Total Screens N**	**Type of Test (%)**	**Total Int. $**	**Programmatic Int. $**	**Clinical Int. $**
Croatia	2 919 069	22.4	77.6	74 943	gFOBT: 100	38.95	8.71	30.24
Italy	647 916	29.0	71.0	10 742	FIT: 81	60.32	17.49	42.82
					Sigmoidoscopy: 19			
Latvia	468 317	8.0	92.0	55 781	gFOBT: 100	8.40	0.67	7.72
Portugal	186 119	21.5	78.5	6344	gFOBT: 97	29.34	6.31	23.03
					Colonoscopy: 3			
Slovenia	5 153 287	31.6	68.4	78 925	FIT: 100	65.29	20.66	44.64

Abbreviations: FIT, fecal immunochemical test; gFOBT, guaiac-based test.

[a]Most of the screens were guaiac or fecal immunochemical tests; 19% of the screens in Italy and 3% in Portugal were endoscopic procedures.