

# Cancer screening programmes in Italy during the COVID-19 pandemic: an update of a nationwide survey on activity volumes and delayed diagnoses

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## Abstract

**Introduction.** In Italy, regional governments are in charge of implementing cervical, breast and colorectal cancer screening programmes. The 2020 Coronavirus pandemic led to a national lockdown and the temporary suspension of several non-urgent health-care activities, including cancer screening. This paper aims to describe the results of a national survey carried out by the National Centre for Screening Monitoring (ONS) on cervical, breast and colorectal cancer screening activities in 2020.

**Materials and methods.** A national survey was conducted by ONS in 2020 to assess: the number of screening invitations by Region; the volumes of screening tests and the attitude to attend the screening programme compared to 2019; the number of delayed diagnoses of malignant or pre-malignant lesions caused by the slowing down of screening programmes, based on the average Region-specific screening detection rate for cervical, breast and colorectal cancers.

**Results.** Screening tests for breast, colorectal and cervical cancer decreased by 37.6%, 45.5% and 43.4% in 2020 compared with 2019. In 2020 the estimated numbers of undiagnosed lesions are: 3,324 breast cancers, 1,299 colorectal cancers, 7,474 colorectal advanced adenomas and 2,782 CIN2 or more severe cervical lesions. Participation in cancer screening programmes decreased by 15%, 15% and 20%, for cervical, breast and CRC screening, respectively.

**Discussion and conclusions.** An urgent call to action is needed to prevent further delays and to limit the impact of the pandemic on cancer diagnosis and prevention.

## Key words

- cancer screening
- COVID-19
- delayed diagnosis
- Italy
- survey

## INTRODUCTION

In Italy, Regions are responsible for organizing cancer screening programmes, aiming at early detection of cervical, breast and colorectal cancer. Indeed, a national law included these screening programmes among the public health interventions that all Regions must implement [1]. The outbreak of the Coronavirus infection (COVID-19) severely hit Italy, and led the

Italian Government to adopt severe containment measures, such as a nationwide lockdown that started the 9 March 2020 [2]. The response to the pandemic (in Italy as well as in other countries) had an impact on the health system and resulted in a sudden suspension of several non-urgent health care activities, including cancer screening services, offered to the asymptomatic population [3]. However, referrals for subjects with

a previous positive cancer screening test were maintained [4].

The effectiveness of cancer screening programmes is entangled with a timely management of patients. This is because timely lesion identification might allow for an early-stage diagnosis, that would lead to more conservative treatments, and prevent severe complications. The risk associated with the delay of the diagnosis of cancer due to COVID-19 has increasingly drawn the scientific community attention. Several studies are ongoing, aiming to assess the impact of interruption of routine screening services on cancer diagnosis and deaths. Simulation modelling studies, even if based on different assumptions, showed that an interruption of screening activity is associated with an increased number of cancer deaths, in particular in the years immediately following the suspension of screening programmes [5-8]. The main determinants of the impact of the interruption of the screening activities on health were: the duration of the suspension; the strategy adopted for catching up those who, even if invited, could not participate in the screening due to the lockdown restrictions/suspension; and the participation rate of the invited population [9]. For example, for stage 3 colorectal cancer, a recent study demonstrated that a 2-month delay to surgery is predicted to cause more than 9% reduction in survival across all age groups, while for a 6-month delay, this reduction is estimated to be >29% [7]. Moreover, the differential impact of stopping screening activity by SES (Socioeconomic Status) as well as the equity implications of adopting different recovery strategies has been debated [10].

In Italy, the National Centre for Screening Monitoring (ONS) and the Italian Group for Colorectal Screening (GISCoR) formulated the criteria to orient decisions about the design of recovery plans, prioritizing people whose screening was delayed because of the lockdown [11, 12]. In Italy, the suspension of screening services lasted from March until April 2020, even though in a non-homogeneous way among the different Regions. In the same way, programmes were restarted in May 2020, with relevant differences among Regions [13]. ONS – a technical network of Italian screening regional centers supporting Regions and the Ministry of Health in screening programmes monitoring and quality assurance – has conducted periodic national surveys to monitor cancer screening programmes during the COVID-19 emergency. The main aim of the surveys was to describe accrued delays by comparing 2019 and 2020 data, to evaluate the reboot velocity after the lockdown and to provide estimates of missed diagnoses – i.e., malignant or pre-malignant lesions subjected to a diagnostic delay due to the slowdown of screening programmes. The first survey showed that, between January and May 2020, half as many tests were done in 2020 at a national level, compared with the same period of 2019. In addition, the survey highlighted that not every regional programme restarted in May 2020 [13]. The survey was designed as a three waves study (Jan-May 2020; June-Sep 2020; Oct-Dec 2020). This paper aims to describe the results of the national survey to closely monitor screening programmes delays and reboots.

## MATERIALS AND METHODS

### Setting

In Italy, regional governments are in charge of implementing cervical, breast and colorectal cancer screening programmes through local health authorities. Breast cancer screening programmes invite women aged between 50 and 69 for a mammogram every two years (in some Regions target age is extended from 45 to 74, with annual screening from 45 to 49). Cervical screening programmes invites all women aged between 25 and 30 for a Pap test every three years, and those aged between 30 and 35 for an HPV test every 5 years until age 64. Finally, colorectal cancer screening programmes invite women and men aged between 50 and 70 (or 74 in some Regions) for a fecal immunochemical test (FIT) every two years. Some Regions also provide the option of one sigmoidoscopy at the age of 58/60.

In Italy, the first COVID-19 case was diagnosed on 21 February 2020. The lockdown was implemented on 8 March 2020, and the infections peaked at the end of March 2020. The lockdown was gradually removed in May/June 2020. As in other European countries, the virus transmission was lower during the summer until October 2020. To face the second wave of COVID-19 infections, the Italian Government implemented a series of new restrictions, but not a complete lockdown ([www.salute.gov.it/portale/nuovocoronavirus/archivio-MonitoraggiNuovoCoronavirus.jsp](http://www.salute.gov.it/portale/nuovocoronavirus/archivio-MonitoraggiNuovoCoronavirus.jsp)).

### Survey procedures

Methods have been described elsewhere [13]. A quantitative survey was conducted by ONS administering an *ad hoc* questionnaire to all 21 regional cancer screening coordinators in October 2020 (first update) and January 2021 (last update). Data were referred to the target population of the breast (women aged 50-69 years old), cervix (women aged 25-64 years old), and colorectal cancer screening (women and men aged 50-69 years old) and concerned:

- screening invitations (i.e. absolute number of subjects contacted either by mail or by phone, counting every subject one time only) between January and December 2020, compared to the same period in 2019;
- absolute number of screening tests performed between January and December 2020 compared to the same period in 2019.

The following estimates, based on the abovementioned data, were then calculated:

- “standard months” of delay (SM), i.e. number of months of activity that would be required to catch up if the programmes were conducted with the same capacity of the pre-COVID era. This parameter is obtained by multiplying the proportion of fewer tests carried out in 2020, in a certain time interval, by the number of months that make up the period;
- missed diagnoses, i.e. the number of malignant or pre-malignant lesions (breast carcinomas, advanced adenomas and colorectal carcinomas, cervical lesions CIN2 or more severe) that will face a diagnostic delay due to the slowing down of screening tests’ offer. The estimates are obtained applying the Region-specific screening detection rate (DR) of the three cancer

screening programmes to the absolute difference of the number of tests performed. The following DRs were applied: (i) breast cancer screening: average DR of years 2016-2018 except for some Regions where data was not available (for Puglia, data relating to the years 2014-2016 were used; for Molise 2014, 2016, 2017; for Calabria 2015, 2016, 2018); (ii) cervical cancer screening: DR of 2017; (iii) colorectal cancer screening: average DR of years 2016-2018 for Fecal Immunochemical Test (FIT)-based programmes (except for Molise where DR was inconsistent and Puglia where the program started in 2019 – for these Regions the average DR from South Italy was applied) and average 2015-2017 DR for flexible-sigmoidoscopy-based programmes;

- attitude to attend the screening test after the invitation, i.e. the comparison of the relative curtailment of screening test performed and with that of screening invitations. The assumption is that if the same number of invitations corresponded to the same participation in 2019, the ratio between exams carried out in 2020 compared to 2019 would correspond to the ratio between invitations made in 2020 compared to 2019.

Twenty-one Regions out of 21 participated in the survey, whereas the results of 2 out of 5 programmes in Calabria are missing. Results are presented for the entire study period (January-December 2020) and sub-periods (Jan-May 2020; June-Sep 2020; Oct-Dec 2020) to monitor reboot speed. However, the data from Basilicata are referred to the whole period of the study and are therefore were not analysed for sub-periods. Secondly, colorectal cancer screening data from Umbria are referred to the 50/74-year-old target population.

## RESULTS

Between January and December 2020, there were 980,994 fewer invitations than 2019 for mammography screening (-26.6%; range Marche -0.5% / Trento -60%), 1,929,530 for colorectal cancer screening (-31.8%; range Basilicata -70.5% / Umbria +6.8%; Puglia not evaluated because the colorectal cancer screening programme started in the second half of 2019), and to 1,279,608 for cervical cancer screening (-33%, range Basilicata -71.3% / Umbria +19.8%) (Table 1). Screening programmes are working hard to recover the delay, even if from the comparison of the three-time periods (January-May, June-September, and October-December) emerged that the recovery is still incomplete. Indeed, the invitations gap between 2020 and 2019 of breast cancer screening decreased from -41.7% to -23.3% and -2.7% in the three-time periods. Similarly, for colorectal cancer screening the gap between 2020 and 2019 decreased from -47.0% to -32.9% and 0.0%; finally, for cervical cancer screening from -41.5% to -38.8% and -13.0%.

The gap of screening tests performed between 2019 and 2020 was of 751,879 exams for breast cancer screening (-37.6 %, range: Umbria -9.1% / Calabria -63.3%), with an average delay of 4.5 SM; of 1,110,414 tests for colorectal cancer screening (-45.5%, range: Umbria -0.2% / Campania -78.6%) with an average delay of 5.5 SM; of 669,742 tests for cervical screening

(-43.4%, range: Basilicata -74% / Umbria +1.8%) with an average delay of 5.2 SM (Table 2, Table 3). However, a large variability was observed among Regions for all three screening programmes.

We estimate that the number of undiagnosed lesions is 3,324 breast cancers; 1,299 colorectal cancers; 7,474 colorectal advanced adenomas; and 2,782 CIN2 or more severe cervical lesions (Table 4). The participation decreased in all three screening programmes: compared with 2019, the attendance rate to screening invitation was 56.6%/67.0%=0.85 for cervical, 62.4%/73.4% = 0.85 breast and 54.5%/68.2% = 0.80 for colorectal cancer screening. These data show a decreased participation by 15%, 15% and 20% in each screening programme.

## DISCUSSION

This paper provides an update of the quantitative estimate of the accumulated delays in cancer screening programmes, due to the COVID-19 epidemic in Italy. While the first survey included data on the lockdown period (March and April 2020), this second one includes data until December 2020, a period of potential recovery. The latest data show that although organized screening restarted after the lockdown, delays did not recover by the end of 2020 and they are increasing compared with the previous year. Despite the efforts, it is complicated to recover the backlog, also because the longer operating time necessary for each exam cause a slowing downtime of screening performance. Indeed, a set of new measures were introduced to reduce risk of contagion - such as disinfection, personal protective equipment, lowered number of people in waiting rooms, reduced availability of personnel and medical rooms. For these reasons delays were still growing in the second (June-September) and third (October-December) observation period, even if slower than in the first period (January-May). Variability in the recovery pace was observed across Regions and programs. After May 2020 Umbria, Emilia-Romagna, and Tuscany invited more individuals than in previous years, showing a commitment to the screening coverage recovery. On the other hand, other Regions (i.e., Campania, Lombardy, Basilicata) showed an opposite trend. Among the three programmes, breast cancer screening showed a faster recovery, as evidenced by the 0.9 and 0.8 SM of the second and third periods.

Analyzing these data, it is worth mentioning that the volumes of screening activities in 2019, which were used as a reference in this study, are intended to represent the pre-pandemic routine healthcare offer rather than a gold standard. Furthermore, results of cervical cancer screening may be influenced by the progressive transition from invitation to Pap test every 3 years to HPV test every 5 years [14]. For instance, the target population in 2020 is lower than in 2019, also because some programmes started HPV test invitations in 2017 (the next invitation will be in 2022 instead of 2020). In addition, some programmes invited more people to the HPV test in 2017 than in 2016. It should be noted that using the data of only one year as a reference (namely those from 2019) is a limit for this analysis. Nevertheless, 2019 data have been chosen because very similar

**Table 1**  
Difference of screening invitations performed in 2020 vs 2019, by screening programme and time period

Regions/ Autonomous Province	Invitations											
	Jan-May			June-Sept			Oct-Dec			January-December 2020 (%)		
	CS	BCS	CCS	CS	BCS	CCS	CS	BCS	CCS	CS	BCS	CCS
Abruzzo	-6,984	-624	-11,630	-7,803	-6,801	-6,241	18,906	2,576	24,221	4,119 (5.9%)	-4,849 (-11.8%)	6,350 (4.0%)
Basilicata§										-22,541 (-71.3%)	-17,726 (-44.6%)	-51,993 (-70.5%)
PA Bolzano	-2,113	-10,924	-5,462	7,104	-955	15,769	-9,658	-104	13,151	-4,667 (-8.0%)	-11,983 (-35.5%)	23,458 (54.9%)
Campania	-4,7212	-75,635	-71,619	-108,283	-35,071	-69,431	-95,300	-10,403	-35,209	-250,795 (-56.5%)	-121,109 (-44.3%)	-176,259 (-65.5%)
Calabria^	-6,677	-7,882	-9,252	-534	-2,903	-358	-9,021	-855	-1,738	-16,232 (-54.6%)	-11,640 (-55.4%)	-11,348 (-64.8%)
Emilia Romagna	-73,336	-70,445	-119,548	-24,899	12,842	51,981	-4,538	9,503	36,669	-102,773 (-33.5%)	-48,100 (-15.7%)	-30,898 (-5.2%)
FVG	-16,350	-25,756	-33,553	-13,448	21,698	-8,315	-10,658	-9,415	1,643	-40,456 (-41.4%)	-13,473 (-15.2%)	-40,225 (-24.0%)
Lazio	-58,095	-77,572	-161,500	-62,392	-22,125	-100,638	77,883	49,502	113,382	-42,604 (-9.3%)	-50,195 (-12.2%)	-148,756 (-19.4%)
Liguria	-18,627	-25,570	-52,582	-36,012	-14,735	-54,098	14,908	2,546	8,594	-39,731 (-33.9%)	-37,759 (-33.0%)	-98,086 (-43.2%)
Lombardia	-45,350	-159,111	-378,491	-35,527	-59,783	-364,673	-40,949	-33,892	-95,015	-121,826 (-62.3%)	-252,786 (-39.2%)	-838,179 (-64.5%)
Marche	-29,500	-22,900	-45,500	9,587	776	23,350	-7,592	21,624	6,913	-27,505 (-21.6%)	-500 (-0.5%)	-15,237 (-7.6%)
Molise	-2,208	-150	-4,151	931	-1,051	-14,618	-1,280	-464	0	-2,557 (-36.2%)	-1,665 (-21.8%)	-18,769 (-60.6%)
Piemonte# FIT	-81,406	-68,732	-24,377	-21,677	-36,218	-3,839	-29,587	-32,609	7,664	-132,670 (-42.8%)	-137,559 (-42.8%)	-20,552 (-20.3%)
Piemonte FS			-23,608			-17,648			883			-40,373 (-59.0%)
Puglia*	-47,720	-13,224	50,132	-73,513	-48,492	-3,610	-45,284	-29,410	-29,156	-166,517 (-52.6%)	-91,126 (-51.0%)	17,366 (21.2%)
Sardegna	-8,466	5,191	-17,608	-22,047	-19,263	-23,412	-25,687	-12,001	-23,966	-56,200 (-47.0%)	-26,073 (-37.6%)	-64,986 (-57.2%)
Sicilia	-91,889	-32,526	-137,787	19,089	7,310	10,732	-3,427	-5,332	-74,222	-76,227 (-17.1%)	-30,548 (-9.4%)	-201,277 (-38.1%)
PA Trento	-7,083	-7,577	-12,201	-6,717	-7,913	-346	-247	-6,116	3,649	-14,047 (-34.0%)	-21,606 (-60.0%)	-8,898 (-13.3%)
Toscana	-52,349	-25,128	-94,404	-26,376	-24,671	-24,182	17,241	19,944	20,834	-61,484 (-20.7%)	-29,855 (-11.0%)	-97,752 (-19.4%)
Umbria	-9,112	-12,515	-16,867	-588	-435	6,757	19,700	8,650	19,110	10,000 (19.8%)	-4,300 (-6.4%)	9,000 (6.8%)
Valle d'Aosta	-1,926	-3,155	-3,698	1,454	559	-2,174	-413	-1,907	-3,674	-885 (-9.9%)	-4,503 (-56.1%)	-9,546 (-56.8%)
Veneto	-61,788	-50,160	-89,851	-48,136	-16,792	-28,449	-4,086	3,313	5,730	-114,010 (-33.3%)	-63,639 (-19.2%)	-112,570 (-18.5%)
<b>ITALY</b>	<b>-668,191</b>	<b>-684,395</b>	<b>-1,263,557</b>	<b>-449,787</b>	<b>-254,023</b>	<b>-613,443</b>	<b>-139,089</b>	<b>-24,850</b>	<b>-537</b>	<b>-1,279,608</b>	<b>-980,994</b>	<b>-1,929,530</b>
	<b>(-41.5%)</b>	<b>(-41.7%)</b>	<b>(-47.0%)</b>	<b>(-38.8%)</b>	<b>(-23.3%)</b>	<b>(-32.9%)</b>	<b>(-13.0%)</b>	<b>(-2.7%)</b>	<b>0.0%</b>	<b>(-33.0%)</b>	<b>(-26.6%)</b>	<b>(-31.8%)</b>

CS= cervical screening, BCS= breast cancer screening, CCS= colorectal cancer screening, FIT=faecal immunochemical test, FS=flexible sigmoidoscopy

\*colorectal cancer screening programme was not activated in 2019

# Data referring to the whole region except for CCS

^ Data of 3 programmes out of 5

§ Data are not provided for subperiods

to what we would expect in terms of invitation and participation rates in 2020 and for this reason, these data should give a realistic estimate of delays.

Referrals for second-level care for positive screening tests have been guaranteed, even if with a lower capacity than before the pandemic, because of organizational needs (i.e., physical distancing and sanitification measures). These new organizational needs may have contributed, after the lockdown, to limit the recovery of the first-level screening tests, and so in further delays in the diagnostic assessment. Additional resources (more professionals, equipment and logistics) are needed as soon as possible to counterbalance the delays accumulated over the whole of 2020.

We estimated that the accumulated delay of 2020, concerning more than two and a half million fewer screening tests being performed, resulted in around 3,300 breast cancers, 1,300 colorectal carcinomas, 7,400 colorectal advanced adenomas and 2,800 CIN2 or more serious cervical lesions facing a diagnostic delay.

The clinical consequences of these delays are more severe for breast and colorectal cancer screening, because those programs are characterized by a relevant detection of invasive cancers (i.e., respectively 4.4 and 1.1 x 1,000 screened compared with 0.15 x 1,000 of cervical cancer screening in 2018-2019) [15]. Therefore, a possible advance in stage at diagnosis would concern a greater amount of cases. Furthermore, a proportion of undetected advanced adenomas could evolve to invasive colorectal carcinoma. [9] Recent studies on the effects of delays in performing a colonoscopy in FIT positive individuals showed that a delay of at least 7-9 months is necessary to observe an increase of the detection of invasive carcinoma and the worsening of the distribution by stage [16, 17].

However, the results of simulation modelling studies on the impact of screening suspension suggest that 3 to 12 months interruptions of screening activity are associated with an increase of mortality and a shift in the diagnosis toward a less favourable stage distribution of screen-detected CRCs [9, 18, 19].



**Table 2**  
Difference of screening tests performed in 2020 vs 2019, by screening programme and time period

Regions/ Autonomous Province	Tests performed																							
	Jan-May						June-Sept						Oct-Dic						January-December 2020					
	CS	%	BCS	%	CCS	%	CS	%	BCS	%	CCS	%	CS	%	BCS	%	CCS	%	CS	%	BCS	%	CCS	%
Abruzzo	-4,779	-48.9	-6,030	-52.9	-5,264	-39.6	-5,070	-44.2	-7,066	-57.2	-251	-1.5	-1,809	-20.8	-6,451	-48.6	-2,313	-21.2	-11,658	-38.9	-19,547	-52.8	-7,828	-19.3
Basilicata§	-1,188	-72.4	-4,832	-53.6	-2,761	-53.5	144	4.1	1,417	35.7	-2,954	-23.3	-407	-2.4	-4,074	-46.6	629	14.2	-1,451	-6.5	-7,489	-34.5	-5,086	-22.8
PA Bolzano	-19,488	-58.7	-23,311	-60.8	-15,622	-54.1	-8,270	-39.4	2,681	21.2	-22,202	-90.6	-24,160	-75.4	-20,133	-93.1	-22,571	-96.3	-51,918	-60.2	-40,763	-56.1	-60,395	-78.6
Campania	-3,536	-75.2	-3,670	-71.2	-1,224	-88.8	1,901	319.0	-597	-42.5	-1,156	-99.9	-2,288	-76.2	-1,191	-57.7	-1,477	-78.0	-3,923	-47.3	-5,458	-63.3	-3,857	-87.1
Calabria ^	-51,854	-62.9	-49,527	-49.1	-71,363	-53.1	-20,658	-33.5	6,364	12.1	12,308	16.7	3,541	9.5	7,311	12.0	21,514	31.1	-68,971	-38.0	-35,852	-16.7	-37,541	-13.5
Emilia Romagna	-11,419	-42.5	-15,144	-53.6	-15,584	-38.6	-5,650	-35.0	7,103	51.4	-7,282	-24.0	-6,164	-35.0	-1,987	-11.9	-998	-3.7	-23,233	-38.3	-10,028	-17.1	-23,864	-24.5
FVG	-30,024	-56.5	-48,910	-65.8	-64,367	-72.0	-12,339	-44.5	-8,103	-20.9	-46,914	-62.4	-21,113	-47.7	-21,986	-37.1	-17,387	-39.7	63,476	-50.7	-78,999	-45.9	-128,668	-61.7
Lazio	-11,232	-60.5	-16,531	-58.9	-18,995	-61.1	-7,568	-78.4	-8,419	-54.9	-20,157	-84.2	-2,260	-26.4	-13,462	-53.9	-11,108	-64.0	-21,060	-57.3	-38,412	-56.2	-50,260	-69.4
Liguria	-21,275	-62.5	-93,399	-61.5	-181,441	-68.6	-17,720	-80.6	-59,195	-47.0	-190,358	-91.3	-26,528	-78.1	-23,926	-24.9	-64,210	-54.8	-65,524	-72.8	-176,520	-47.2	-436,009	-73.9
Lombardia	-12,700	-55.0	-10,900	-51.9	-16,200	-55.5	-4,133	-25.2	-7,192	-40.4	4,285	22.7	-9,144	-33.9	-2,334	-13.6	-2,215	-11.2	-25,977	-39.1	-20,426	-36.5	-14,130	-20.8
Marche	-667	-42.6	-1,420	-50.1	1,381	66.1	141	17.6	-375	-21.5	-6,517	-100.0	-360	-43.7	-1,077	-44.7	0	0.0	-886	-27.8	-2,872	-41.1	-5,136	-59.7
Molise	-38,845	-55.4	-40,160	-52.9	-15,954	-53.7	-26,622	-58.5	-21,774	-41.0	-13,566	-57.4	-23,273	-53.0	-17,963	-36.9	-4,367	-24.0	-88,740	-55.6	-79,897	-45.0	-33,887	-47.4
Piemonte# FIT																								
Piemonte# FS																								
Piemonte*	-21,680	-50.6	-18,906	-50.6	7,700	(nv)	-20,179	-62.4	-16,829	-59.4	-188	-19.1	-3,997	-22.0	-9,098	-34.6	-7,344	-49.0	-45,856	-49.1	-44,833	-48.7	168	1.1
Sardegna	-8,502	-45.1	-5,754	-45.3	-7,308	-56.0	-6,735	-50.1	-7,508	-69.5	-9,177	-80.1	-7,399	-53.6	-5,211	-53.5	-6,647	-71.0	-22,636	-49.1	-18,473	-55.6	-23,132	-67.6
Sicilia	-27,883	-63.1	-22,921	-55.7	-6,982	-43.3	-2,806	-11.3	-10,681	-35.9	-20,342	-52.1	-15,112	-45.3	-13,186	-39.7	-26,452	-80.1	-45,801	-44.8	-46,788	-44.9	-53,776	-61.0
PA Trento	-5,985	-50.5	-5,979	-50.8	-6,716	-45.7	-1,945	-23.9	-6,071	-72.1	1,277	24.9	-1,693	-21.0	-4,051	-60.7	-1,743	-12.1	-9,623	-34.3	-16,101	-59.9	-7,182	-21.0
Toscana	-31,309	-45.0	-31,996	-40.3	-66,393	-57.6	-12,328	-25.0	-5,951	-12.0	-16,921	-27.5	9,336	22.5	2,804	6.0	-993	-1.8	-34,301	-21.4	-35,143	-20.0	-84,307	-36.2
Umbria	-8,013	-48.2	-12,053	-53.4	-6,689	-32.6	-387	-3.5	-1,277	-10.0	-3,581	-16.4	9,100	78.4	8,830	61.4	10,170	69.6	700	1.8	-4,500	-9.1	-100	-0.2
Valle d'Aosta	-1,551	-54.9	-2,001	-48.9	-2,240	-43.4	570	28.1	147	22.9	-3,617	-100.0	-585	-33.1	-1,265	-67.5	-2,839	-100.0	-1,566	-23.7	-3,119	-51.8	-8,696	-74.8
Veneto	-42,735	-56.5	-41,181	-44.7	-100,018	-55.1	-22,006	-39.4	-6,212	-9.8	-836	-0.7	-5,837	-12.3	-6,746	-11.3	1,901	2.1	-70,578	-39.5	-54,139	-25.1	-98,953	-25.6
<b>ITALY</b>	<b>-354,665</b>	<b>-55.3</b>	<b>-454,625</b>	<b>-53.6</b>	<b>-600,664</b>	<b>-57.6</b>	<b>-171,660</b>	<b>-39.6</b>	<b>-149,538</b>	<b>-27.1</b>	<b>-352,795</b>	<b>-45.3</b>	<b>-130,152</b>	<b>-28.9</b>	<b>-135,196</b>	<b>-23.7</b>	<b>-140,938</b>	<b>-23.8</b>	<b>-669,742</b>	<b>-43.4</b>	<b>-751,879</b>	<b>-37.6</b>	<b>-1,110,414</b>	<b>-45.5</b>

CS= cervical screening, BCS= breast cancer screening, CCS= colorectal cancer screening, FIT=faecal immunochemical test, FS=flexible sigmoidoscopy

\*colorectal cancer screening programme was not activated in 2019

# Data referring to the whole region except for CCS

^ Data of 3 programmes out of 5

§ Data are not provided for subperiods

**Table 3**  
Standard months of delay in 2020, by screening programme and time period

Regions/ Autonomous province	Cervical cancer screening				Breast cancer screening				Colorectal cancer screening			
	Jan- May	Jun- Sep	Oct- Dic	Jan- Dic	Jan- May	Jun- Sep	Oct- Dic	Jan- Dic	Jan - May	Jun - Sep	Oct - Dic	Jan - Dic
Abruzzo	-1.9	-2.0	-0.7	-4.7	-2.0	-2.3	-2.1	-6.3	-1.6	-0.1	-0.7	-2.3
Basilicata§				-8.9				-5.2				-8.1
PA Bolzano	-0.6	0.1	-0.2	-0.8	-2.7	0.8	-2.3	-4.1	-1.5	-1.6	0.3	-2.7
Campania	-2.7	-1.2	-3.4	-7.2	-3.9	0.4	-3.3	-6.7	-2.4	-3.5	-3.5	-9.4
Calabria^	-5.1	2.7	-3.3	-5.7	-5.1	-0.8	-1.7	-7.6	-3.3	-3.1	-4.0	-10.5
Emilia Romagna	-3.4	-1.4	0.2	-4.6	-2.8	0.4	0.4	-2.0	-3.1	0.5	0.9	-1.6
FVG	-2.3	-1.1	-1.2	-4.6	-3.1	1.5	-0.4	-2.0	-1.9	-0.9	-0.1	-2.9
Lazio	-2.9	-1.2	-2.0	-6.1	-3.4	-0.6	-1.5	-5.5	-3.7	-2.7	-1.0	-7.4
Liguria	-3.7	-2.5	-0.7	-6.9	-2.9	-1.5	-2.4	-6.7	-3.1	-3.3	-1.8	-8.3
Lombardia	-2.8	-2.4	-3.5	-8.7	-3	-1.9	-0.8	-5.7	-3.7	-3.9	-1.3	-8.9
Marche	-2.3	-0.7	-1.6	-4.7	-2.3	-1.5	-0.5	-4.4	-2.9	0.8	-0.4	-2.5
Molise	-2.5	0.5	-1.4	-3.3	-2.4	-0.6	-1.8	-4.9	1.9	-9.1	0.0	-7.2
Piemonte# FIT	-2.9	-2.0	-1.8	-6.7	-2.7	-1.5	-1.2	-5.4	-2.7	-2.3	-0.7	-5.7
Piemonte FS									-3.3	-3.3	-1.8	-8.4
Puglia*	-2.8	-2.6	-0.5	-5.9	-2.5	-2.2	-1.2	-5.8				
Sardegna	-2.2	-1.8	-1.9	-5.9	-2.1	-2.7	-1.9	-6.7	-2.6	-3.2	-2.3	-8.1
Sicilia	-3.3	-0.3	-1.8	-5.4	-2.6	-1.2	-1.5	-5.4	-0.9	-2.8	-3.6	-7.3
PA Trento	-2.6	-0.8	-0.7	-4.1	-2.7	-2.7	-1.8	-7.2	-2.4	0.4	-0.6	-2.5
Toscana	-2.3	-0.9	0.7	-2.6	-2.2	-0.4	0.2	-2.4	-3.4	-0.9	-0.1	-4.3
Umbria	-2.4	-0.1	2.8	0.2	-2.9	-0.3	2.1	-1.1	-1.4	-0.8	2.1	0.0
Valle d'Aosta	-2.8	1.0	-1.1	-2.8	-4	0.3	-2.5	-6.2	-2.3	-3.7	-2.9	-9.0
Veneto	-2.9	-1.5	-0.4	-4.7	-2.3	-0.3	-0.4	-3	-3.1	0	0.1	-3.1
ITALIA	-2.8	-1.3	-1.0	-5.2	-2.8	-0.9	-0.8	-4.5	-3.0	-1.8	-0.7	-5.5

CS= cervical screening, BCS= breast cancer screening, CCS= colorectal cancer screening, FIT=faecal immunochemical test, FS=flexible sigmoidoscopy.

\*colorectal cancer screening programme was not activated in 2019

# Data referring to the whole region except for CCS

^ Data of 3 programmes out of 5

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Similar results have been reported from modelling studies on breast cancer mortality and stage shift, as a result of delayed diagnosis following screening suspension [8, 19]. For cervical lesions, consequences could be less severe because this screening aims at identifying pre-neoplastic lesions with a natural history characterized by a slow progression and sometimes a possible regression [20]. If a CIN 3 lesion is detected instead of a CIN 2, the standard treatment is not more invasive and the prognosis is similar. Anyway, a more accurate estimate of the impact of the lockdown on cancer screening will be possible by comparing the stage at diagnosis of cancers detected in 2020 with the ones detected in the previous years.

Modelling studies are also showing that the impact of screening suspension is related to some factors: the duration of the suspension, the participation rate during the recovery period, and the catch-up strategy adopted by the screening center. An immediate catch-up of all delayed invitations would minimize the negative impact of the suspension. However, the observed trend in the recovery progression suggests that such an option is un-

likely to be feasible in every setting. Recovery strategies based on the adoption of priority criteria may, however, mitigate the negative effects of the screening suspension [8, 9, 11, 12, 19]. As an example, the approach of the Dutch breast cancer screening program to first invite those women who were not able to previously attend due to the suspension, might explain the unobserved shift towards a higher tumor stage at diagnosis. Nevertheless, a decreased incidence of screen-detected tumors was reported [21]. To allow directing limited resources to people who may benefit the most, the screening centers should adopt risk-based approaches to screening, following frameworks established before the pandemic, or adopting the expected Positive Predictive Value of the test as a priority criterion for the invitation. At the same time, the screening interval for lower-risk subjects should be extended. The implementation of these strategies may ensure equity of access to screening.

Low participation is still limiting the impact of the recovery strategies. Following the lockdown, in Italy as in other countries, patients were frightened, especially those with comorbidities, and sometimes they try to

**Table 4**

Quantitative estimate of lesions that may face a diagnostic delay due to the screening interruption by screening programme, 2020 vs 2019

Regions/ Autonomous Province	Cervical cancer screening			Breast cancer screening			Colorectal cancer screening				
	Gap of screening test in 2020 vs 2019	Detection Rate of CIN2+ (per 1000 screened)	Missed diagnosis of CIN2+ (estimate)	Gap of screening test in 2020 vs 2019	Detection Rate of breast cancer (x 1000 screened)	Missed diagnosis of breast cancer (estimate)	Gap of screening test in 2020 vs 2019	Detection Rate of colorectal cancer (x 1000 screened)	Missed diagnosis of colorectal cancer (estimate)	Detection Rate of Advanced adenoma (x 1000 screened)	Missed diagnosis of advanced adenoma (estimate)
Abruzzo	-11,658	5.7	-66	-19,547	4.5	-88	-7,828	3	-23	11.8	-92
Basilicata§	-13,264	1.8	-24	-12,520	4.1	-51	-16,017	1.1	-18	1.2	-19
PA Bolzano	-1,451	NA		-7,489	4.8	-36	-5,086	1.1	-6	4.3	-22
Campania	-51,918	2	-104	-40,763	2.9	-118	-60,395	1.6	-97	4.5	-272
Calabria ^	-12,383	10	-39	-5,458	4	-22	-3,857	3.1	-12	3.4	-13
Emilia Romagna	-68,971	5.2	-362	-35,852	5.5	-197	-37,541	0.9	-34	7.6	-285
FVG	-23,233	4.9	-114	-10,028	5.7	-57	-23,864	1	-24	4.2	-100
Lazio	-63,476	4.4	-278	-78,999	4.2	-332	-128,668	1.9	-244	10.4	-1,338
Liguria	-21,060	5.4	-114	-38,412	3.1	-119	-50,260	0.8	-40	4.4	-221
Lombardia	-65,524	3.8	-250	-176,520	4.4	-777	-436,009	0.9	-392	4.9	-2,136
Marche	-25,977	2.8	-73	-20,426	4	-82	-14,130	1.1	-16	6.8	-96
Molise	-886	1.0	-1	-2,872	3.5	-10	-5,136	1.7	-9	5.6	-29
Piemonte# FIT	-88,740	6.4	-568	-79,897	5.5	-439	-33,887	1.7	-58	12.2	-413
Piemonte FS							-11,758	2.8	-33	46.1	-542
Puglia*	-45,856	0.4	-18	-44,833	4.3	-193					
Sardegna	-22,636	5.1	-116	-18,473	3.3	-61	-23,132	2.1	-49	6	-139
Sicilia	-45,801	1.8	-84	-46,788	3	-140	-53,776	1.1	-59	5.7	-307
PA Trento	-9,623	5.2	-50	-16,101	6	-97	-7,182	1	-7	7.4	-53
Toscana	-34,301	6.4	-220	-35,143	5.2	-183	-84,307	0.9	-76	5.6	-472
Umbria	-700	12.3	9	-4,500	3.4	-15	-100	0.6	0	5.8	-1
Valle d'Aosta	-1,566	3	-5	-3,119	4.5	-14	-8,696	0.5	-4	6	-52
Veneto	-70,578	4.3	-307	-54,139	5.4	-292	-98,953	1	-99	8.8	-871
ITALY	-669,742	4.5	-2,782	-751,879	4.7	-3,324	-1,110,582	1.1	-1,299	6.7	-7,474

CS= cervical screening, BCS= breast cancer screening, CCS= colorectal cancer screening, FIT=faecal immunochemical test, FS=flexible sigmoidoscopy.

\*colorectal cancer screening programme was not activated in 2019

# Data referring to the whole region except for CCS

^ Data of 3 programmes out of 5

§ Data are not provided for subperiods

NA: not available

avoid healthcare settings that they perceived as at high risk of infection. Studies showed that even severe symptomatic patients avoided searching for medical assistance in emergency departments [22, 23]. Our results confirm that the attitude of the invited population to attend screening invitations was lower than before the pandemic, with a reduction in participation of 15% for cervical, 15% for breast and 20% for colorectal cancer screening. A decrease in screening uptake is not reported everywhere: the Scottish experience shows that pandemic represented an opportunity to transform and renew screening services with a robust recovery plan and a clear practical implementation of the restart. Such an approach led to greater participation levels than in previous years for breast, colorectal, and cervical screening [24]. It will therefore be of the utmost importance to develop communication strategies suitable for promoting

participation during this emergency, as well as to pursue new possible organizational features, such as postal delivery of self-sampling devices for HPV test or FIT test [14]. These measures will be of particular relevance also to counterbalance the possible search of opportunistic screening, not adequately monitored, and to prevent inequity issues that may arise from this tendency.

## CONCLUSIONS

Although organized screening restarted after the 2020 lockdown, delays have not been recovered yet. For this reason, 3,324 breast cancers, 1,299 colorectal cancers and 7,474 colorectal advanced adenomas, and 2,782 CIN2 or more severe cervical lesions may have potentially missed an early diagnosis in Italy in 2020. Effective recovery strategies would involve the adoption of explicit priority criteria, the implementation of well-

designed communication strategies to promote participation, and the allocation of the necessary resources to ensure the implementation of the recovery plans and the sustainability of the programme activities over time.

### Acknowledgements

The Authors wish to thank all the regional screening coordinators for providing regional data: Manuela di Giacomo (Abruzzo), Teresa Landro, Anna Giorno, Annalisa Spinelli (Calabria), Angelo D'Argenzio (Campania), Priscilla Sassoli de' Bianchi (Emilia Romagna), Giulio Menegazzi (Friuli Venezia Giulia), Diego Baiocchi (Lazio), Luigina Ada Bonelli (Liguria), Silvia Deandrea, Claudia Lobascio (Lombardia), Giuseppe Feliciangeli (Marche), Angelo Marcheggiani (Molise), Carlo Senore (Piemonte), Fabio Vittadello (Provincia Autonoma di Bolzano), William Mantovani (Provincia Autonoma di Trento), Nehludoff Albano (Puglia), Pierina Tanchis (Sardegna), Gabriella Dardanoni, Lucia Li Sacchi (Sicilia), Paola Mantellini (Toscana), Stefania Prandini (Umbria), Maurizio Castelli (Valle D'Aosta), Elena Narne (Veneto), Martina Rossi (Osservatorio nazionale screening). We thank Dr. Elisa Betti for the proofreading.

### REFERENCES

- Decreto del Presidente del Consiglio dei Ministri, 12 gennaio 2017. Definizione e aggiornamento dei livelli essenziali di assistenza, di cui all'articolo 1, comma 7, del decreto legislativo 30 dicembre 1992, n. 502. Supplemento Ordinario alla Gazzetta Ufficiale n. 65, 18 marzo 2017.
- Decreto del Presidente del Consiglio dei Ministri. Ulteriori disposizioni attuative del decreto-legge 23 febbraio 2020, n. 6, recante misure urgenti in materia di contenimento e gestione dell'emergenza epidemiologica da COVID-19, applicabili sull'intero territorio nazionale. Gazzetta Ufficiale Serie Generale n. 62, 9 marzo 2020.
- Hamilton W. Cancer diagnostic delay in the COVID-19 era: what happens next? *Lancet Oncol.* 2020;21(8):1000-2. doi: 10.1016/S1470-2045(20)30391-0
- Ministero della Salute. Chiarimenti Rif. Linee di indirizzo per la rimodulazione dell'attività programmata differibile in corso di emergenza da COVID-19. Nota 8076 del 30 marzo 2020.
- Sud A, Torr B, Jones ME et al. Effect of delays in the UK 2-week-wait cancer referral pathway during the COVID-19 pandemic on cancer survival: a modelling study. *Lancet Oncol.* 2020;21(8):1035-44. doi: 10.1016/S1470-2045(20)30392-2
- Maringe C, Spicer J, Morris M, et al. The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population-based, modelling study. *Lancet Oncol.* 2020;21(8):1023-34. doi: 10.1016/S1470-2045(20)30388-0
- Loveday C, Sud A, Jones ME, et al. Prioritisation by FIT to mitigate the impact of delays in the 2-week wait colorectal cancer referral pathway during the COVID-19 pandemic: a UK modelling study. *Gut.* 2021;70:1053-60.
- Breast Screening Working Group (WG2) of the Covid-19 and Cancer Global Modelling Consortium, Figueroa JD, Gray E et al. The impact of the Covid-19 pandemic on breast cancer early detection and screening Preventive Medicine. 2021;151:106585. doi: <https://doi.org/10.1016/j.ypmed.2021.106585>
- de Jonge L, Worthington J, van Wifferen F et al. Impact of the COVID-19 pandemic on faecal immunochemical test-based colorectal cancer screening programmes in Australia, Canada, and the Netherlands: a comparative modelling study. *Lancet Gastroenterol Hepatol.* 2021;6(4):304-14. doi: 10.1016/S2468-1253(21)00003-0
- Castanon A, Rebolj M, Pesola F, Sasieni P. Recovery strategies following COVID-19 disruption to cervical cancer screening and their impact on excess diagnoses. *Br J Cancer.* 2021;124(8):1361-5.
- Osservatorio Nazionale Screening. I programmi regionali di screening oncologico in emergenza COVID-19: raccomandazioni ad interim dell'Osservatorio Nazionale Screening alle Regioni e Provincie Autonome. ISPRO. Available from: [www.osservatorionazionale-screening.it/sites/default/files/allegati/Indicazioni%20Ripartenza%20ONS\\_27-04%20%281%29.pdf](http://www.osservatorionazionale-screening.it/sites/default/files/allegati/Indicazioni%20Ripartenza%20ONS_27-04%20%281%29.pdf).
- Italian group for colorectal cancer screening (GISCoR). Raccomandazioni per il riavvio e recupero dell'attività di screening. Available from: [www.giscor.it/Documenti/doc\\_giscor/recupero\\_attivita\\_CCR\\_proposta\\_GISCoR\\_r2.pdf](http://www.giscor.it/Documenti/doc_giscor/recupero_attivita_CCR_proposta_GISCoR_r2.pdf).
- Mantellini P, Battisti F, Armaroli P et al. Oncological organized screening programmes in the COVID-19 era: an Italian survey on accrued delays, reboot velocity, and diagnostic delay estimates. *Epidemiol Prev.* 2020;44(Suppl. 2):344-52. doi: 10.19191/EP20.5-6.S2.136
- Giorgi Rossi P, Fortunato C., Barbarino, P et al. Self-sampling to increase participation in cervical cancer screening: an RCT comparing home mailing, distribution in pharmacies, and recall letter. *Br J Cancer.* 2015;112:667-75. doi: <https://doi.org/10.1038/bjc.2015.11>
- Osservatorio Nazionale Screening. Rapporto 2019. ISPRO; 2019. Available from: [www.osservatorionazionale-screening.it/content/rapporto](http://www.osservatorionazionale-screening.it/content/rapporto).

### Authors' contribution

Mantellini P, Zappa M: conception and design, critical revision of the article for important intellectual content, final approval of the article; Battisti F: drafting of the article, critical revision of the article for important intellectual content, final approval of the article; Falini P, Gorini G: acquisition of the data, data analyses, critical revision of the article for important intellectual content, final approval of the article; Armaroli P, Giubilato P, Zorzi M, Battagello J: data analyses, critical revision of the article for important intellectual content, final approval of the article; Sassoli de Bianchi P, Giorgi Rossi P, Senore C: critical revision of the article for important intellectual content, final approval of the article.

### Funding

No external funding.

### Conflict of interest statement

All Authors declare that they have no conflict of interest.

Received on 4 October 2021.

Accepted on 2 February 2022.



16. Corley DA, Jensen CD, Quinn VP et al. Association between time to colonoscopy after a positive fecal test result and risk of colorectal cancer and cancer stage at diagnosis. *JAMA*. 2017;25;317(16):1631-41. doi: 10.1001/jama.2017.3634
17. Zorzi M, Hassan C, Capodaglio G et al. Colonoscopy later than 270 days in a fecal immunochemical test-based population screening program is associated with higher prevalence of colorectal cancer. *Endoscopy*. 2020;52(10):871-6. doi: 10.1055/a-1159-0644
18. Yong JH, Mainprize JG, Yaffe MJ, Ruan Y, Poirier AE, Coldman A, Nadeau C, Iragorri N, Hilsden RJ, Brenner DR. The impact of episodic screening interruption: COVID-19 and population-based cancer screening in Canada. *J Med Screen*. 2021;28(2):100-7. doi: 10.1177/0969141320974711
19. Kregting LM, Kaljouw S, de Jonge L, et al. Effects of cancer screening restart strategies after COVID-19 disruption. *Br J Cancer*. 2021;124(9):1516-23.
20. Woodman CBJ, Collins SI, Young LS. The natural history of cervical HPV infection: unresolved issues. *Nat Rev Cancer*. 2007;7(1):11-22.
21. Eijkelboom AH, de Munck L, Lobbes MBI et al. Impact of the suspension and restart of the Ducht breast cancer screening program on breast cancer incidence and stage during the COVID-19 pandemic. *Preventive Medicine* 2021;151:106602. doi: <https://doi.org/10.1016/j.ypmed.2021.106602>
22. De Rosa S, Spaccarotella C, Basso C et al. Reduction of hospitalizations for myocardial infarction in Italy in the COVID-19 era. *Eur Heart J*. 2020;41(22):2083-88.
23. De Filippo O, D'Ascenzo F, Angelini F et al. Reduced Rate of Hospital Admissions for ACS during Covid-19 Outbreak in Northern Italy. *N Engl J Med*. 2020;383:88-9.
24. Campbell C, Sommerfield T, Clarck GRC et al. COVID-19 and cancer screening in Scotland: A national and coordinated approach to minimising harm. *Preventive Medicine*. 2021;151:106606. doi: <https://doi.org/10.1016/j.ypmed.2021.106606>