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Screening for colorectal cancer in Italy: 2011-2012 survey

Screening del cancro colorettale in Italia: survey 2011-2012

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Abstract

We present the main results of the 2011-2012 survey of the Italian screening programmes for colorectal cancer carried out by the National centre for screening monitoring (Osservatorio nazionale screening, ONS) on behalf of the Ministry of Health.

By the end of 2012, 112 programmes were active, of which 11 had been activated during 2012 and 4 during 2011. The national theoretical extension increased from 66% of Italians aged 50-69 years residing in areas covered by organized screening programmes in 2010 to 73.7% in 2012. The majority of programmes employ the fecal immunochemical test (FIT), while some have adopted flexible sigmoidoscopy (FS) once in a lifetime and FIT for non-responders to FS.

Overall, about 7,744,000 subjects were invited to undergo FIT, 53.1% of those to be invited within the two years. The adjusted attendance rate was 47.1% and 3,531,937 subjects were screened. Large differences in the attendance rate were observed among regions. Positivity rate of FIT programmes was 5.2% at first screening (range: 1.0-12.4%) and 4.0% at repeat screening (range: 3.4-6.4%). The average attendance rate to total colonoscopy (TC) was 81.2% and in two regions (Molise and Campania) it was lower than 70%. Completion rate for total colonoscopy (TC) was 91%. Among the 1,316,327 subjects attending screening for the first time, the detection rate (DR) per 1,000 screened subjects was 2.0 for invasive cancer and 9.1‰ for advanced adenomas (AA, adenomas with a diameter ≥1 cm, with villous/tubulo-villous type or high-grade dysplasia). As expected, the corresponding figures in the 2,215,610 subjects at repeat screening were lower (1.0‰ and 6.8‰ for invasive cancer and AA, respectively). Many programmes reported some difficulties in guaranteeing TC in the appropriate time frame to FIT+ subjects: in 15% of cases the waiting time was longer than two months.

Ten programmes in 2011 and eight in 2012 employed FS as the screening test: 24,549 subjects were screened in the two years, with an attendance rate of 24.5%. Overall, 85.9% of FSs were classified as complete. Overall, TC referral rate was 9.8% and the DR per 1,000 screened subjects was 3.0 and 48.2 for invasive cancer and AA, respectively.

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Keywords: screening, colorectal cancer, national survey, faecal immunochemical test, flexible sigmoidoscopy, Italy

Riassunto

Presentiamo i dati nazionali di attività dei programmi di screening del carcinoma colorettale relativi al biennio 2011-2012. A fine 2012 erano attivi in Italia 112 programmi, di cui undici attivati nel corso del 2012 e quattro attivati nel 2011. In particolare, sono stati attivati: un programma in Puglia e il programma della provincia autonoma di Bolzano, due nuovi programmi in Lazio, due in Abruzzo, uno in Campania, cinque in Sicilia e tre in Sardegna. L'estensione teorica nazionale del-

lo screening è passata dal 66% della popolazione eleggibile di età compresa tra i 50-69 anni nel 2010 al 72,3% a fine 2012. Complessivamente, nel 2011 e 2012 sono state invitate allo screening con la ricerca del sangue occulto fecale immunochimico (SOF) 7.744.295 persone, pari al 53,1% della popolazione target da invitare nel biennio. I soggetti che nel 2011-2012 hanno eseguito il SOF sono stati 3.531.937, con un'adesione corretta all'invito del 47,1%, con notevoli differenze tra Regioni.

La proporzione di positivi è stata del 5.2% nei soggetti al primo esame di screening (range: 1,0-12,4%) e del 4,0% agli esami successivi (range: 3,4-6,4%). L'adesione alla colonscopia delle persone con SOF+ è stata dell'81,2%, con valori inferiori al 70% in sole due Regioni (Molise e Campania). Più del 95% dei soggetti ha avuto una colonscopia completa e/o completata da un ulteriore esame di approfondimento.

Tra i 1.316.327 soggetti al primo esame di screening, il tasso di identificazione dei carcinomi è stato del 2,2 ogni 1.000 screenati e quello degli adenomi avanzati del 10,3‰. I tassi di identificazione sono maggiori nei maschi rispetto alle femmine e aumentano progressivamente con l'età in entrambi i sessi. Come atteso, tassi di identificazione più bassi (1,0‰ e 6,8‰ per carcinomi e adenomi avanzati, rispettivamente) sono stati registrati nei 2.215.610 soggetti presentatisi a episodi di screening successivi al primo. Molti programmi hanno riportato serie difficoltà a garantire in tempi brevi la colonscopia in caso di positività al SOF: circa un sesto delle persone ha dovuto attendere più di due mesi (15%).

Dieci programmi nel 2011 e otto nel 2012 hanno proposto come test di primo livello la rettosigmoidoscopia (RS) a singole coorti di età (58/60enni). Nel biennio hanno esaminato complessivamente 24.549 persone, con un'adesione corretta all'invito del 24,5%. E' stato classificato come completo l'85,9% delle RS. Sono stati inviati ad approfondimento colonscopico il 9,8% degli screenati e sono stati diagnosticati 3,0 carcinomi e 48,2 adenomi avanzati ogni 1.000 screenati.

INTRODUCTION

This paper presents the data from the survey carried out by the National centre for screening monitoring (Osservatorio nazionale screening, ONS) on behalf of the Ministry of Health, regarding the activities performed by Italian screening programmes for colorectal cancer during 2011-2012. The previous surveys are available at the ONS website.[1]

Important differences prevail among colorectal cancer screening programmes in Italy. The main difference regards the type of screening test performed. While the majority of programmes employ the fecal immunochemical test (FIT), some (nearly restricted to one region, Piemonte) have adopted flexible sigmoidoscopy (FS) once in a lifetime and FIT for non-responders to FS (figure 1). Moreover, FIT programmes have different targets as far as age is concerned. Invitation to attend screening starts at the age of 50 years; whereas the maximum age is 69 or 70 years in most programmes, in a number of programmes it is as high as 74 or 75 years. FS programmes invite a single cohort of subjects aged 58-60.

All FIT programmes are set to invite their target population by mail every 2 years to undergo a 1-time immunochemical FIT, without any dietary restriction. Quantitative haemoglobin analysis is performed by automated instruments using the 100 ng Hb/ml threshold to determine positivity (80 ng Hb/ml in a few programmes). People with a negative FIT are notified of their results by mail and they are advised to repeat screening 2 years later. Non responders to the first invitation are mailed a reminder, usually within 6 months. Subjects with a positive screening test are contacted to undergo a total colonoscopy (TC) or, when a complete colonoscopy is not possible, a double-contrast barium enema X-ray or a colonography (virtual colonoscopy). Colonoscopies are usually performed at an endoscopic referral centre, during dedicated sessions. Patients with screen-detected neoplasms are referred to surgery or endoscopy, and then enrolled in a follow-up programme.

In 2007, the Italian group for colorectal cancer screening (Gruppo italiano screening mammografico, GISCoR) published an *Operative report of quality indicators* for the evaluation of colorectal cancer screening programmes. For each indicator the reference standards (acceptable, desirable) are provided. Table 1 (p. 96) shows the indicators and standards utilized in this paper. The operative report is available at the ONS website.[2]
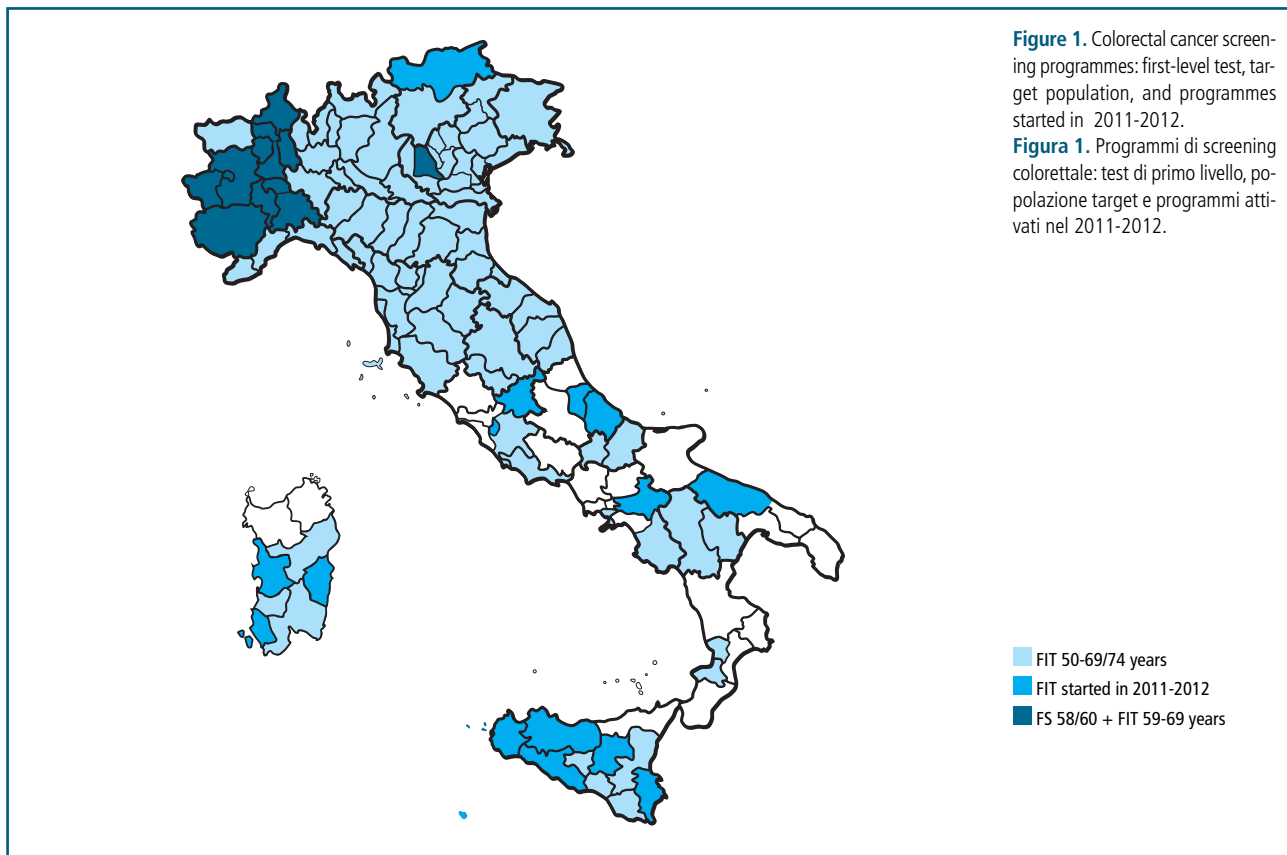
DATA COMPLETENESS

Only 44% of the 215 questionnaires collected in 2011-2012 provided complete data (31% in 2011; 56% in 2012). The items with the lowest level of completeness were screen-detected lesions and surgery: time to surgical treatment, stage at diagnosis, kind of treatment (endoscopic *vs* surgical). However, some programmes (N=7) were unable to provide even baseline data.

EXTENSION AND COMPLIANCE
Programmes activated as of 31.12.2012

During 2011-2012, 15 new programmes were launched, 12 of which in the South of Italy and Islands (figure 1).

As of 31st December 2012, 112 programmes were active in all regions (table 2, p. 97). The vast majority of programmes (N=104) employ the fecal immunochemical test (FIT), while eight have adopted flexible sigmoidoscopy (FS) once in a lifetime, and FIT for non-responders to FS. In 2012, 7 programmes, mainly from the South of Italy and Islands, were suspended.

The results of FIT programmes are reported in the following sections; data of FS programmes are presented in a specific section. In order to describe the national situation, it is necessary to

Figure 1. Colorectal cancer screening programmes: first-level test, target population, and programmes started in 2011-2012.
Figura 1. Programmi di screening colorettale: test di primo livello, popolazione target e programmi attivati nel 2011-2012.

Legend:
- FIT 50-69/74 years
- FIT started in 2011-2012
- FS 58/60 + FIT 59-69 years

simplify the variability of the target population among the programmes, by narrowing the analysis to a homogeneous age group. Therefore, we provide the data related only to subjects aged 50-69 years that are common to all FIT programmes and constitute the real target population of most of them.

Theoretical extension

Theoretical extension refers to eligible subjects residing in areas covered by organized screening programmes.
According to the National institute of statistics (Istat), at the beginning of 2012 approximately 14,718,125 people aged 50-69 years were living in Italy.[3] The number of subjects residing in areas where an organized screening programme was active was 10,272,496, with a national theoretical extension of 73.3% (table 2), more than eight points higher than that observed in 2011 (64.9%). Compared to the previous years, the northern and central regions were almost completely covered by screening programmes, while in the South of Italy and Islands theoretical extension increased to 45.2% (compared to 29% in 2010), notwithstanding the discontinuation of some programmes.

In particular, programmes on a regional-scale basis were activated in Emilia-Romagna, Friuli-Venezia Giulia, Liguria, Lombardia, Marche, Molise, Piemonte, Toscana, Umbria, Valle d'Aosta, Veneto, Trento, and Bolzano.

Extension of invitations

We define extension of invitations as the proportion of the res-

ident population who was sent a screening invitation during the study period.
During 2011-2012, some 7,744,295 subjects were invited to attend a screening programme, accounting for 53.1% of the Italian resident population aged 50-69 years to be invited in the biennium (table 3, p. 98). Extension showed a clear trend across the country, with the highest value in the North (82.5%) and the lowest in the South of Italy and Islands (12.2%). While some regions confirmed the full capacity reached in the previous years, other regions reported low levels, due either to the recent activation of many programmes or to the chronic difficulty of many programmes in ensuring the necessary number of invitations.

If we restrict analysis to the areas with ongoing programmes, the extension of invitations was 77.7%, higher in the North (92.0%), intermediate in the Centre (73.7%), and lower in the South of Italy and Islands (35.2%). The most recent programmes reported a lower performance (46.4%; 10th percentile: 9.7%) than those that had been activated before 2007 (94.1%; 10th percentile: 72.5%) (table 4, p. 98).

Overall, 63.1% of programmes reached GISCoR's acceptable standard of >80% (85% of programmes that started by 2007, 42.6% of those that started by 2007-2009, and 27.3% of the others). Intra-regional variability, illustrated in table 3 through the percentiles for the regions with at least four programmes, was high in all but a few regions, where all programmes reached high levels.

Table 1. Indicators and reference standards.
Tabella 1. Indicatori e standard di riferimento.

Indicator	Standard					
	acceptable			**desirable**		
actual extension	>80%			>90%		
compliance to invitation	>45%			>65%		
positivity rate	**FIT:**	first test:	<6%	**FIT:**	first test:	<5%
		repeat tests:	<4.5%		repeat tests:	<3.5%
	FS:	<8%		**FS:**	<6%	
inadequate screening tests	**FIT:**	<1%				
	FS:	<10%		**FS:**	<5%	
attendance to further assessment	**FIT:**	>85%		**FIT:**	>90%	
	FS:	>90%		**FS:**	>95%	
complete FS rate	>85%			>90%		
complete TC rate	>85%			>90%		
detection rate	**FIT**			**FIT**		
	carcinoma	first test:	>2.0‰	carcinoma	first test:	>2.5‰
		repeat tests:	>1.0‰		repeat tests:	>1.5‰
	adv. adenoma	first test:	>7.5‰	adv. adenoma	first test:	>10‰
		repeat tests:	>5.0‰		repeat tests:	>7.5‰
	FS			**FS**		
	carcinoma	>3.0‰		carcinoma	>4.0‰	
	adv. adenoma	>35‰		adv. adenoma	>40‰	
detection rate of adenomas at FS	males	>10%		males	>15%	
	females	>5%		females	>10%	
PPV of FIT at colonoscopy for advanced adenoma or carcinoma	first test	>25%		first test	>30%	
	repeat tests	>15%		repeat tests	>20%	
PPV of FS at colonoscopy for proximal advanced adenoma	>7%			>10%		
delay between FIT screening and negative result	>90% within 21 calendar days			>90% within 15 calendar days		
delay between the call for assessment and the assessment procedure	>90% within 30 calendar days			>95% within 30 calendar days		
proportion of screen-detected cancers in stage III+	<30%			<20%		

FIT: faecal immunochemical test; FS: flexible sigmoidoscopy; TC: total colonoscopy; PPV: positive predictive value.

Adapted from: Zorzi M et al. Indicatori di qualità per la valutazione dei programmi di screening dei tumori colorettali. *Epidemiol Prev* 2007;6 (Suppl 1):1-56.

Compliance with invitation

We report data on adjusted compliance, calculated as the proportion of subjects invited to attend screening (minus those with a wrong address and those excluded after invitation for a recent test) who underwent a screening test.

Overall, about 3,351,937 people were screened with FIT in 2011-2012. Adjusted compliance (47.1%) slightly decreased compared to the 48% rate observed in 2010 (table 3). Adjusted compliance was higher in the northern (52%) and central regions (40.6%), while in the South of Italy and Islands it was lower (28.6%).

The analysis of compliance by region shows a high inter-regional variability, with values ranging from 13.7% in Campania to 67.7% in Valle d'Aosta (table 3). Moreover, a high intra-regional variability in almost all regions must be highlighted.

The 10th percentile (24%) is clearly insufficient to guarantee suitable coverage of the population and, consequently, efficiency of a screening programme. Overall, 57.1% of programmes reached the acceptable GISCoR standard (>45%) (table 4).

As was the case for extension, attendance was likewise greater in programmes that started before 2007 (50.8%; 10th percentile: 40.3%) compared to those that started after 2009 (27.6%; 10th percentile: 11.8%), independently of geographical area.

This result in part depends on the higher proportion of subjects that have never been invited that characterizes recent programmes. The attendance rate of subjects invited for the first time was 34.3%, that of those who had already responded to previous invitations was 82.5%, while 17.8% of subjects who had never responded to previous invitations responded to a new invitation during 2011-2012.

DIAGNOSTIC INDICATORS

The most important diagnostic indicators (positivity rates, detection rates, positive predictive values) are strongly influenced by the underlying frequency of the disease in the screened population. Colorectal cancer and pre-cancerous lesions are more frequent in males than females, and progressively increase with age.[4] Moreover, the disease is more frequently detected in subjects at first screening test (prevalence round) than in those at repeat tests (incidence round).

Therefore, these indicators are presented separately for subjects at first and repeat screening tests, as well as by gender and five-year age group. Subjects screened in newly activated pro-

Region	Programmes[1]	Total resident subjects (N)[2]	Subjects residing in areas covered by a programme in 2012 (N)	Theoretical extension 2011 (%)[3]	Theoretical extension 2012 (%)[3]	Coverage 2011-2012 (%)[4]
Abruzzo	0 / 2	324.572	176.812	0.0	54.5	0.1
Alto Adige*	0 / 1	114.793	114.793	0.0	100	0.9
Basilicata	1 / 0	139.899	0	59.3	0.0	7.0
Calabria	2	470.890	129.729	14.7	27.5	1.8
Campania	3 / 2	1.333.753	299.315	26.8	22.4	1.6
Emilia-Romagna	11	1.083.295	1.083.295	100	100	60.4
Friuli-Venezia Giulia*	1	322.158	322.158	100	100	56.7
Lazio	6 / 7	1.366.176	783.637	55.0	57.4	5.4
Liguria	5	421.051	421.051	100	100	15.9
Lombardia	15	2.400.066	2.400.066	100	100	45.4
Marche	5	380.090	380.090	100	100	26.2
Molise*	1	78.110	78.110	100	100	29.7
Piemonte**	9	1.134.756	428.158	39.1	37.7	23.6#
Puglia	0 / 1	980.945	393.271	0.0	40.1	1.7
Sardegna	3 / 6	434.190	329.153	51.3	75.8	22.8
Sicilia	5 / 8	1.194.196	834.151	34.1	69.9	3.4
Toscana	12	944.371	944.371	100	100	45.0
Trentino*	1	129.509	129.509	100	100	57.6
Umbria*	1	222.785	222.785	100	100	48.2
Valle d'Aosta*	1	32.358	32.358	100	100	61.6
Veneto	21	1.210.162	1.132.237	93.7	93.6	59.5#
Italy	**103 / 112**	**14.718.125**	**10.635.049**	**64.9**	**72.3**	**25.1**
North	**64 / 65**	**6.848.148**	**6.063.625**	**87.0**	**88.5**	**41.8**
Centre	**24 / 25**	**2.913.422**	**2.330.883**	**78.6**	**80.0**	**23.7**
South/Islands	**15 / 22**	**4.956.555**	**2.240.541**	**25.2**	**45.2**	**4.4**

[1] pairs of values refer to 2011 / 2012
[2] residents 50-69 yrs old at 01.01.2012 (source: Istat)
[3] proportion of eligible subjects residing in areas covered by a screening programme
[4] proportion of eligible subjects that were screened in 2011-2012
* regional-based programmes
** programmes screen only subjects aged 58-69 years
# subjects who underwent a flexible sigmoidoscopy included

Table 2. Main data of FIT programmes, 50-69 year-old subjects, by region. Years 2011-2012.
Tabella 2. Dati principali dei programmi di screening colorettale, soggetti 50-69enni, per Regione. Anni 2011-2012.

grammes all undergo first screening, while in the older programmes the proportion of subjects at repeat screening progressively increases. Moreover, while subjects at first screening test are younger (47.4% were 50-54 year old in 2012), those at repeat screening are mainly distributed in the older age classes (65-69 years old: 30%; 50-54 years old: 15.8%).

The mean values of these indicators by region are standardized by age and gender, using the national mean as standard population. The data refer to 3,531,937 subjects screened during 2011-2012 for which data are available; of these 1,316,327 (37%) underwent first screening and 2,215,610 (63%) subsequent examinations.

Positivity rates

In subjects at first screening, the proportion of positive FIT was 5.2%, with quite homogeneous values among the mean regional values of the regions with a significant number of screens (table 5, p. 99). The 10th and 90th percentile of positivity rates reported by the programmes were 3.7% and 6.6%,

respectively. Outlier values were observed in programmes with a few number of screened subjects and in some of the recently-activated programmes.

In subjects at repeat screening, the proportion of FIT+ was 4.0%, with a higher homogeneity between programmes (10th-90th: 3.3%-5.1%). Seventy-six percent of programmes met the acceptable standard at the first (<6%) exam and sixty-six at repeat examination (<4.5%).

As shown in figure 2 (p. 99), the proportions of positive results were higher in males both at first and repeat examinations, and progressively increased with age, particularly at first screening test.

Inadequate tests

Inadequate tests are essentially due to an incorrect sampling by the subject.

During 2011-2012, 95% of programmes reported a proportion of inadequate FITs lower than the standard (<1%). Overall, the national mean value was 0.3%.

Region	Invited subjects (N)	Extension of invitations[1]		Screened (N)	Adjusted compliance[2]	
		%	10th - 90th percentile[3]		%	10th - 90th percentile[3]
Abruzzo	445	0.2		174	46.2	
Alto Adige	2.549	2.2		1.020	40.1	
Basilicata	26.868	19.2		9.524	36.8	
Calabria	18.384	3.8		8.293	47.2	
Campania	154.394	11.9		21.039	13.7	
Emilia-Romagna	1.084.128	116.6	89.7 - 118.9	557.021	52.1	44.4 - 61.7
Friuli-Venezia Giulia	309.016	108.3		156.208	52.3	
Lazio	321.952	22.5	6.3 - 66.8	73.757	24.0	11.7 - 41.9
Liguria	227.489	55.5	29.1 - 110.1	64.327	29.1	11.2 - 41.7
Lombardia	2.189.985	97.2	83.3 - 110.8	1.027.550	48.5	41.4 - 65.9
Marche	311.050	92.9	54.2 - 116.2	87.420	28.2	23.3 - 35.5
Molise	64.468	81.3		23.221	36.6	
Piemonte°	299.236	26.3	24.3 - 103.4	132.428	44.7	34.2 - 49.7
Puglia	64.605	4.6		16.305	36.5	
Sardegna	207.105	40.8		98.836	50.3	
Sicilia	277.331	19.2		40.312	15.6	
Toscana	842.794	90.7	68.1 - 104.7	409.649	50.1	38.6 - 59.4
Trentino	112.473	97.7		66.225	59.8	
Umbria	213.225	106.4		95.939	45.8	
Valle d'Aosta	29.632	89.8		19.869	67.7	
Veneto	987.166	91.9	78.5 - 117.2	622.820	65.5	46.1 - 76.7
Italy	**7.744.295**	**53.1**	**21.5 - 111.8**	**3.531.937**	**47.1**	**24.0 - 67.7**
North	**5.241.674**	**82.5**	**59.4 - 115.2**	**2.647.468**	**52.0**	**36.2 - 70.0**
Centre	**1.689.021**	**58.9**	**19.5 - 105.0**	**666.765**	**40.6**	**23.2 - 56.6**
South/Islands	**813.600**	**12.2**	**0.4 - 89.9**	**217.704**	**28.6**	**12.9 - 63.1**

[1] proportion of the target population that was actually invited in 2011-2012
[2] subjects attending out of those invited, excluding from the denominator those reporting a recent test and those who did not receive the invitation letter
[3] only Regions with at least four programmes
° programmes screen only subjects aged 59-69 years

Table 3. FIT programmes: extension of invitations and adjusted compliance in 2011-2012, by region.
Tabella 3. Estensione degli inviti ed adesione aggiustata dei programmi SOF nel biennio 2011-2012, per Regione.

	Start year			
	<2007	2007-2009	2010+	Total
Number of programmes				
Total	60	27	22	109
North	46	14	5	65
Centre	12	6	6	24
South/Islands	2	7	11	20
Extension of invitations (%)*	94.1	68.6	46.4	77.7
10th-90th percentile	72.5 - 112.9	15.9 - 116.1	9.7 - 99.0	24.2 - 112.9
proportion of programmes with extension >80%	85.0	42.6	27.3	63.1
Adjusted compliance (%)	50.8	44.7	27.6	47.1
10th-90th percentile	40.3 - 68.4	27.5 - 62.3	11.8 - 50.7	26.4 - 67.2
proportion of programmes with adjusted compliance >45%	79.2	37.0	20.5	57.1

* proportion of the target population of the areas with a screening programme that was actually invited in 2011-2012

Table 4. FIT programmes: extension of invitations and adjusted compliance in 2011-2012, by year of programme start.
Tabella 4. Estensione degli inviti e adesione corretta dei programmi SOF nel biennio 2011-2012, per anno di attivazione del programma.

Region	First screening episode		Repeat screening episode	
	Positivity rates (%)	10th - 90th percentile[1]	Positivity rates (%)	10th - 90th percentile[1]
Abruzzo	1.0			
Alto Adige°	7.1			
Basilicata	12.4			
Calabria	5.3		6.4	
Campania	6.1		4.7	
Emilia-Romagna	5.5	5.0 - 6.3	4.0	3.7 - 4.3
Friuli-Venezia Giulia	5.2		3.9	
Lazio	4.9	2.4 - 5.9	4.7	3.3 - 9.9
Liguria	5.3	2.6 - 18.8	4.3	
Lombardia	5.5	4.5 - 6.2	4.0	3.2 - 4.8
Marche	6.3	2.5 - 8.7	3.6	
Molise	4.6		4.2	
Piemonte°	6.6		4.6	
Puglia	4.6			
Sardegna	4.5		4.9	
Sicilia	5.5			
Toscana	5.1	4.3 - 7.5	3.9	3.7 - 4.5
Trentino	4.7		3.9	
Umbria	4.8		4.0	
Valle d'Aosta	4.3		3.4	
Veneto	5.1	3.4 - 6.4	3.9	3.1 - 4.8
Italy	5.2	3.7 - 6.6	4.0	3.3 - 5.1
North	5.3	4.0 - 6.6	4.0	3.3 - 4.8
Centre	5.4	3.3 - 6.6	3.9	3.5 - 5.7
South/Islands	5.0	3.1 - 6.2	4.6	4.3 - 10.6

[1] only Regions with at least four programmes
° not standardized (Piemonte screened only subjects aged 59-69 years, Alto Adige in 2012 screened only subjects aged 65-69 years)

Table 5. FIT programmes: positivity rates at first and repeat screening episodes in 2011-2012 standardized (by age and gender, utilising the overall screened population as standard population) by region.
Tabella 5. Programmi SOF: tassi di positività ai primi esami e agli esami successivi nel 2011-2012 standardizzati (per età e sesso utilizzando come riferimento l'intera popolazione screenata), per regione.
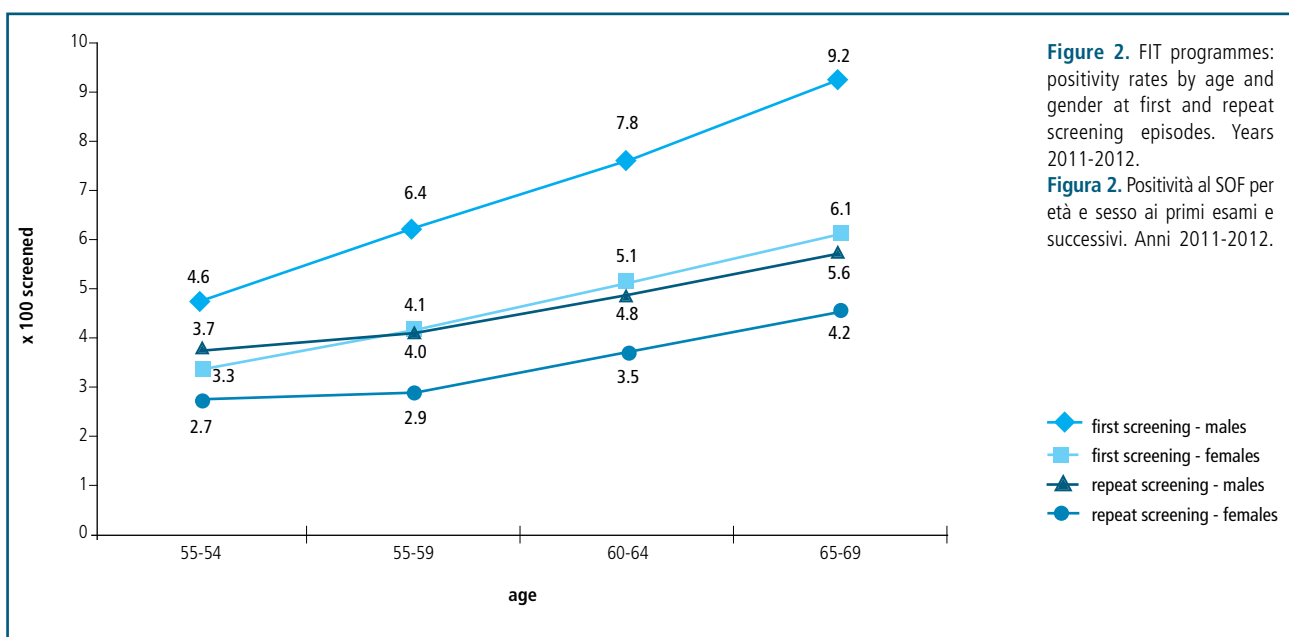

Figure 2. FIT programmes: positivity rates by age and gender at first and repeat screening episodes. Years 2011-2012.
Figura 2. Positività al SOF per età e sesso ai primi esami e successivi. Anni 2011-2012.

Region	Complete colonoscopy rate[1] (%)	Complete workup rate[2] (%)
Basilicata	80.6	81.0
Campania	96.5	96.7
Emilia-Romagna	91.5	96.5
Friuli-Venezia Giulia	93.7	97.0
Lazio	88.7	98.4
Liguria	80.2	85.4
Lombardia	91.7	95.7
Marche	92.1	95.5
Piemonte	91.1	91.1
Sardegna	96.6	99.7
Sicilia	83.2	87.5
Toscana	87.9	94.5
Trentio	97.0	98.9
Umbria	88.0	91.9
Valle d'Aosta	95.0	95.0
Veneto	93.0	97.5
Italy 2011-2012	91.5	95.5

[1] proportion of first total colonoscopies following a positive screening test that reached caecal intubation
[2] proportion of subjects who underwent a second-level workup who had a complete assessment (a complete total colonoscopy and/or other exams)

Table 6. Complete colonoscopy rate and complete workup rate in 2011-2012, by region.
Tabella 6. Tasso di colonscopie complete e tasso di approfondimenti completi, per Regione. Periodo 2011-2012.

Attendance to colonoscopy assessment

Attendance to colonoscopy assessment is essential for screening programmes to achieve colorectal cancer mortality reduction. Overall, 81.1% of FIT+ subjects attended colonoscopy in 2011-2012, a figure which is similar to those observed in 2010 (81.4%) and 2009 (82.5%). Attendance rate was higher in the North (83.0%) and progressively decreased in the Centre (79.6%) and South and Islands (67.0%).

Only 19.5% of programmes met the desired standard (>90%), while 7.8% was under the cut-off of 70%.

As already reported in the previous years, attendance was higher in males (80.6%) than in females (78.9%).

Complete colonoscopies

Besides compliance to colonoscopy, a cornerstone element in measuring the effectiveness of a screening programme is the completeness of the endoscopic examination. Overall, 91.5% of the colonoscopies carried out in 2011-2012 were classified as complete, a highly satisfactory result (table 6). Eighty-one percent of programmes met the acceptable (>85%) and 61.5% the desired standard (>90%).

Mean regional values ranged from 80.2% in Liguria to 97% in Trentino. The values of single programmes ranged from 53.8 and 100% and the lowest values were due to a small number of outliers (10th percentile: 82.6%). Programmes generally reported higher proportions of complete exams in males compared to females (overall 91.6% vs 89.3%, respectively), as reported in the literature.[5]

Since a proportion of subjects complete the second-level assessment by repeating colonoscopy or undergoing other exams, we also calculated the rate of completion of the diagnostic workup. Overall in 2011-2012, second-level assessment was completed by 95.5% of subjects with a positive first-level test.

Complications at colonoscopy

Two hundred and nine cases of bleeding were reported, 165 of which were during operative TCs, with a rate of 0.065% for non-operative and 0.29% for operative TCs; both values are in accordance with GISCoR standards (<0.5% and <2.5%, respectively). Sixty-five perforations were recorded (52 during operative TCs), with a rate of 0.02% for non-operative and 0.09% for operative TCs, in line with GISCoR standards (<0.5% and <2.5%, respectively).

Overall these results are good; however, a high variability in the collection and recording of criteria was observed. Most programmes do not provide a systematic data collection within a fixed interval of time after the examination (e.g., 30 days), possibly resulting in an underestimation of complications, including the most serious ones. On the other hand, the data about bleeding might refer to self-limiting episodes that did not require any intervention such as hospitalisation, blood transfusion, or endoscopic interventions. In that case, the indicator would be overestimated.
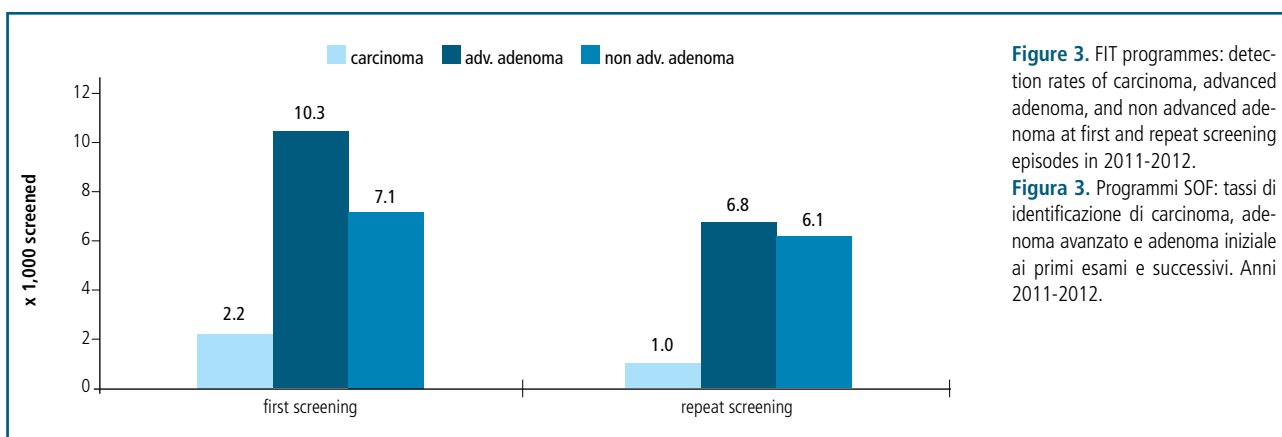

Figure 3. FIT programmes: detection rates of carcinoma, advanced adenoma, and non advanced adenoma at first and repeat screening episodes in 2011-2012.
Figura 3. Programmi SOF: tassi di identificazione di carcinoma, adenoma avanzato e adenoma iniziale ai primi esami e successivi. Anni 2011-2012.

Detection rates

We describe the detection rates (DR) of invasive carcinomas, advanced adenomas (i.e., adenomas with a diameter ≥1 cm, villous/tubulo-villous type, or high-grade dysplasia) and non-advanced adenomas (smaller in size, tubular type, and low-grade dysplasia). DRs are defined as the number of histologically-confirmed lesions detected per 1,000 screened subjects.

Overall, in subjects screened for the first time, 2,916 carcinomas, 13,578 advanced adenomas, and 9,320 non-advanced adenomas were detected. Therefore, the DR was 2.2‰ for carcinoma, 10.3‰ for advanced adenomas and 7.1‰ for non-advanced adenomas (figure 3). Sixty-three percent of programmes reached the acceptable standard for carcinoma (>2‰), and 75% for advanced adenoma (>7.5‰).

In subjects undergoing repeat testing, 2,306 carcinomas, 15,001 advanced adenomas, and 13,427 non-advanced adenomas were detected. As expected, the DRs were lower than the corresponding figure at first exams (figure 3). Sixty-nine percent of programmes reached the acceptable standard for carcinoma (>1‰), and 63% for advanced adenoma (>5‰).

The ratio between the DRs of advanced and non-advanced adenomas does not reflect the underlying prevalence of the two groups of lesions in the screened population, the frequency of non-advanced adenomas being higher than that of advanced adenomas. The DR of advanced adenomas is higher, since FIT appears to be highly selective for these lesions, which tend to bleed more easily than non-advanced adenomas, as described in the literature.[6] However, we observed a high variability among programmes in the ratio between advanced and non-advanced adenomas. This result suggests a low standardisation of the diagnostic criteria used by the different programmes to classify adenomas.

At first exams, we observed a high variability among the regional mean values of DRs of carcinoma (from 1.7‰ in Calabria to 7.8‰ in Bolzano, both non-standardized values), advanced adenomas (from 1.9‰ in Puglia to 13.7‰ in Marche and Emilia-Romagna; in Piemonte, with its 19.4‰, programmes screened only subjects aged 58-69 years) and non-advanced adenomas (from 3.3‰ in Puglia to 14.7‰ in Friuli-Venezia Giulia and Bolzano) (figure 4).

We did not observe any geographical North-South trend in the detection rates of carcinoma and advanced adenoma, as expected according to the underlying epidemiological figures (carcinoma: North 2.3‰, Centre 2.2‰, South-Islands 2.2‰; advanced adenoma: North 11.2‰, Centre 10.6‰, South/Islands 7.1‰; non-advanced adenoma: North 7.6‰, Centre 7.5‰, South/Islands 4.8‰). At repeat examinations, a higher homogeneity was reported among regions for the DR of carcinoma (from 0.6‰ in Marche to 2.3‰ in Calabria), but not for advanced adenoma (from 2.3‰ in Calabria to 10.3‰ in Sardegna) nor non-advanced adenoma (from 3.1‰ in Valle d'Aosta to 11.6‰ in Trentino) (figure 5, p. 102).
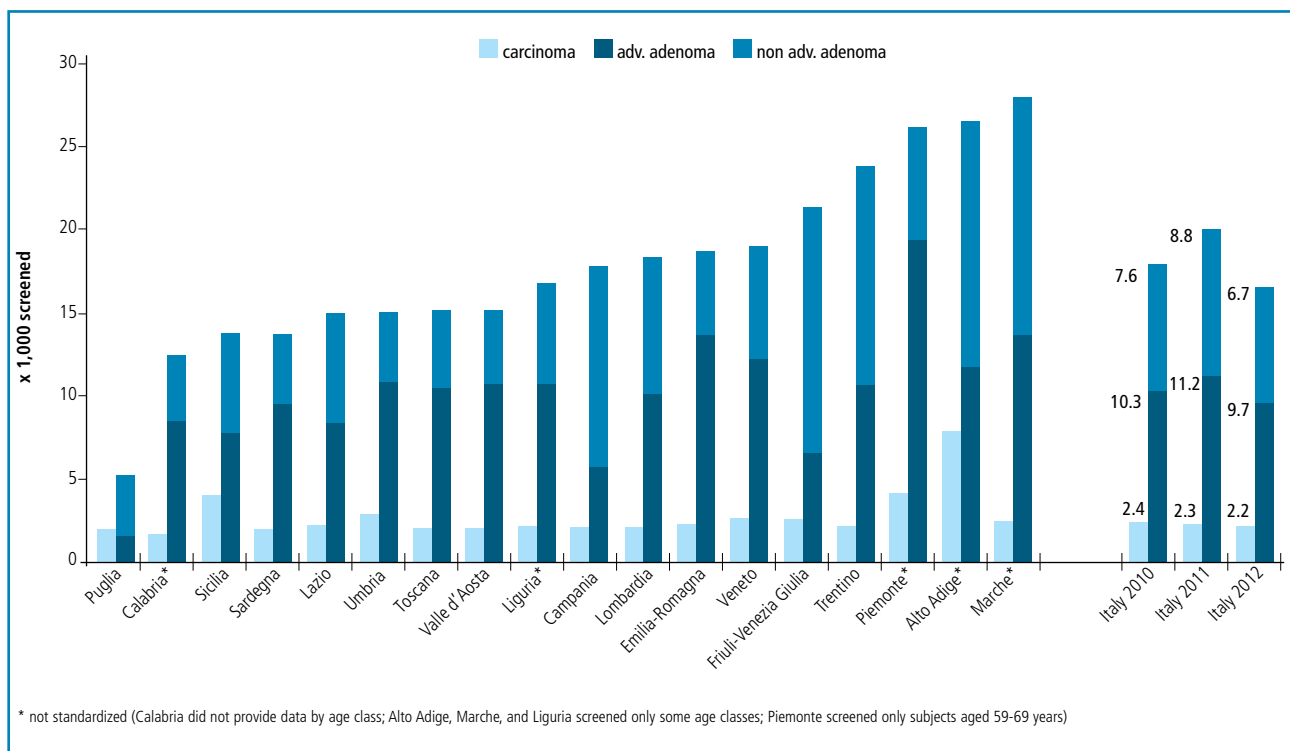

Figure 4. FIT programmes: standardized (by age and gender, utilising the overall screened population as standard population) detection rates for carcinoma, advanced adenoma and non-advanced adenoma at first screening, by region. Years 2011-2012.
Figura 4. Programmi SOF: tassi di identificazione di carcinoma, adenoma avanzato e adenoma iniziale ai primi esami, standardizzati (per età e sesso, utilizzando come riferimento l'intera popolazione screenata), per regione. Anni 2011-2012.
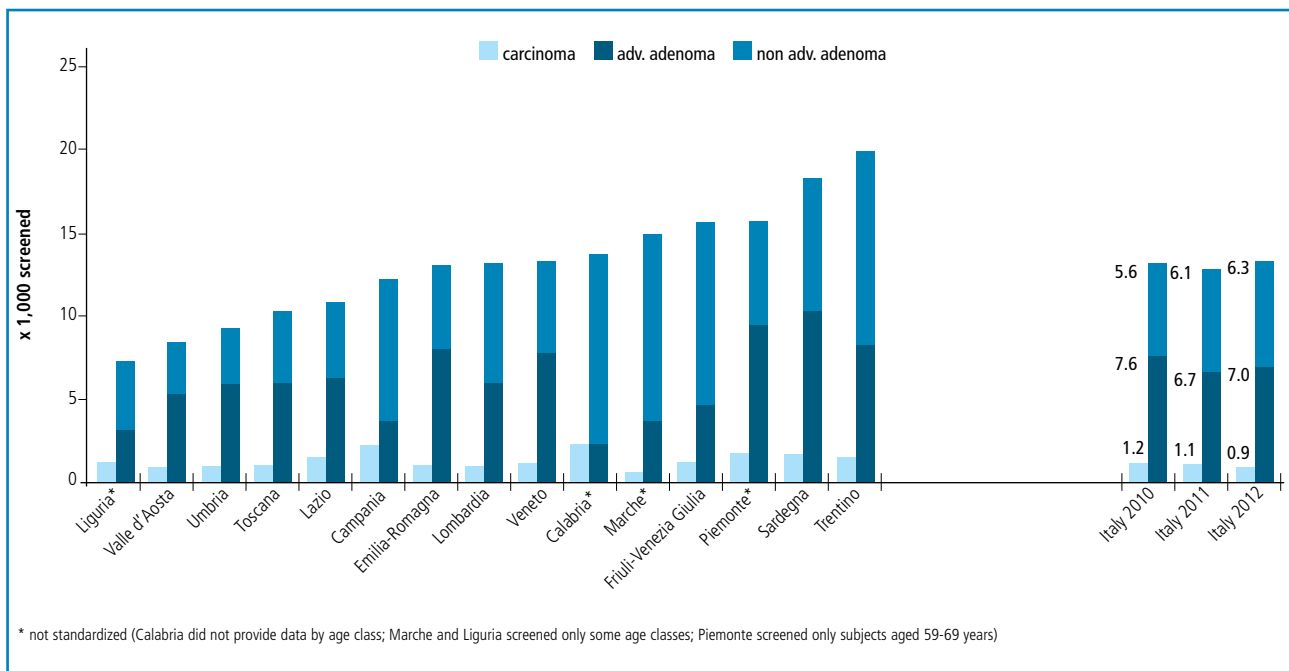
**Figure 5.** FIT programmes: standardized (by age and gender, utilising the overall screened population as standard population) detection rates for carcinoma, advanced adenoma and non-advanced adenoma at repeat screening episodes, by region. Years 2011-2012.

Figura 5. Programmi SOF: tassi di identificazione di carcinoma, adenoma avanzato e adenoma iniziale agli esami successivi, standardizzati (per età e sesso, utilizzando come riferimento l'intera popolazione screenata), per regione. Anni 2011-2012.
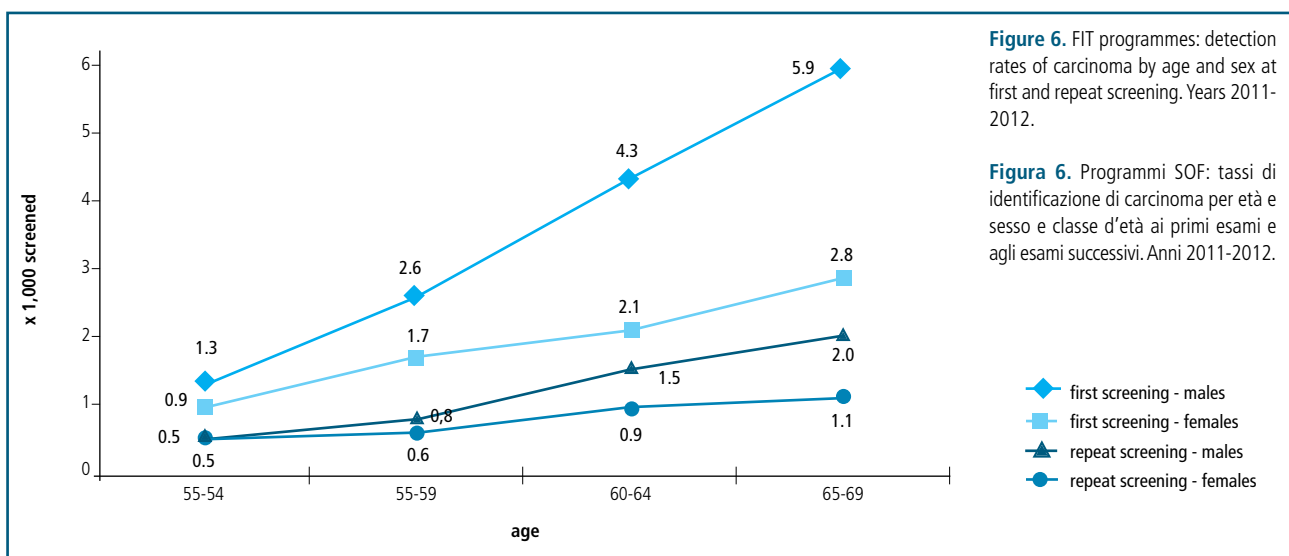
Figure 6. FIT programmes: detection rates of carcinoma by age and sex at first and repeat screening. Years 2011-2012.

Figura 6. Programmi SOF: tassi di identificazione di carcinoma per età e sesso e classe d'età ai primi esami e agli esami successivi. Anni 2011-2012.

As expected, on the basis of underlying epidemiological figures, the DRs of carcinoma were higher in males and progressively increased with age in both genders (figure 6). This trend may be observed both in subjects screened for the first time and in those at repeat screening.

The reduction in DRs between first and repeat exams was larger in males and in the older groups: this could be due to a proportionally higher impact in these subjects of the polyps' removal that takes place in the prevalence round, and it is in agreement with the data about positivity rates of FIT (figure 2).

Positive predictive value

Positive predictive value (PPV) of FIT+ at colonoscopy is defined as the number of subjects with a diagnosis of carcinoma or advanced adenoma, as a proportion of FIT+ subjects that underwent colonoscopy.

In 2011-2012, the FIT showed a noteworthy capability of selecting subjects with a high risk of invasive carcinoma or advanced adenoma, as already reported in the previous years. Among the 55,419 subjects at first screening round who underwent a colonoscopy after a FIT+, a diagnosis of carcinoma was formulated in 5.3% and advanced adenoma in a further 24.5%.

	Males	Females	Total
screened 2012 (N)	5,983	5,741	11,724
screened 2011 (N)	6,646	6,179	12,825
compliance with invitation to FS (%)	25.8	23.2	24.5
compliance with invitation to FS+FIT (%)	35.3	37.5	36.4
reason prompting colonoscopy (%)			
advanced adenoma*	7.4	3.6	5.6
other	4.6	3.8	4.2
detection rate (‰)			
carcinoma	4.4	1.5	3.0
advanced adenoma	63.9	31.1	48.2
non advanced adenoma	96.8	61.6	79.9
PPV (%) for proximal neoplasia**	12.0	9.0	11.0

* at least one advanced adenoma (with a diameter ≥10 mm, villous/tubulo-villous type, or high-grade dysplasia); 3 or more adenomas with diameter <10 mm, tubular type, and low grade dysplasia
** carcinoma or advanced adenoma

Table 7. Main results of FS programmes. Years 2011-2012.
Tabella 7. Risultati principali dei programmi RS. Anni 2011-2012.

Among the 74,810 subjects at repeat screening, the corresponding values were respectively 3.1% for carcinoma and 20.1% for advanced adenoma.

Seventy-five percent of programmes reached the acceptable standard for subjects at first screening (>25%) and 85% for those at repeat screening (>15%).

Once again, males showed constantly higher values than females (31.0% *vs* 22.6% for carcinoma and advanced adenoma altogether) and an increasing PPV trend was observed with age (from 24.2% in subjects 50-54 years old to 29.4% in those aged 65-69).

Waiting times

In order to reduce the anxiety of screened subjects, the delay between the test and mailing of a negative result or the carrying out of a further assessment for those positive must be kept as short as possible. Since FIT is a laboratory test, it can be carried out quite quickly (as compared to the reading of mammograms and Pap smears), therefore the delay between the test and the mailing of a negative result is generally short. In fact, about 94% of letters after a negative result were mailed within 15 days and a further 3% within 21 days.

On the contrary, all regions recorded serious difficulties in guaranteeing a colonoscopy to FIT+ subjects within a short period of time. Overall, colonoscopy was carried out within 30 days after FIT only in 53.3% of cases and only nine programmes met the acceptable standard (>90% within 30 days). Fifteen percent of subjects had to wait for more than two months. Finally, surgery was performed within 30 days after diagnosis in 52% of cases, and in a further 33% within two months.

FS SCREENING PROGRAMMES

FS is proposed as a first level test by 9 programmes in Piemonte and 1 in Veneto (in 2012 two programmes were suspended). These programmes also offer FIT to subjects refusing FS screening and to those up to 69 years of age. The principal data are presented in table 7.

Overall, these programmes invited 53,668 subjects in 2011, corresponding to an 88.2% actual coverage of their target population (N= 61,973) and 47,499 subjects in 2012 (84% of 55,871 subjects in the target population).

Overall, 12,825 subjects were screened in 2011 and 11,724 in 2012. Uptake of invitation was 24.5% (range: 6.9-36.8%). In almost all programmes, uptake was higher for males in comparison to females (overall: 25.8% *vs* 23.2%), as reported in the literature. Compliance to FS screening was lower than for FIT. However, the comparison is related to different geographical areas.

The programmes offer FIT to subjects refusing FS screening. This strategy makes it possible to increase overall coverage and reduce gender differences, as reported where this strategy has been ongoing for a number of years. In fact, the proportion of subjects that underwent one of the two tests was 36.4% and was higher among females (37.5%) than males (35.3%) (table 7). Since FS is performed on a once-in-a-lifetime basis, the proportion of complete exams should be as high as possible. On the other hand, caution must be taken to avoid perforations, bleeding, or other complications. Overall, 85.9% of FS were classified as complete, with higher levels in males (88.6%) than in females (82.5%). This result is in line with GISCoR's acceptable standard (>85%). A considerably high variability between programmes was recorded (range: 74.4-94%).

Generally, the programmes referred to colonoscopy assessment 9.8% of screened subjects (12.0% of males and 7.4% of females). Only in 57% of these cases was the reason prompting colonoscopy an advanced adenoma, which, according to the literature, is associated with an increased probability of neoplasia in the proximal colon.

The overall attendance rate of the assessment was 93.5% in 2011 and dropped to 81.9% in 2012, probably due to a loss of data. The colonoscopy completeness rate was 91.9%, with values of single programmes ranging from 86.2% to 100%.

Among the subjects referred to colonoscopy, the prevalence of

Stage	FIT programmes		FS programmes (N=62) (%)
	first screening (N=1,910) (%)	repeat screening (N=1,823) (%)	
I	41.9	42.9	37.1
I*	10.8	9.8	22.6
II	20.4	19.5	12.9
III-IV	26.8	27.9	27.4

Stage I: T1 or T2. N0. M0
Stage I*: T1. NX
Stage II: T3 or T4. N0. M0
Stage III-IV: lymph-node involvement or distant metastases

Table 8. Stage distribution of screen-detected cancers in 2011-2012. Cases with known stage (3,733 out of 5,222 carcinomas).
Tabella 8. Distribuzione per stadio alla diagnosi dei carcinomi diagnosticati allo screening nei programmi SOF e RS nel biennio 2011-2012 (%). Casi con stadio noto (3.733 su 5.222 carcinomi totali).

proximal advanced lesions (advanced adenomas plus cancers) ranged between 2.7% and 14.9%.
Overall, FS programmes detected 71 carcinomas, of which 67 in the distal tract of the colon, and 1,129 advanced adenomas, with a DR of 3.0 and 48.2‰, respectively.

Stage at diagnosis
Overall, 2,916 cancers were detected in subjects at first screening and 2,306 at repeat screening. Invasive malignant polyps represented 27.6% of cancers at first screening and 22.3% at repeat screening. FS programmes detected 71 cancers, 14 of which were invasive malignant polyps.
As already observed in the previous years, many programmes did not collect any data about stage at diagnosis, while information provided by others was incomplete. Therefore, stage is available only for 3,733 cases (71.5%) of the 5,222 carcinomas, similar to 2010 and 2009 (73.5% and 71.7% respectively). The incompleteness of this information was one of the most critical issues encountered by Italian programmes during 2010.
Table 8 shows the distribution by stage at diagnosis of cases screen-detected by FIT and FS programmes. The distribution of cases diagnosed at first *vs* repeat FIT are similar, with more than half of cases at stage I and a considerable proportion of cases treated only by endoscopic resection.
Overall, 27.3% of cases were in stage III+ at diagnosis, in ac-

cordance with the acceptable standard (<30%). As for the proportion of cases in stage III-IV, small differences were reported between cases at first and repeat screening.
Sixty percent of cases diagnosed by FS programmes were at stage I; of these, 22.6% were invasive (pT1) malignant polyps that underwent endoscopic resection alone.

Surgery
This survey collects data about the kind of therapy performed on carcinomas, invasive malignant polyps and advanced adenomas, and distinguishes between surgical intervention and endoscopic resection alone. Overall, data were provided for 81.4% of carcinomas and 91.8% of advanced adenomas.
Eighty-five percent of carcinomas underwent surgery, while in 15% of cases treatment was limited to endoscopic resection. This percentage increased to 40.8% considering only pT1 cases. As for advanced adenomas, treatment was exclusively endoscopic in 96.7% of cases.

Post-colonoscopy follow- up
The national survey collected information about recommendations given at the end of the diagnostic workup by type of diagnosis, and distribution of the colonoscopies carried out by the screening programmes, by type: second-level assessments, repetition, follow-up, etc.
■ Recommendations after a clean colon
Most subjects with a negative colonoscopy were invited to perform a FIT after 5 years (79.6%), in line with the European guidelines[7] (table 9). Thirteen percent of the cases were recommended to undergo a further colonoscopy, at different intervals, without any relevant difference between geographical areas. The European guidelines recommend to return subjects to screening even in case of a diagnosis of non-advanced adenoma. This recommendation was respected only by 10.7% cases, while the indication in the vast majority of cases was a further colonoscopy, at longer intervals in the North (53% after 5 years and 20% after 3) compared to the Centre (37% after 5 years, 34% after 3) and the South of Italy and Islands (23% and 25%, respectively).
Advanced adenomas should be recalled to colonoscopy after 1 or 3 years (depending on the number and dimension of the adenomas). This recommendation was given in 73% of cases,

Table 9. Distribution of recommendations after *clean colon*, by diagnosis at colonoscopy in 2011-2012.
Tabella 9. Distribuzione percentuale delle raccomandazioni dopo *clean colon* per diagnosi istologica nel biennio 2011-2012.

Recommendation	Negative (%)	Low-risk adenoma (%)	High-risk adenoma* (%)	Cancerized adenoma (%)
FIT after 5 years	79.6	8.1	1.4	1.9
FIT after 2 years	4.4	2.6	0.6	0.0
colonoscopy after 5 years	7.3	50.8	5.8	0.6
colonoscopy after 3 years	3.3	22.2	48.4	4.0
colonoscopy after 6 months/1 year	2.4	7.9	33.9	16.9
surgery	0.6	1.9	5.7	68.9
other	2.4	6.5	4.2	7.7

* high-risk adenoma: at least one advanced adenoma (with a diameter ≥10 mm, villous/tubulo-villous type, or high-grade dysplasia); 3 or more adenomas with diameter <10 mm, tubular type, and low-grade dysplasia

Type of colonoscopy	Total	Programmes with active follow-up (%)	
		start date 2000-2006	start date 2007-2010
second level assessment after a positive first-level exam	74.5	66.7	74.3
repetition, etc	4.8	5.0	5.6
follow-up (after *clean colon*)	20.3	27.9	19.3
other	0.4	0.4	0.8

Table 10. Distribution of colonoscopies performed in 2011-2012, by type (%).
Tabella 10. Distribuzione percentuale delle colonscopie per motivo di esecuzione nel biennio 2011-2012.

while in 9.6% of cases colonoscopy was anticipated after 6 months and 2% of cases were recalled to FIT.

Sixty-nine percent of the cases of invasive malignant polyps were sent to surgery, a further 8.3% to repeat colonoscopy after 6 months.

■ **Distribution by reason prompting colonoscopy**

Seventy-four percent of the colonoscopies performed in 2011-2012 were second-level assessments in subjects with a positive screening test (table 10), 20.3% were post-colonoscopy follow-up and 4.8% completion or repetitions of a previous colonoscopy.

The proportion of follow-up colonoscopies was very low (1.6%) in the programmes without an active invitation to follow-up, while it rose to 26.5% in those with an active follow-up. Among the latter, the proportion of follow-up colonoscopies was highest in programmes older than 6 years (27.9%).

DISCUSSION

During 2011 and 2012, colorectal cancer screening programmes continued to spread gradually, and by the end of the period they covered 74% of the national target population.

About 7.7 million subjects were invited to screening, half of whom underwent a screening test; 5,222 carcinomas and 28,579 advanced adenomas were diagnosed, making the Italian experience one of the most advanced in the world.

Fifteen new programmes were started, 12 of which were in the South of Italy and Islands, which maintained a delay in comparison with the North and Centre, in part because a number of programmes was suspended.

Overall, 78% of the annual target population residing in areas with a programme were invited.

The extension of invitations of the programmes that had been activated before 2007 was optimal, while the more recent programmes showed much lower performances (on average, 46%). It seems that the new programmes are meeting more problems in reaching adequate numbers of invitations. We recommend a careful monitoring of this indicator to all programmes.

Compliance with invitation is in line with the previous years. However, the very low values that affect many programmes, particularly when associated with a limited extension of invitations, are of particular concern, as in some cases the com-bined effect of these two elements makes the proportion of the target population that has been effectively screened marginal. Intra-regional attendance showed high levels of variability, which suggests the possibility of increasing the performance of many programmes.

Overall, 82% of the subjects that had attended a screening episode responded to the subsequent invitation. No differences according to age or gender were observed, suggesting that the experience of the previous screening episode becomes the main driver for subsequent attendance, as already described in the literature.[8] Thus, the effect of other factors, which influence response to the first invitation, decreases. It is therefore important for programmes to identify the limitations that may have determined a lack of satisfaction in the screened population, especially if the attendance rate is low, because attendance in subsequent rounds is necessary to obtain the expected protection. Attendance among subjects that had already been invited but never attended was 18%. This reflects the possibility to enrol subjects at higher risk (because they have never been screened) and the importance of continuing to regularly invite this group of people that might seem reluctant to participate in screening. These data suggest that the screened population changes over the years. This means that:

■ the test coverage of the target population is higher than the number of screened subjects;

■ for subjects who do not regularly undergo screening, the protective effect of screening will be lower than expected.

This aspect should be taken into consideration when comparing the impact of FIT *vs* FS programmes, because the latter provides a protection that lasts for at least 12 years to all screenees. On the other hand, the protection afforded by FIT will be extended to a greater number of subjects than those annually recorded in the survey.

The available data are not enough to estimate the length of the protection of FIT and hence the interval between two tests that still confers a consistent risk reduction.

The evaluation of diagnostic indicators is difficult because many programmes produced incomplete data and this may be misleading when interpreting the results on a regional basis: some indicators depend on many factors (e.g., DRs are influenced by the distribution of the screenee by age and sex, by FIT positivity, and by compliance to colonoscopy) and they should be interpreted according to their intra-regional composition. For each indicator we had to select the programmes that sent complete data, with a possible selection bias. Unfortunately, the less complete questionnaires came from the regions with the lower number of programmes, leading to an even greater bias. FIT showed to be an excellent first-level test for colorectal screening in terms of homogeneity of positivity rates both at first and subsequent episodes, with high PPVs and short delay between the test and the mailing of a negative result. Other evidence is still sparse, such as evaluation of the sensitivity of FIT-based programmes through interval cancers. GISCoR produced an *Operative report* on the collection of interval cancers and the estimate of sensitivity, for the purpose of making

the monitoring of this fundamental aspect of screening programmes easier and more homogenous.

Particular attention should be given to attendance to colonoscopy (81.1%). This is a critical point of FIT programmes which has been observed in the last 5 years without any sign of improvement. The actual proportion of FIT+ subjects that did not undergo any further assessment was probably lower, since many programmes did not collect data about assessments performed in non-screening settings. According to a multicentric Italian study, about 3% of FIT+ subjects underwent TC outside the screening programme.[9]

However, it must be stressed that the duty of screening programmes is not only that of reaching high levels of attendance to colonoscopy, but also making sure that FIT+ subjects have undergone assessment, even if outside the programme. The data reported suggest that many programmes did not concern themselves with this aspect.

A further issue that needs to be analyzed locally is the relationship between attendance to colonoscopy and the use of sedation and waiting time for assessment. During 2011-2012, we observed a generalized difficulty for endoscopic services in dealing with the workload deriving from screening positives, as the burden of colonoscopies for the follow-up of adenomas progressively increases.

Italian data are similar to those reported in the literature.[10-12] Some Italian experiences, which recorded attendance rates higher than 90%, underlined the relationship between a high compliance to colonoscopy and the diagnostic yield of screening programmes.[13,14] A multicentric study recently showed that different modalities of invitation may be used to increase compliance with colonoscopy.[9]

The analysis of PPV of FIT+ at colonoscopy confirms the high values reported in the previous years. According to these findings, it is essential that screening programmes adopt strategies in order to maximise colonoscopy attendance, or to ensure that subjects with a positive FIT undergo further diagnostic assessment in non-screening structures.

Compared to the last years, the overall DRs of carcinoma and advanced adenoma were stable, even though many programmes showed a lower DRs at first screening. This is not worrisome, since for programmes at subsequent rounds, a high proportion of the population that undergoes the screening test for the first time is represented by fifty-year-old subjects, which are at lower risk of disease.

Since DRs are calculated dividing the diagnosed lesions by the screened population, they are inversely associated with loss of attendance to colonoscopy. In fact, when adjusting the DRs by attendance to colonoscopy, we observed a levelling off of the differences between regional means (data not shown).

The fluctuations of DRs between programmes and regions suggest, beyond different underlying prevalence rates, the presence of other factors responsible for this aspect influencing the diagnostic sensitivity of the screening programme, such as the quality of endoscopy and the different criteria locally used to classify adenomas as advanced or non-advanced. The high variability among programmes of the ratio between advanced and non-advanced adenomas seems to confirm the importance of the latter factor.

Adenoma detection rate is one of the most important indicators to monitor the quality of colonoscopy.[7] The data obtained from programmes show a good quality of colonoscopies in terms of completeness (91% of caecal intubation rates) and complication rates, both for surgical and non-surgical TCs.

The National centre for screening monitoring, together with GISCoR and with the major Italian scientific societies of endoscopy, carried out an assessment, the Equipe study, in order to evaluate the performance of colonoscopies at the level of individual endoscopists and endoscopy services. The results of the study are in line with those produced by the national survey. In particular, the analysis of 75,569 total colonoscopies carried out in 44 screening programmes showed that policies addressing organizational issues, such as sedation and the availability of screening sessions, may improve adenoma detection rate and overall quality of colonoscopy.[15]

As for treatment, we collected information about the use of surgical intervention versus endoscopic resection alone. Overall, 15% of carcinomas underwent endoscopic resection alone, resulting in improved patient quality of life and cost reduction. This percentage increased only to 41% in pT1 cases, which mostly involve invasive malignant polyps. A possible overtreatment of these subjects should be accounted for. Overall, 97% of advanced adenomas were treated through endoscopic resection alone.

An important step that requires evaluation is post-colonoscopy follow-up, which represents a relevant share of the total endoscopic workload of programmes that actively invite subjects to follow-up. Application of the European guidelines protocols would reduce the burden of these exams substantially, because the observed recommendations mainly result in an over-prescription of endoscopic follow-up. We encourage screening programmes to locally evaluate the indicators that are reported in this survey, in order to verify compliance with the European guidelines, both of endoscopists and endoscopy services, especially if the waiting time for colonoscopy is particularly long.

This survey could not evaluate the outcomes of follow-up: this would require an individual collection of information about the timing and diagnosis of the index colonoscopy. We recommend that programmes and regions that have adequate historical databases carry out these analyses, which are expected to confirm the evidence underlying the recommendations of the European guidelines and would be useful to support the spread of their application.

Finally, the results of this survey may be used by new programmes to estimate the burden of colonoscopic workload they may expect as time goes by.

Conflicts of interests: none declared

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