National Cancer Registry Ireland

Cancer Trends

Breast, cervical and colorectal cancer 1994-2019: National trends for cancers with population-based screening programmes in Ireland

Introduction

The overall burden of cancer in Ireland is increasing, primarily due to population growth and ageing, with the annual number of cases of breast cancer, cervical cancer and colorectal cancer estimated to increase by 50%, 56% and 113% respectively by 2045 compared with 2015.[1 2]

The purpose of this report is to present the most up to date national data and trends on incidence, stage, survival and mortality for invasive breast, cervical and colorectal cancers in Ireland, providing context to the screening programmes for these cancers overall and for age-ranges currently relevant to screening.[3 4 5]

At present, there are three national cancer screening programmes in Ireland: BreastCheck, CervicalCheck and BowelScreen. These programmes aim to reduce morbidity and mortality in the population through prevention or early detection of cancer, thus improving the likelihood of better outcomes.

Internationally, there is substantial evidence showing that the introduction of a screening programme results in 'stage shift' towards a greater proportion of early stage cases (stage I and II) among diagnosed cancers. It is also known that earlier diagnosis results in improvements in survival time at an individual level and reductions in cancer mortality rates in the longer term. In the shorter-term, changes in incidence rates may occur when a screening programme is first introduced, due to the identification of prevalent cancers at the time of screening implementation. This report aims to review the epidemiology of invasive breast, cervical and colorectal cancers in Ireland, with a specific emphasis on such expected changes.

Summary statistics

On average, there were 6,524 cases of breast, cervical and colorectal cancers diagnosed (6,490 excluding male breast cancers) and 1,834 deaths due to these cancer types (1,828 excluding male breast cancers) each year in Ireland over the period 2017-2019 (Table 1). Of these, approximately 25% of breast, 32% of cervical and 6% colorectal diagnoses were screen-detected. While these include a small number of people screened opportunistically (see Glossary for more details), the vast majority were screened as part of one of the national screening programmes (at least 94%, 79% and 84% of screen-detected breast, cervical and colorectal cancers respectively).

Breast, cervical and colorectal cancers (screen-detected and symptomatic) accounted for 27.0% of all invasive cancers (excluding non-melanoma skin cancers) diagnosed 2017-2019, and 19.9% of all deaths from malignant neoplasms 2017-2019. In women, these three cancers accounted for 43.7% of all invasive cancers diagnosed (excluding non-melanoma skin cancers) and 29.0% of deaths from malignant neoplasms over that time period. The incidence figures are based on the first invasive cancer of a particular morphological grouping occurring at a specific site in a patient, in line with international rules on reporting of multiple primaries.[6]

Table 1. Average annual number of total cases and deaths, and age-standardised rates (ASR) for breast, cervical and colorectal cancer 2017-2019

	Incidence 2017-2019					Mortality 2017-2019				
	Annual case counts			ASR per 100,000*		Annual deaths			ASR per 100,000*	
	#Male	Female	All	Male	Female	Male	Female	All	Male	Female
C50 Breast (all ages)	**34**	**3507**	**3542**	**1.3**	**130.0**	**6**	**732**	**738**	**0.2**	**23.8**
0-49 years	3	814	817	0.2	44.4	0	78	78	0	4.3
50-69 years	13	1713	1726	2.5	323.0	2	253	255	0.4	47.4
70+ years	18	980	998	8.5	391.3	4	400	404	1.8	147.8
C53 Cervix uteri (all ages)	-	**292**	**292**		**11.3**	-	**93**	**93**	-	**3.4**
0-24 years	-	<1	<1		<1	-	<1	<1	-	<1
25-59 years†	-	228	228		19.1	-	42	42	-	3.6
60+ years	-	64	64		13.3	-	51	51	-	10.1
C18-20 Colorectum (all ages)	**1552**	**1138**	**2690**	**57.3**	**37.7**	**584**	**419**	**1003**	**21.0**	**12.6**
0-59 years	334	280	614	17.1	14.0	79	58	137	4.0	2.9
60-69 years	427	265	693	184.8	113.2	125	77	202	53.9	32.8
70+ years	791	593	1384	376.4	225.9	380	284	664	182.7	102.7

* Rates are standardised to the 1976 European standard population.
#Males are not included in BreastCheck, however number of male breast cancers are tabulated here for completeness.
Age-groups in *italics* in table above are eligible for current screening programmes.
† The average number of incident cases 2017-2019 in women aged 25-60 years (exact screening age group) was 233 and in women 61+ years of age was 59.

For both cervical and colorectal cancer, the most recent trends over time have shown a decrease of 2.8% per year for cervical cancer since 2009, 2.5% per year for colorectal cancer in men since 2012 and 0.3% per year for colorectal cancer in women since 1994 (Table 2). In contrast, trends in breast cancer incidence are complex, with the most recent trend being an increase of 1.7% (95% CI 0.6 to 2.9) per year starting around 2014. Trends in mortality have shown decreasing trends for all three cancers since 1994 (Table 2).

Table 2. Summary of trends in age-standardised incidence and mortality rates 1994-2019 based on joinpoint analysis[7]

Trends in incidence rate per 100,000 (1976 ESP age weights)				**Trends in mortality rate per 100,000 (1976 ESP age weights)**			
C50 BREAST							
from-to	**apc**	**ci**	**trend**	**from-to**	**apc**	**ci**	**trend**
1994-2002	2.9	[2.1,3.7]	↑	1994-2019	-1.8	[-2.1,-1.6]	↓
2002-2005	-1.8	[-7.8,4.6]	↔				
2005-2008	5.5	[-0.7,12.2]	↔				
2008-2014	-0.9	[-2.1,0.4]	↔				
2014-2019	1.7	[0.6,2.9]	↑				
C53 CERVIX UTERI							
from-to	**apc**	**ci**	**trend**	**from-to**	**apc**	**ci**	**trend**
1994-1999	-4.7	[-11.3,2.5]	↔	1994-2019	-1.1	[-1.6,-0.5]	↓
1999-2009	4.1	[1.4,6.9]	↑				
2009-2019	-2.8	[-4.7,-0.9]	↓				
C18-20 COLORECTUM							
Male							
from-to	**apc**	**ci**	**trend**	**from-to**	**apc**	**ci**	**trend**
1994-2012	0.2	[-0.1,0.5]	↔	1994-2019	-2	[-2.3,-1.7]	↓
2012-2019	-2.5	[-3.4,-1.5]	↓				
Female							
from-to	**apc**	**ci**	**trend**	**from-to**	**apc**	**ci**	**trend**
1994-2019	-0.3	[-0.5,-0.1]	↓	1994-2019	-2	[-2.3,-1.7]	↓
from-to=range of years; apc =annual percentage change over range (%); ci =95% confidence intervals of apc for each distinct range; trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level							

Breast cancer

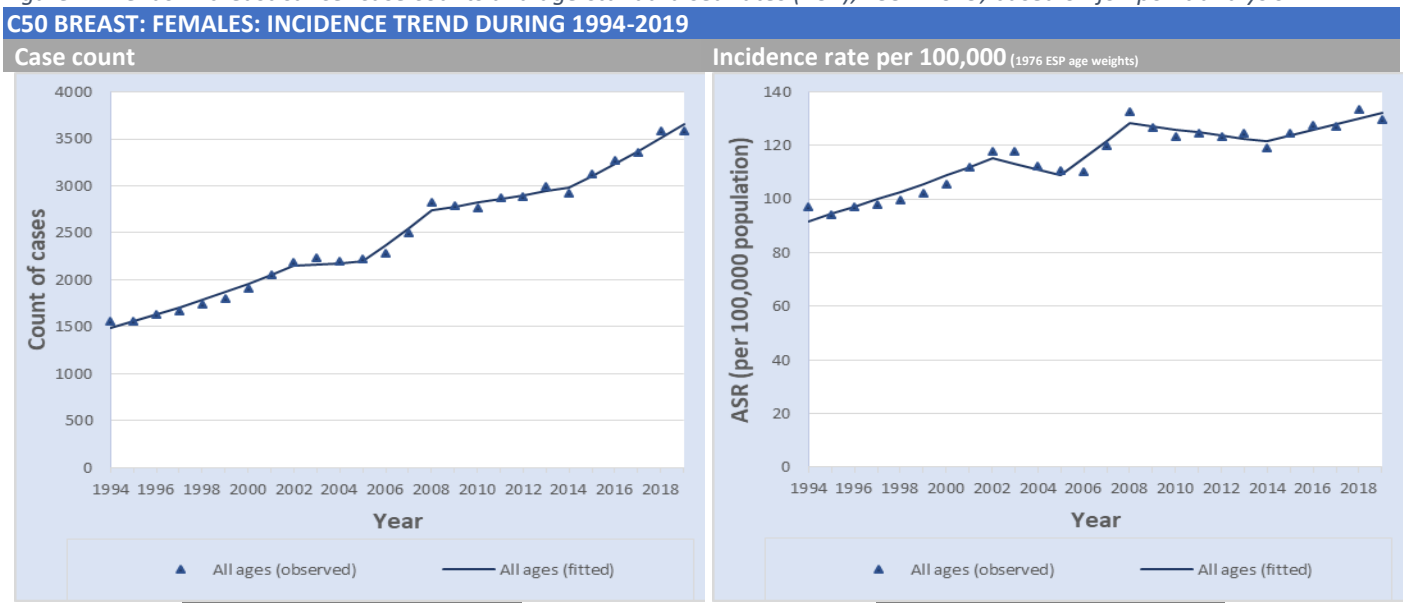
Breast cancer screening in Ireland

BreastCheck began screening for breast cancer in the eastern half of the country in 2000 and this was extended to other regions from 2007.[8] Screening was offered initially every two years to women aged 50-64 years, with an extension of the age eligibility to 69 years starting in 2015.[9] The uptake rate of breast cancer screening is consistently reported to be >70%.[9]

Incidence

In the period 2017-2019, invasive breast cancer accounted for 31% of all incident invasive cancers (excluding non-melanoma skin cancer) in women.[1] Overall, the total number of diagnosed cases per year has been increasing steadily since 1994 (apart from 2002-2005 when numbers stabilised) (Figure 1). However, for age-standardised incidence rates, taking into account changes in the size and age-structure of the underlying population, the increasing trend has only been significant between 1994 and 2002 when rates were increasing by 2.9% annually and then again between 2014 and 2019 when annual increases of 1.7% were seen (Figure 1). These trends are in line with what would be expected given the introduction of a screening programme.

Figure 1. Trends in breast cancer case counts and age-standardised rates (ASR), 1994-2019, based on joinpoint analysis[7]



from-to	apc	ci	trend
1994-2002	4.7	[3.9,5.4]	↑
2002-2005	0.8	[-5.1,7.0]	↔
2005-2008	7.7	[1.6,14.2]	↑
2008-2014	1.4	[0.2,2.6]	↑
2014-2019	4.1	[3.0,5.3]	↑

from-to	apc	ci	trend
1994-2002	2.9	[2.1,3.7]	↑
2002-2005	-1.8	[-7.8,4.6]	↔
2005-2008	5.5	[-0.7,12.2]	↔
2008-2014	-0.9	[-2.1,0.4]	↔
2014-2019	1.7	[0.6,2.9]	↑

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Incidence by age

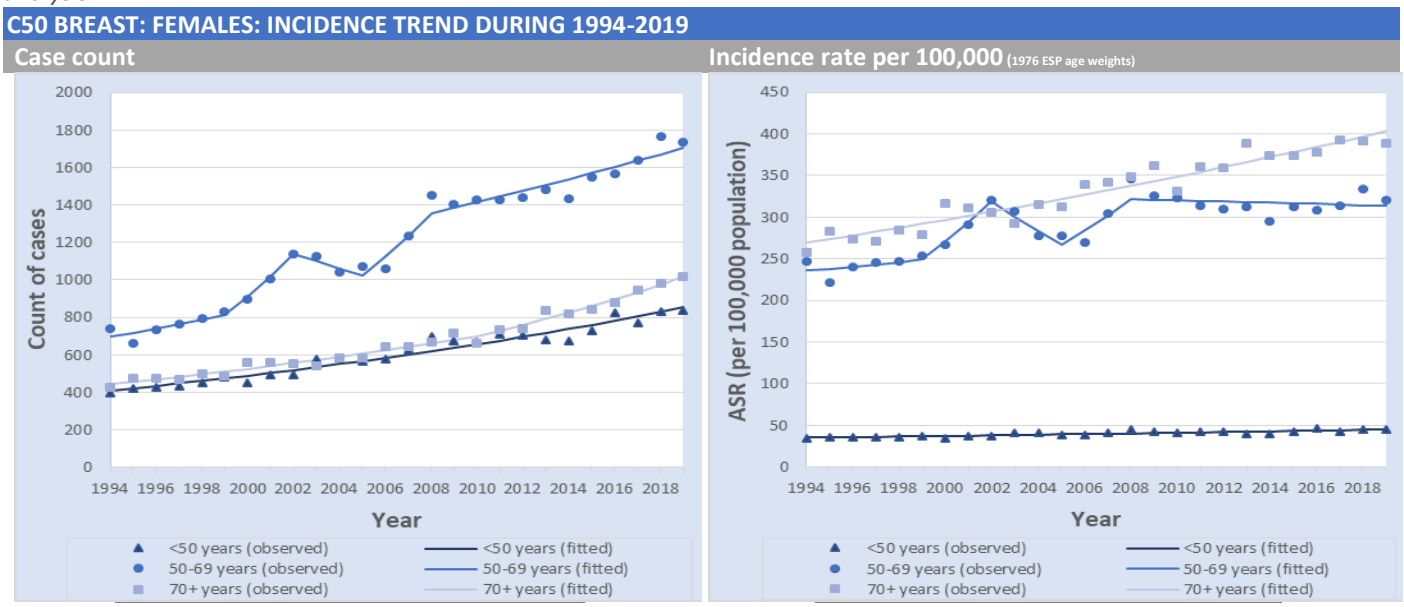
In order to clarify the possible effects of breast cancer screening on incidence of invasive breast cancer, the data were stratified into three age groups based on screening eligibility criteria: pre-screening age group (<50 years); screening age group (50-69 years); and post-screening age group (70+ years).

The age-standardised rate of breast cancer in women in the pre-screening age group increased significantly between 1994 and 2019, by an average of 1% each year (Figure 2).

The age-standardised incidence rate trends in women in the screening age group show a similar pattern to what has been reported previously i.e. an increase in incidence rates followed by a short term decrease, which would be expected following the introduction/expansion of a screening programme (Figure 2).[4] [10] However, none of the modelled trends in annual percentage changes in rates in the screening age group were found to be significant on joinpoint analysis (Figure 2).

The age-standardised rate in women in the post-screening age group experienced a significant average increase, by on average 1.6% per year, over the period 1994-2019 (Figure 2).

Figure 2. Trends in breast cancer case counts and age-standardised rates (ASR) by age group, 1994-2019, based on joinpoint analysis[7]



Age group	from-to	apc	ci	trend
<50 years	1994-2019	3.0	[2.7,3.3]	↑
50-69 years	1994-1999	3.1	[-0.2,6.6]	↔
	1999-2002	11.9	[-1.9,27.6]	↔
	2002-2005	-3.4	[-14.7,9.3]	↔
	2005-2008	9.8	[-2.6,23.8]	↔
	2008-2019	2.1	[1.4,2.8]	↑
70+ years	1994-2010	2.9	[2.5,3.3]	↑
	2010-2019	4.2	[3.4,5.0]	↑

Age group	from-to	apc	ci	trend
<50 years	1994-2019	1.0	[0.7,1.3]	↑
50-69 years	1994-1999	1.1	[-2.2,4.6]	↔
	1999-2002	8.6	[-4.9,24.1]	↔
	2002-2005	-5.8	[-16.9,6.7]	↔
	2005-2008	6.5	[-5.7,20.2]	↔
	2008-2019	-0.2	[-0.9,0.5]	↔
70+ years	1994-2019	1.6	[1.4,1.8]	↑

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

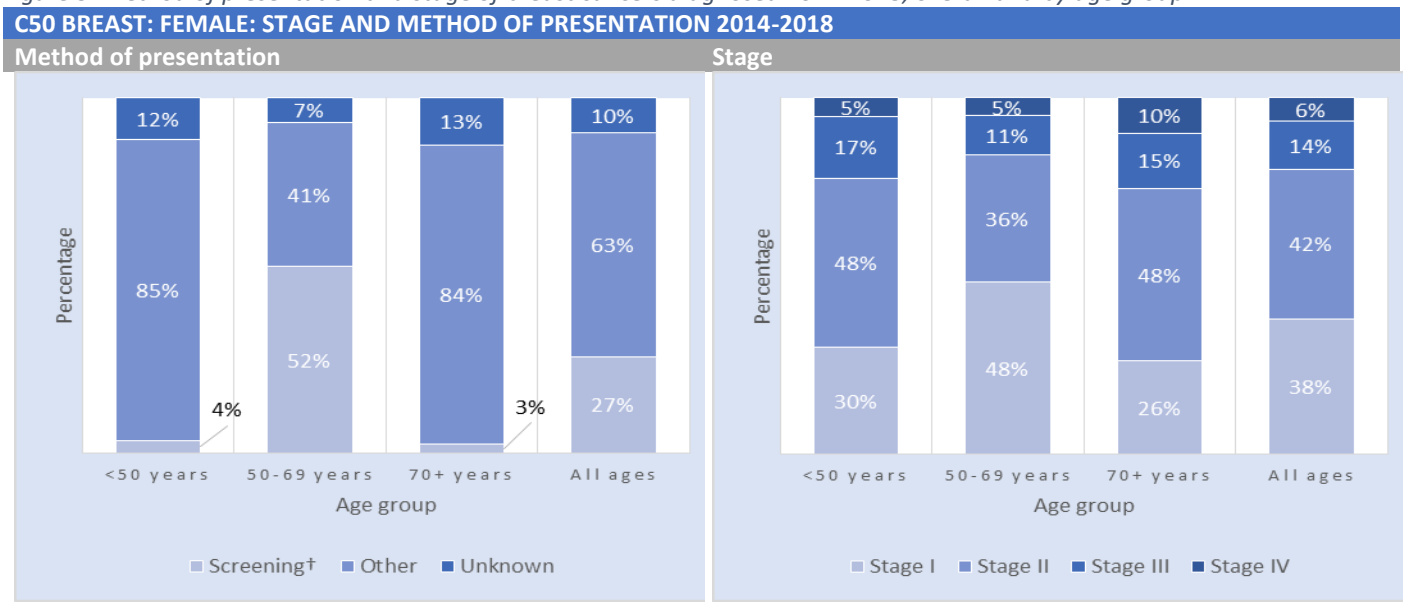
Stage and method of presentation

Data on stage relates to cancers diagnosed up to 2018. Over the 5 years 2014-2018, 24% of cases occurred in women aged <50 years of age, 49% in women aged 50-69 years and 27% in women aged 70+ years (these proportions are the same as for all diagnosed cases 1994-2019). Just under 10% of breast cancers diagnosed 2014-2018 were stage unknown or unstaged (9.3% overall, 8.5%, 8.6% and 11.1% for women aged <50 years, 50-69 years and 70+ years respectively). A small number (n=91) of cases were staged as stage 0 (mainly Paget disease), included here with the stage I category.

As would be expected, the method of presentation of women in the screening age group differs markedly to women in the pre- and post-screening age groups (Figure 3). There is clear evidence of a stage shift in the screening age group, with a higher proportion of women in this age group diagnosed at an early stage (84% stage I and II) compared to the pre-screening (78% stage I and II) and post-screening age groups (75% stage I and II) and a corresponding reduction in the proportion of women diagnosed with late stage cancers (16% stage III and IV) compared to the pre-screening (22% stage III and IV) and post-screening age groups (25% stage III and IV). These results are consistent with what has been reported previously.[4]

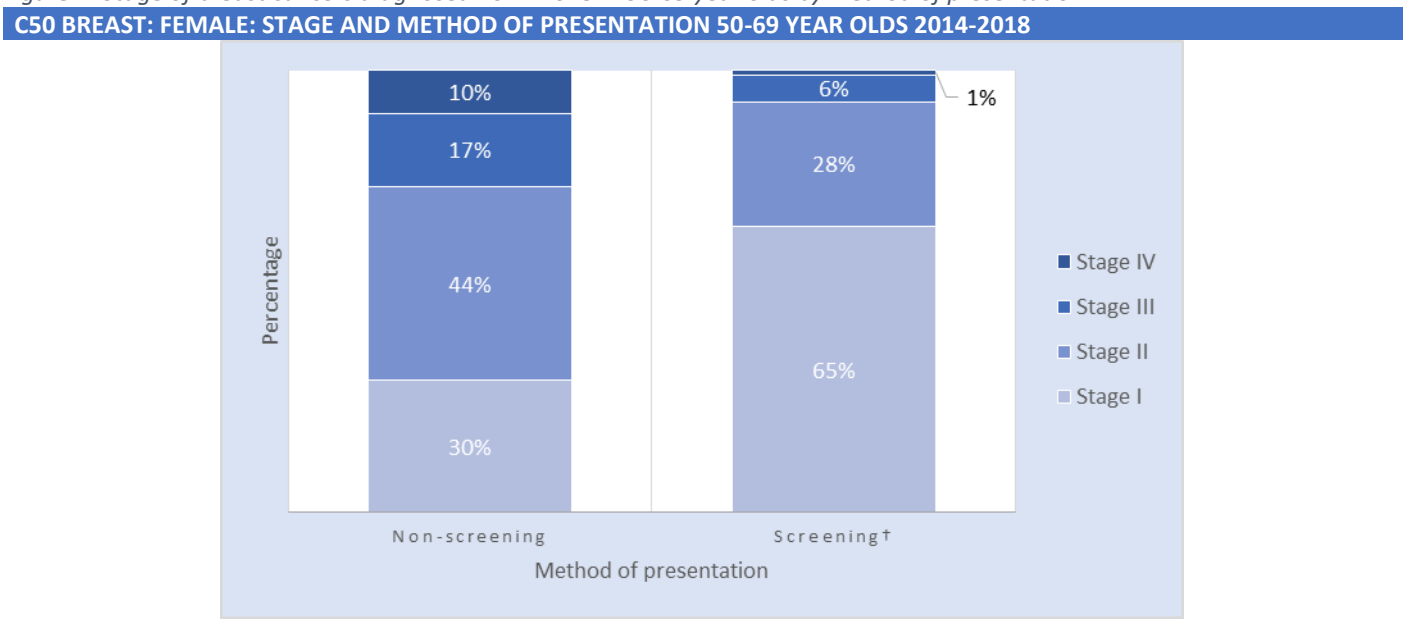
When the stage distribution of tumours in women in the screening age group is examined in combination with the method of presentation (Figure 4), it is clear that a much greater proportion of women diagnosed through screening in the screening age group are diagnosed at stage I (65%) compared to those in the same age group diagnosed through other routes (30%) and those in other age groups (26%-30%). If women diagnosed at stage II are included, then 93% of women diagnosed through screening in the screening age group are diagnosed at stage I or II compared to 74% detected through other routes in the same age group and 74%-78% in the other age groups, with a corresponding reduction in late-stage presentation in women diagnosed through screening in the screening age group.

Figure 3. Method of presentation and stage of breast cancers diagnosed 2014-2018, overall and by age group



† Includes opportunistic & unspecified screening (see glossary for more details)

Figure 4. Stage of breast cancers diagnosed 2014-2018 in 50-69 year olds by method of presentation

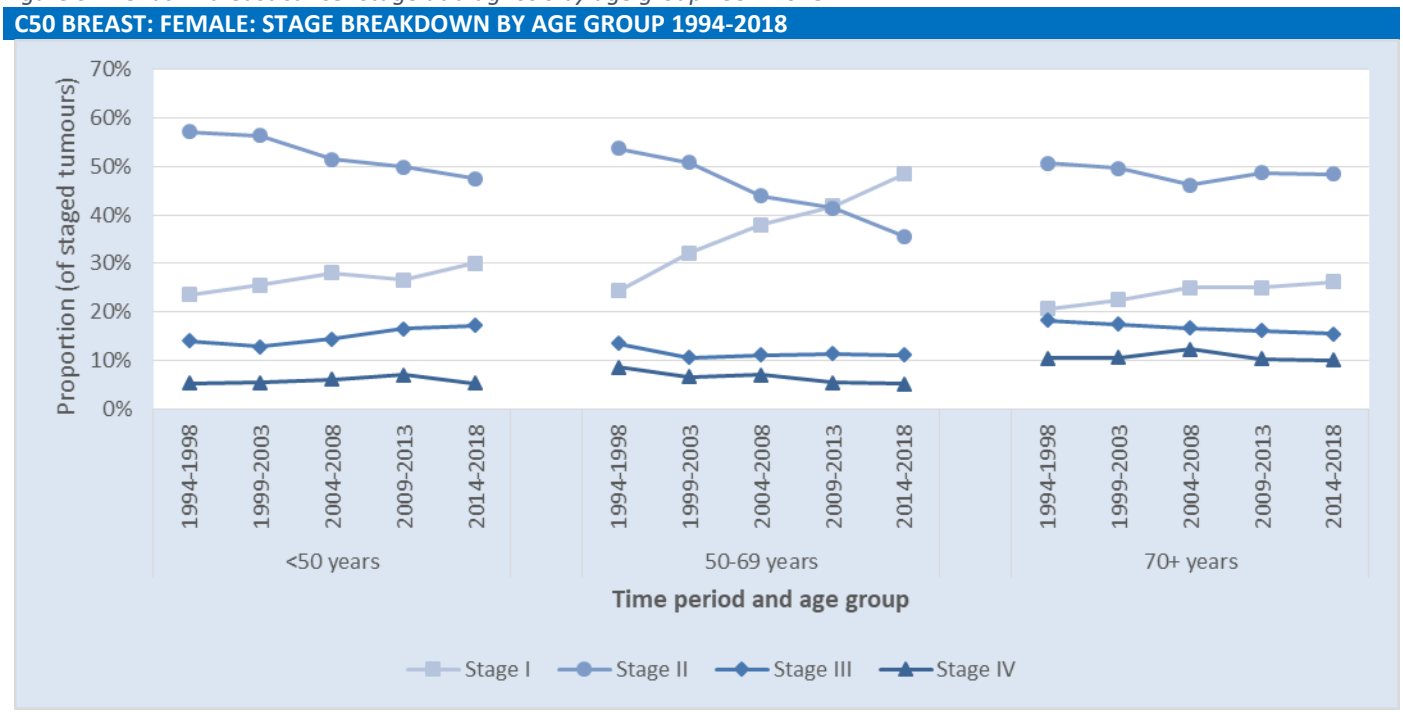


† Includes opportunistic & unspecified screening (see glossary for more details)

When the proportional breakdowns of stage at diagnosis over time are examined, a number of trends can be seen (Figure 5). The proportion of breast cancers diagnosed at stage I has increased in all age groups since 1994-1998, with the most pronounced increase occurring in women in the screening age group (from 24% of staged tumours in 1994-1998 to 48% of staged tumours in 2014-2018). Concurrently, the proportion of women with stage II tumours either decreased (pre- and screening age groups) or remained stable (post-screening age group), with the most pronounced change again occurring in women in the screening age group (from 54% of staged tumours in 1994-1998 to 36% of staged tumours in 2014-2018). The proportion of cancers being diagnosed at stage III and IV in women in the screening age group has also decreased (from 13% to 11% and 9% to 5% from the earliest to the latest time period for stage III and stage IV cancers respectively).

On joinpoint analysis (details not shown), all of the trends described above were statistically significant apart from trends in the proportions of stage III cancers in the screening age group and stage IV cancers in pre-and post-screening groups, which were found not to be significant.

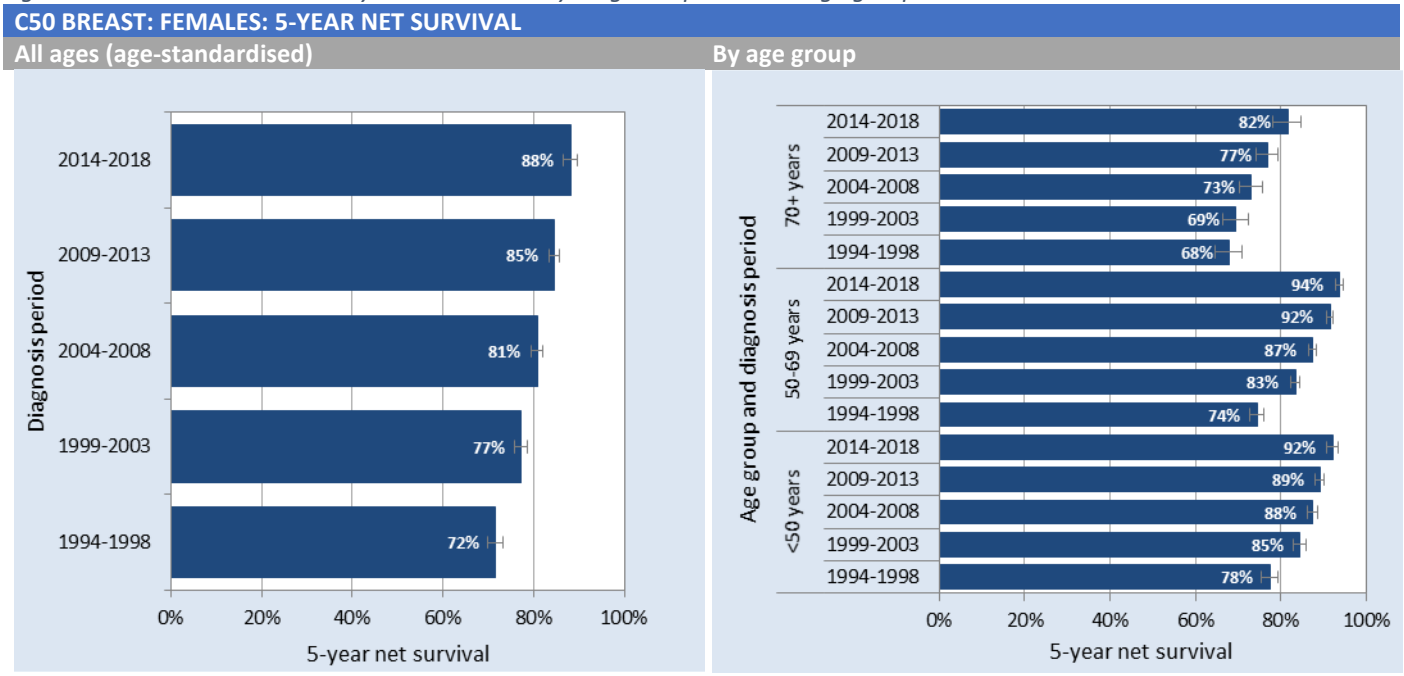
Figure 5. Trends in breast cancer stage at diagnosis by age group 1994-2018



Survival

5-year net survival (age-standardised) was calculated for successive diagnosis periods from 1994-1998 to 2014-2018.[11] Overall 5-year net survival for breast cancer has increased from 72% in cases diagnosed in 1994-1998 to 88% in those diagnosed in 2014-2018. Increases in survival were seen across all age groups with the greatest improvement in women in the screening age group (50-69 years) whose survival increased by 20 %-points between 1994-1998 and 2014-2018 compared to increases by 14 %-points in women in both the pre- and post-screening age groups over the same period (Figure 6).

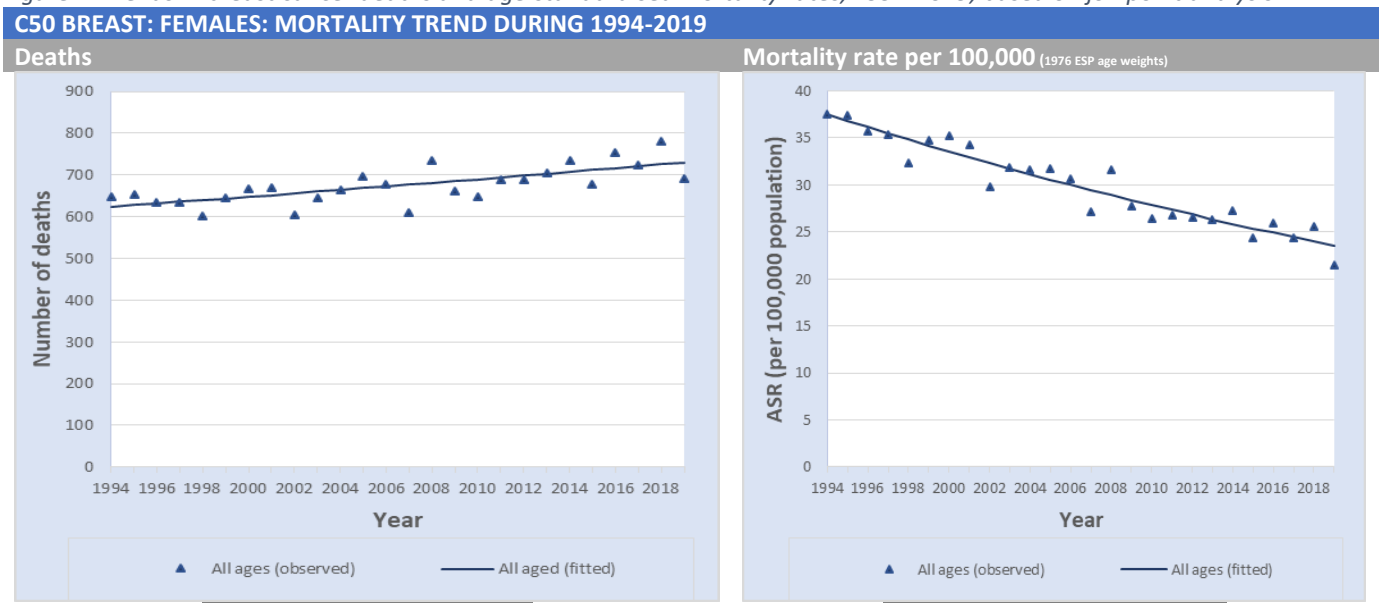
Figure 6. Female breast cancer 5-year net survival by diagnosis period and age group



Mortality

While total numbers of breast cancer deaths per year have shown an ongoing, increasing trend from 1994 to 2019, age-standardised mortality rates (taking into account changes in the size and age-profile of the underlying population) show a significant decreasing trend (by on average 1.8% per annum) (Figure 7).

Figure 7. Trends in breast cancer deaths and age-standardised mortality rates, 1994-2019, based on joinpoint analysis[7]



from-to	apc	ci	trend
1994-2019	0.6	[0.4,0.9]	↑

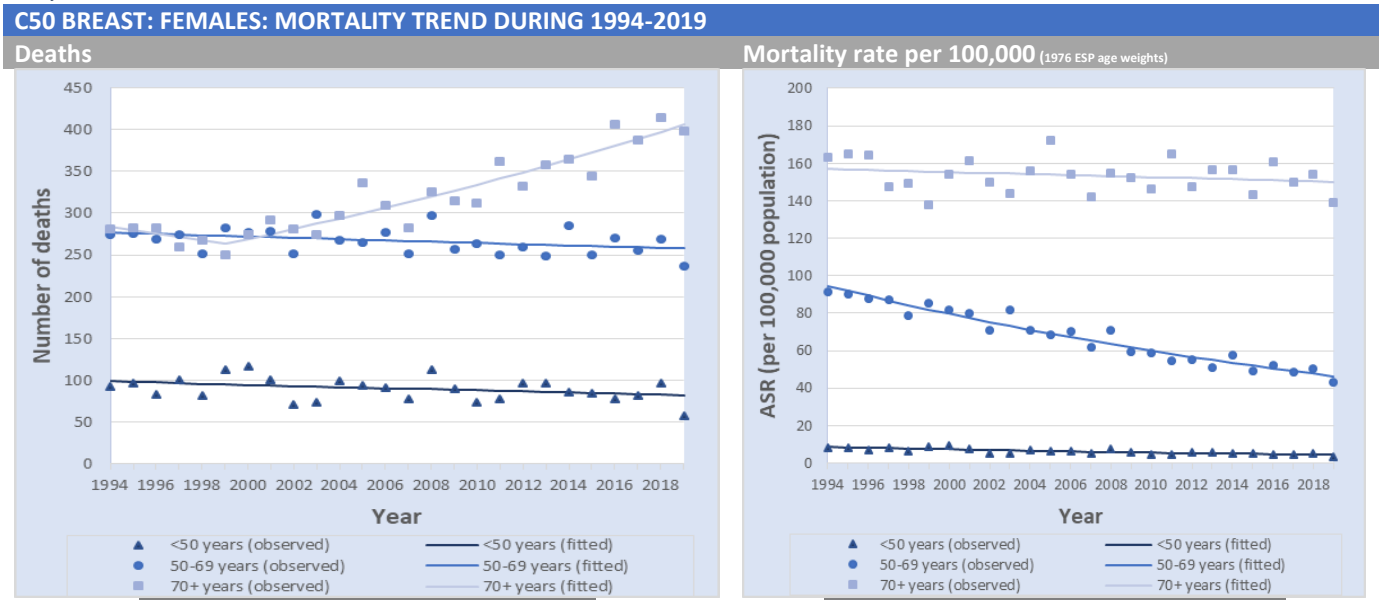
from-to	apc	ci	trend
1994-2019	-1.8	[-2.1,-1.6]	↓

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Mortality by age

When the three previously defined age groups are examined individually, it can be seen that age-standardised mortality rates have decreased significantly in women in the pre-screening age group by, on average, 2.7% per year (Figure 8). Mortality rates in women in the screening age group have also decreased by a similar magnitude (2.8% annually) over the same period, while rates in women in the post-screening age group have remained stable since 1994 (Figure 8). [Note: scale issues mean that the rate trend in the pre-screening group is less apparent from the graph, but see the tabulation below graph.] For numbers of deaths by age, the only significant trend has been an increase in women aged 70 years and over (by on average 2.2% per year) between 1999 and 2019.

Figure 8. Trends in breast cancer deaths and age-standardised mortality rates, by age group, 1994-2019, based on joinpoint analysis[7]



Age group	from-to	apc	ci	trend
<50 years	1994-2019	-0.7	[-1.5,0.1]	↔
50-69 years	1994-2019	-0.3	[-0.6,0.0]	↔
70+ years	1994-1999	-1.5	[-5.1,2.3]	↔
	1999-2019	2.2	[1.8,2.6]	↑

Age group	from-to	apc	ci	trend
<50 years	1994-2019	-2.7	[-3.5,-1.9]	↓
50-69 years	1994-2019	-2.8	[-3.1,-2.5]	↓
70+ years	1994-2019	-0.2	[-0.5,0.1]	↔

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Cervical cancer

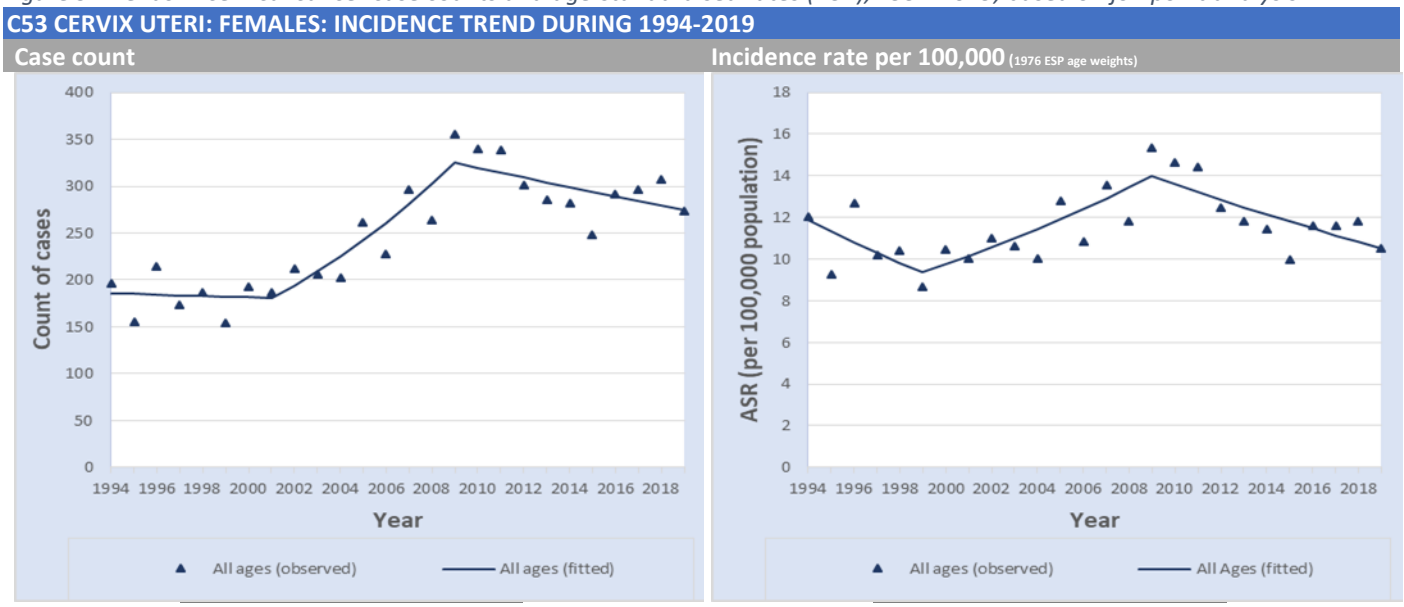
Cervical cancer screening in Ireland

A national cervical screening program (CervicalCheck) was rolled out in Ireland in 2008. Since that time, women and anyone with a cervix, between the ages of 25 years and 60 years (extended to 65 years during 2020), have been eligible for regular screening. During 2008-2019, CervicalCheck used primary liquid-based cytology screening and offered screening to those aged 25 to 44 every three years and to those aged from 45 years to 60 years every five years. [12] [13] While organised screening programmes for cervical cancer have been proven to reduce the burden of cervical cancer overall, it is less effective against certain sub-types of cervical cancer (e.g. adenocarcinoma).[14] Currently, CervicalCheck screening coverage is reported to be around 80%.[13]

Incidence

In the period 2017-2019, invasive cancer of the cervix uteri accounted for 2.6% of all invasive cancers (excluding non-melanoma skin cancer) in women.[1] Overall, the age-standardised rates of cervical cancer have shown a significant decreasing trend of 2.8% per year since 2009 following the introduction of screening, reversing the previous trend of a significant increase from 1999 to 2009. The trend in the total number of diagnosed cases of cervical cancer has also stabilised following a significant increasing trend from 2001 to 2009 (Figure 9).

Figure 9. Trends in cervical cancer case counts and age-standardised rates (ASR), 1994-2019, based on joinpoint analysis[7]



from-to	apc	ci	trend
1994-2001	-0.4	[-4.9,4.2]	↔
2001-2009	7.6	[3.4,12.0]	↑
2009-2019	-1.7	[-3.7,0.4]	↔

from-to	apc	ci	trend
1994-1999	-4.7	[-11.3,2.5]	↔
1999-2009	4.1	[1.4,6.9]	↑
2009-2019	-2.8	[-4.7,-0.9]	↓

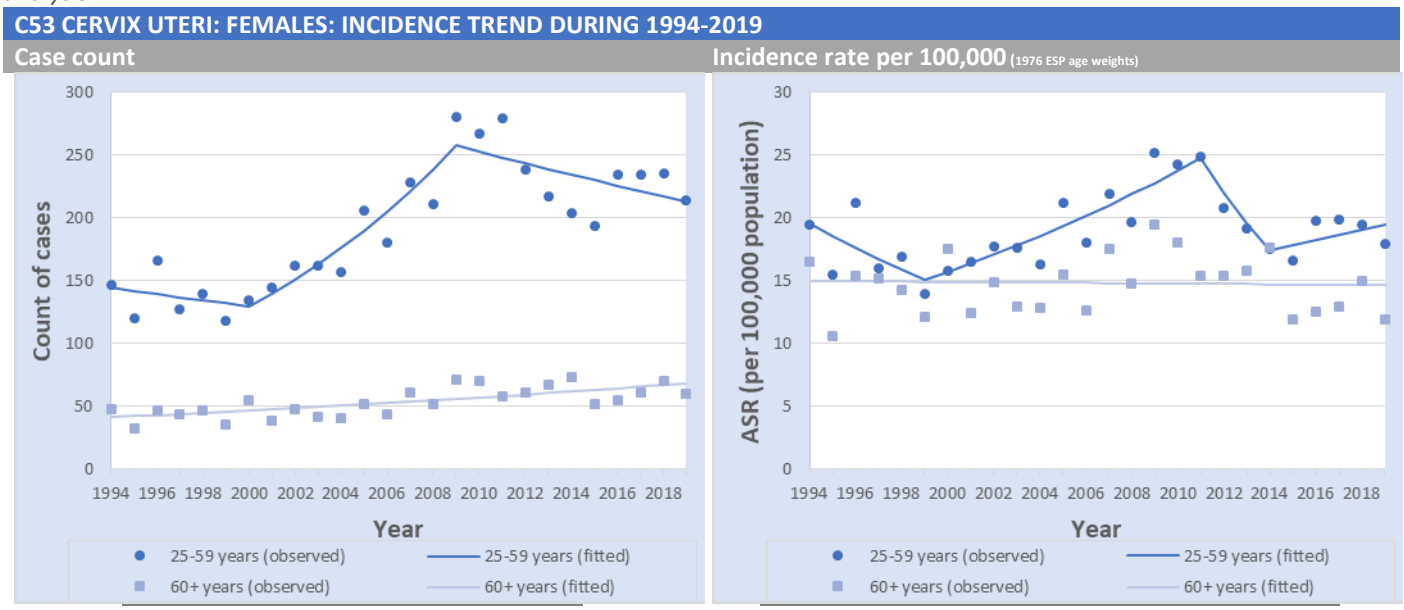
from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Incidence by age

In order to clarify the possible effects of cervical screening on the incidence of cervical cancer, the data were stratified into three age groups based on screening eligibility criteria: pre-screening age group (<25 years); screening age group (25-59 years) and post-screening age group (60+ years). [Note: age 60 was excluded from the screening age-group for this analysis because age-standardisation is based on 5-year age-groups.] As the numbers of cases of cervical cancer in women in the pre-screening group were too small to allow meaningful analysis, reported analyses focus on the screening and post-screening age groups only.

The age-standardised incidence rates of cervical cancer in women in the screening age group showed a significant increasing trend over the period 1999-2011 of 4.2% annually. However, following the introduction of screening in 2008, the incidence rate in women in this age group has shown the fluctuations that would be expected to occur after the introduction of a screening programme with a nonsignificant decrease of 11% annually 2011-2014 and a nonsignificant increase 2014-2019 (Figure 10). Over the full 1994-2019 period, annual age-standardised incidence rates in women over 59 years have remained stable, with modelled rates in the range of 14-15/100,000.

Figure 10. Trends in cervical cancer case counts and age-standardised rates (ASR) by age group, 1994-2019, based on joinpoint analysis[7]



Age group	from-to	apc	ci	trend
25-59 years	1994-2000	-1.7	[-7.8,4.7]	↔
	2000-2009	7.9	[4.2,11.8]	↑
	2009-2019	-1.9	[-4.0,0.3]	↔
60+ years	1994-2019	2.0	[1.2,2.9]	↑

Age group	from-to	apc	ci	trend
25-59 years	1994-1999	-5.0	[-12.0,2.5]	↔
	1999-2011	4.2	[2.2,6.3]	↑
	2011-2014	-11.0	[-31.8,16.1]	↔
	2014-2019	2.2	[-3.9,8.7]	↔
60+ years	1994-2019	-0.1	[-1.0,0.8]	↔

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Stage and method of presentation

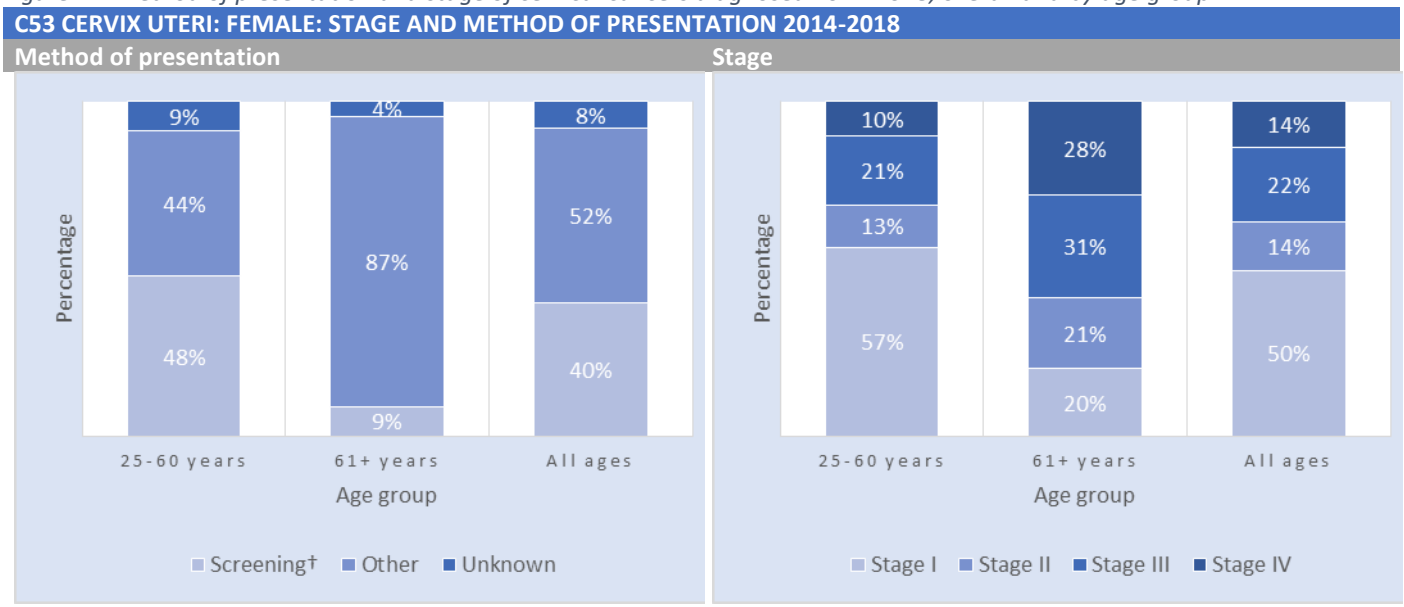
Data on stage relates to cancers diagnosed up to 2018. Over the five years 2014-2018, <1% of cases were in women <25 years of age at diagnosis, 80% were diagnosed in women 25-60 years of age and 20% were diagnosed in women aged 61 years and over (this breakdown is the same as for all cases 1994-2019).

Fewer than 5% of women with cervical cancers diagnosed 2014-2018 were stage unknown or unstaged (4.2% overall; by age group 0%, 3.3% and 8.2% for women aged <25, 25-60 and 61+ years respectively). Due to very small number of diagnoses in women aged <25 years, figures for this age group are not presented separately but are included in overall totals.

As expected, and as seen in Figure 11, the proportion of cases detected by screening is much higher in women in the screening age group compared to women in the post-screening age group (48% vs 9%) as is the proportion of women diagnosed at stage I or II (70% vs 41%) (Figure 11). The corresponding proportion of cases diagnosed as stage IV is much lower in women in the screening age group compared to the post-screening cohort (10% vs 28%).

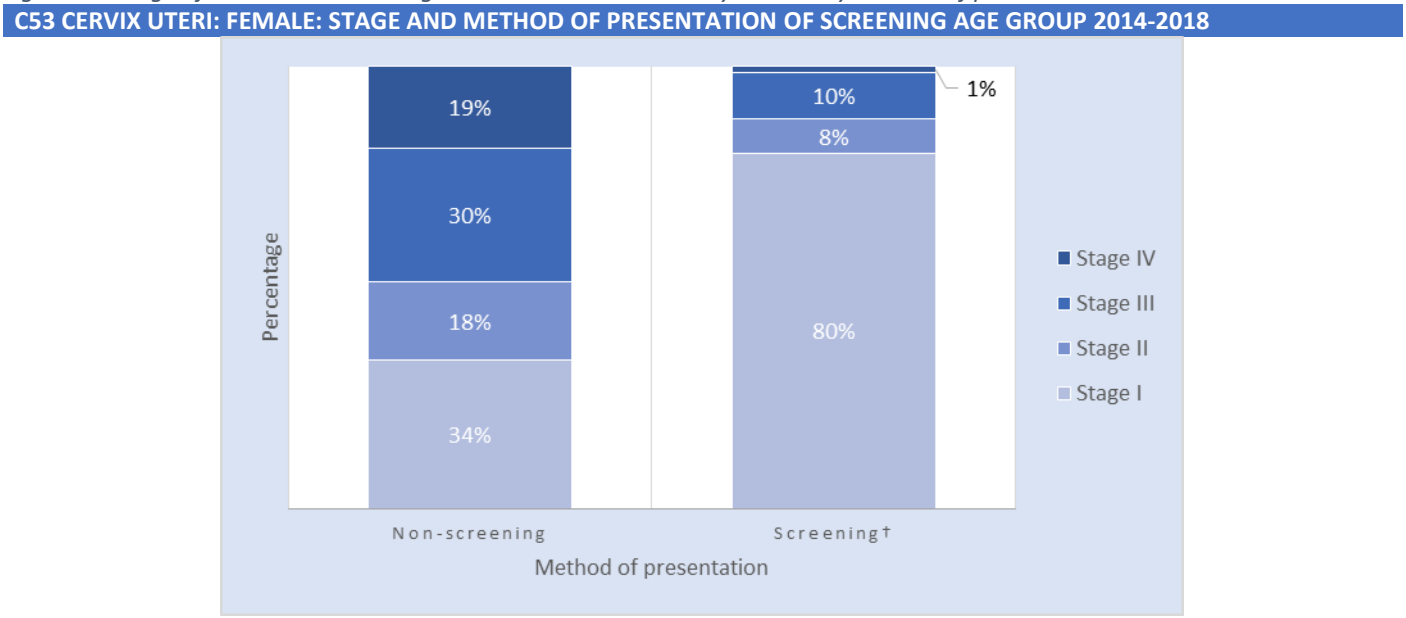
When the screening age group is split into those detected by screening vs those detected by other/unknown methods, the proportion of women diagnosed with early-stage cancers (stage I or II) is even higher (88% of screen-detected vs 52% of non-screen-detected) (Figure 12) with a corresponding reduction in the proportion of women diagnosed with stage IV cancers (1% of screen-detected vs 19% of non-screen-detected).

Figure 11. Method of presentation and stage of cervical cancers diagnosed 2014-2018, overall and by age group



† Includes opportunistic & unspecified screening (see glossary for more details)

Figure 12. Stage of cervical cancers diagnosed 2014-2018 in 25-60 year olds by method of presentation

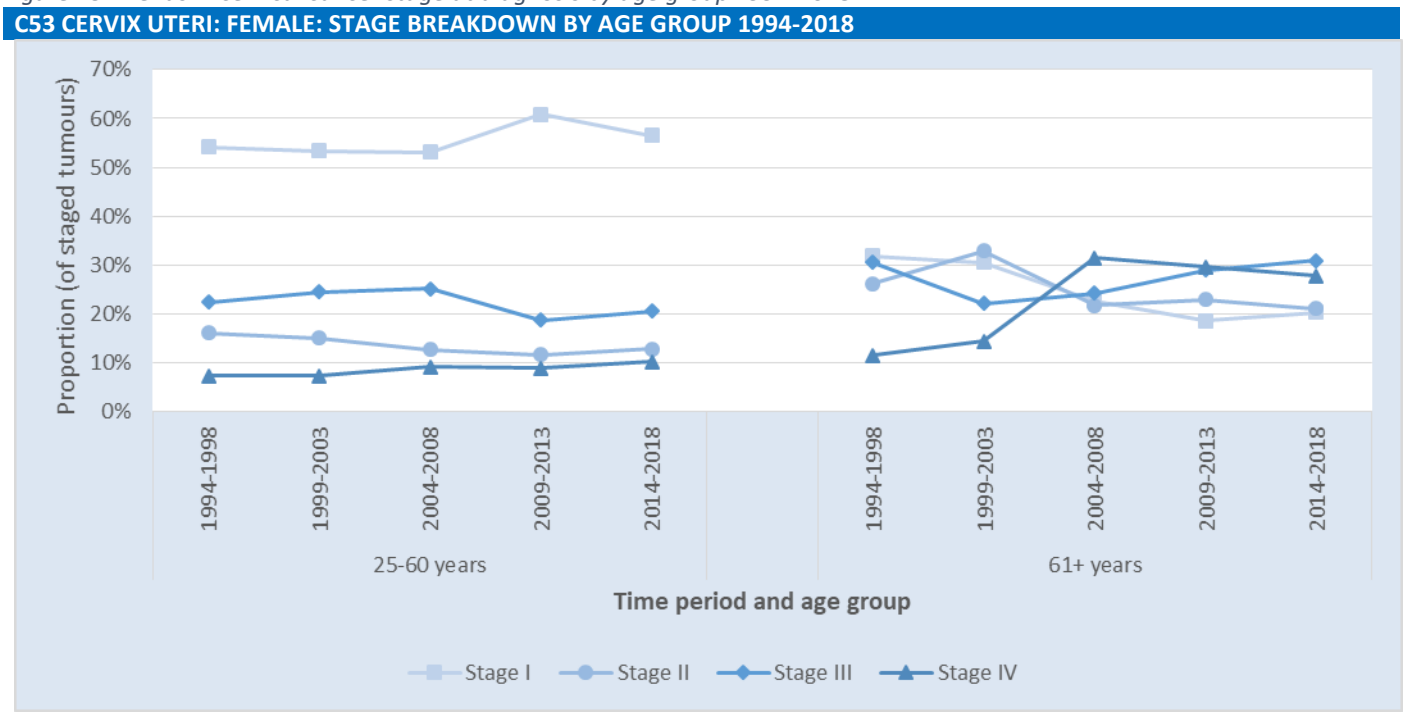


† Includes opportunistic & unspecified screening (see glossary for more details)

When the breakdown of stage at diagnosis over time is examined, a number of trends can be seen (Figure 13). In women in the screening age group, the proportion of cancers diagnosed at stage I has increased slightly in recent periods (2009-2013 and 2014-2018) compared to earlier periods. Concurrently, the proportions of tumours diagnosed at stage II and stage III have decreased. In contrast, the proportion of stage IV tumours increased. In women in the post-screening age-group, there is evidence of a decrease over time in the proportions of tumours diagnosed at stage I and II, and a concurrent increase in the proportion of tumours diagnosed at stage IV, however, these should be interpreted with caution due to the relatively small numbers of cases in this age group.

Joinpoint analysis (details not shown) of stage breakdown in women in the screening age group demonstrated a significant increasing trend in the proportion of stage IV cancers from 1994 to 2018 with a significant decreasing trend identified in the proportion of stage II cancers over the same period.

Figure 13. Trends in cervical cancer stage at diagnosis by age group 1994-2018

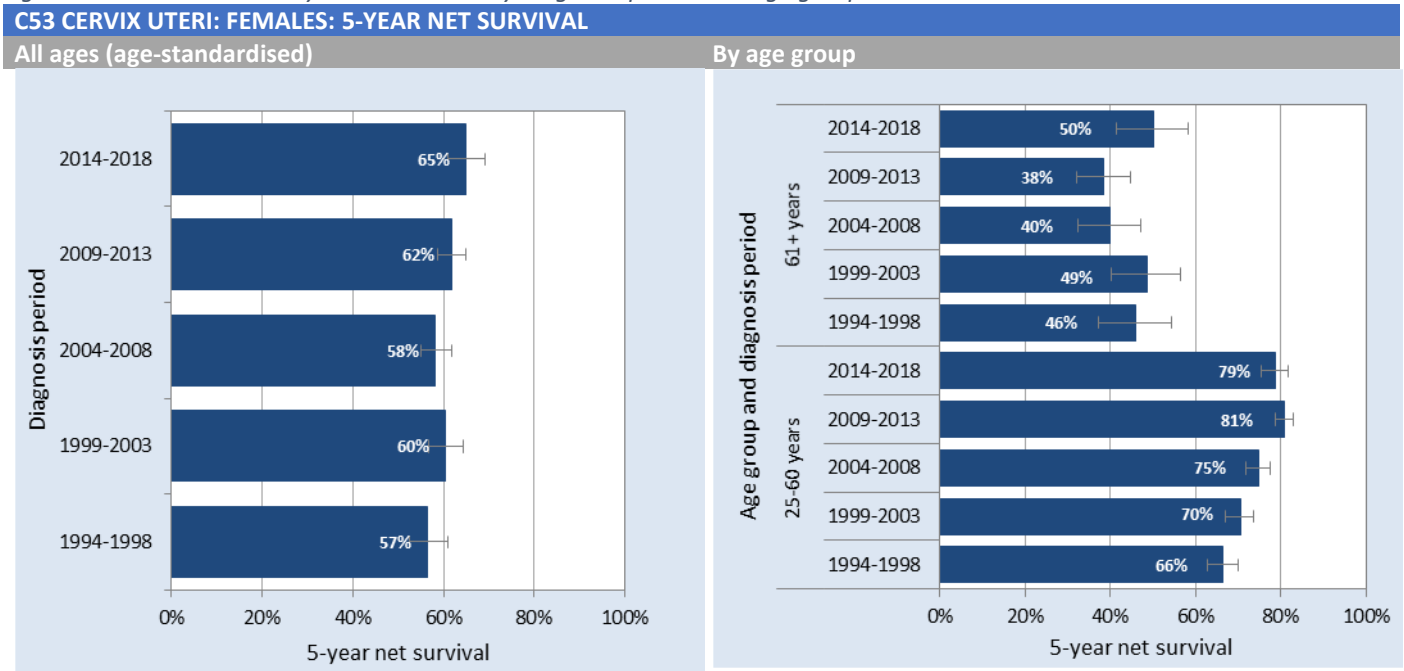


Due to coding changes a small number of tumours have been excluded from the calculation of proportions over time

Survival

5-year net survival (age-standardised) was calculated for successive diagnosis periods from 1994-1998 to 2014-2018.[11] Overall 5-year net survival for cervical cancer has increased from 57% in women diagnosed in 1994-1998 to 65% in those diagnosed in 2014-2018. An increase in survival was seen in women in the screening age group (25-60 years) from 66% in 1994-1998 to 79% in 2014-2018. No significant increase in survival can be detected in women in the post-screening age group (Figure 14).

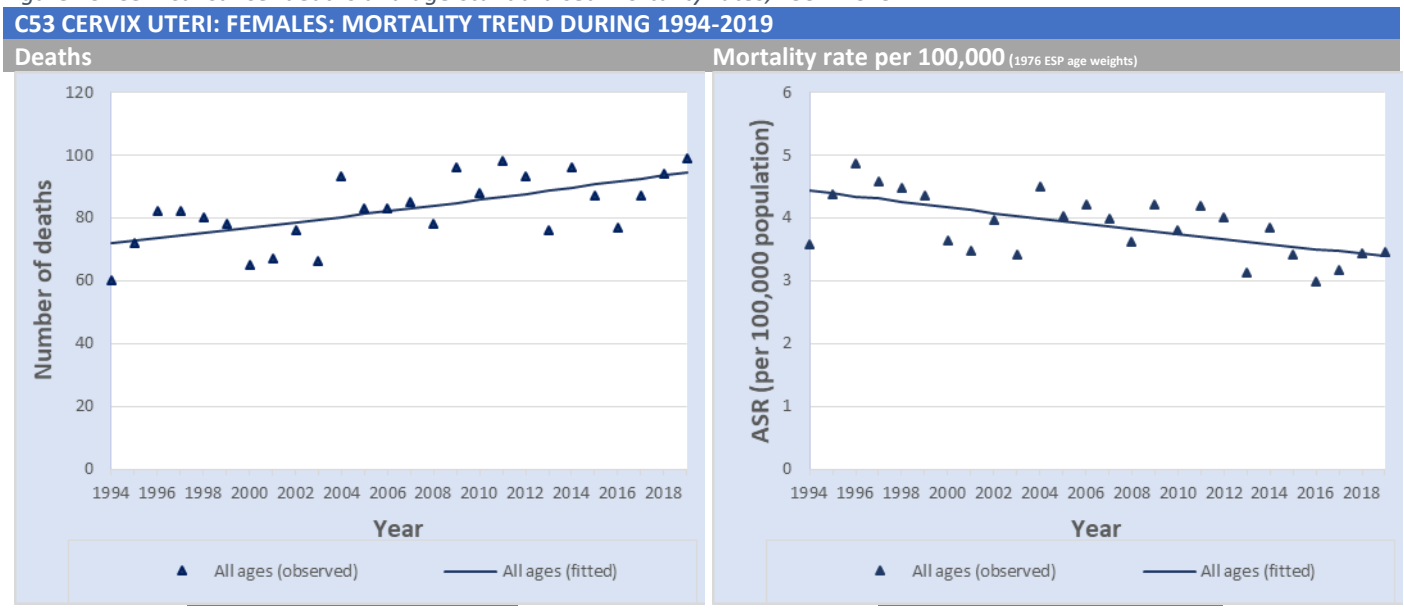
Figure 14. Cervical cancer 5-year net survival by diagnosis period and age group



Mortality

While total numbers of cervical cancer deaths per year have shown an increasing trend from 1994 to 2019, age-standardised mortality rates, taking into account changes in the size and age-profile of the underlying population, have shown a significant decreasing trend (by on average 1.1% per year) over the same period (Figure 15).

Figure 15. Cervical cancer deaths and age-standardised mortality rates, 1994-2019



from-to	apc	ci	trend
1994-2019	1.1	[0.5,1.7]	↑

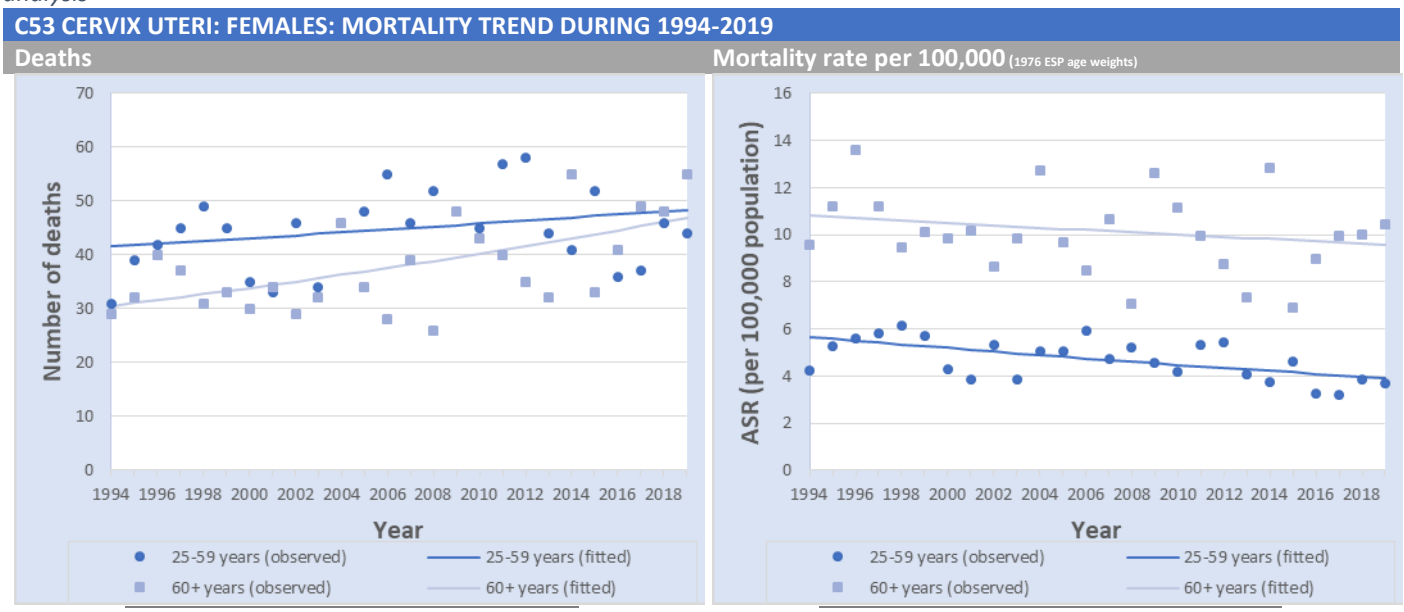
from-to	apc	ci	trend
1994-2019	-1.1	[-1.6,-0.5]	↓

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Mortality by age

Mortality rates from cervical cancer in women in the screening age group have decreased steadily since 1994 by on average 1.5% per year, while there has been no significant change in mortality rates in the post-screening age group over the same period (Figure 16). The only significant change in numbers of deaths was an increase (by 1.7% per year) in the post-screening group between 1994 and 2019.

Figure 16. Trends in cervical cancer deaths and age-standardised mortality rates, by age group, 1994-2019, based on joinpoint analysis[7]



Age group	from-to	apc	ci	trend
25-59 years	1994-2019	0.6	[-0.3,1.5]	↔
60+ years	1994-2019	1.7	[0.8,2.7]	↑

Age group	from-to	apc	ci	trend
25-59 years	1994-2019	-1.5	[-2.3,-0.6]	↓
60+ years	1994-2019	-0.5	[-1.4,0.4]	↔

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Colorectal cancer

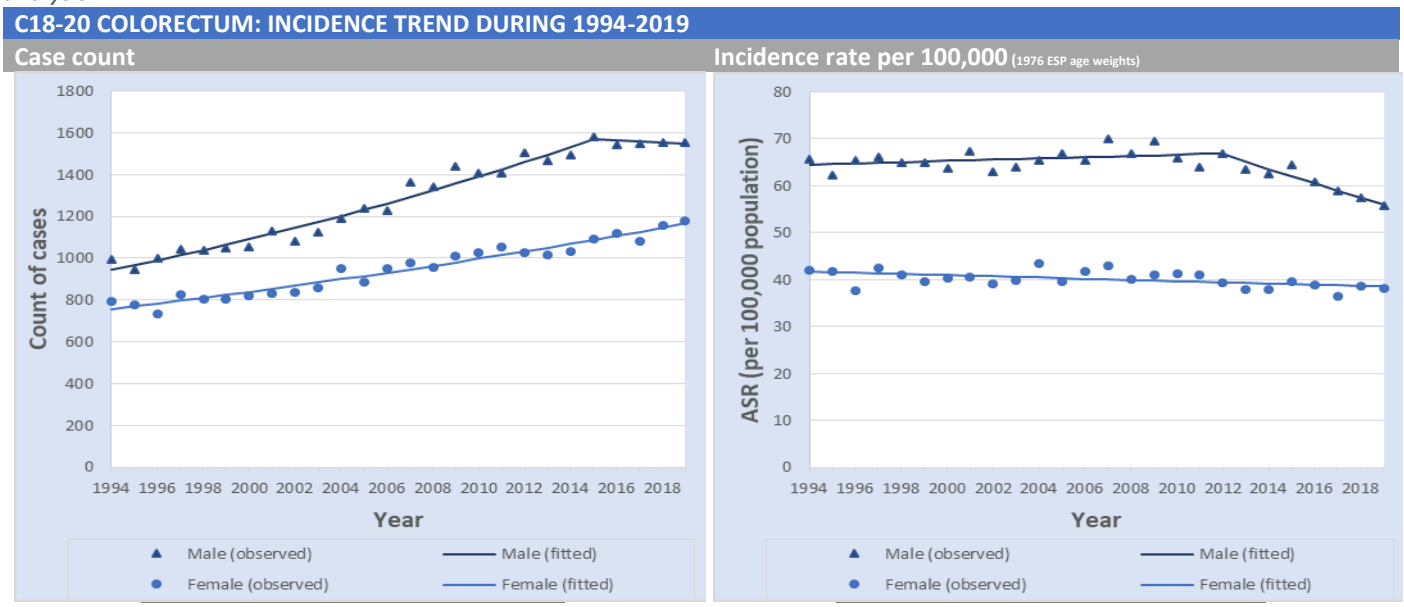
Colorectal screening in Ireland

Studies have shown that screening for bowel cancer can reduce incidence as well as mortality.[15] BowelScreen, the national screening programme for bowel (i.e. colorectal) cancer was rolled out from 2012, and anyone aged 60-69 years is eligible for screening every 2 years. Uptake rates are reported to be around 40%.[16] The uptake of BowelScreen is slightly higher in women than in men (8% higher in 60-64 year olds and 1% higher in 65-69 year olds in the third round of screening).[16]

Incidence

In the period 2017-2019, invasive cancer of the colorectum accounted for 11.1% of all invasive cancers (excluding non-melanoma skin cancer).[1] Since screening was introduced in 2012, the age-standardised incidence rates of colorectal cancer in men have shown a significant downward trend, of 2.5% annually (Figure 17). In comparison, there appears to have been a smaller but ongoing decreasing trend (-0.3% per year) in women since 1994 (Figure 17).

Figure 17. Trends in colorectal cancer case counts and age-standardised rates (ASR) by sex, 1994-2019, based on joinpoint analysis[7]



Sex	from-to	apc	ci	trend
Male	1994-2015	2.5	[2.2,2.7]	↑
	2015-2019	-0.4	[-2.9,2.2]	↔
Female	1994-2019	1.7	[1.6,1.9]	↑

Sex	from-to	apc	ci	trend
Male	1994-2012	0.2	[-0.1,0.5]	↔
	2012-2019	-2.5	[-3.4,-1.5]	↓
Female	1994-2019	-0.3	[-0.5,-0.1]	↓

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

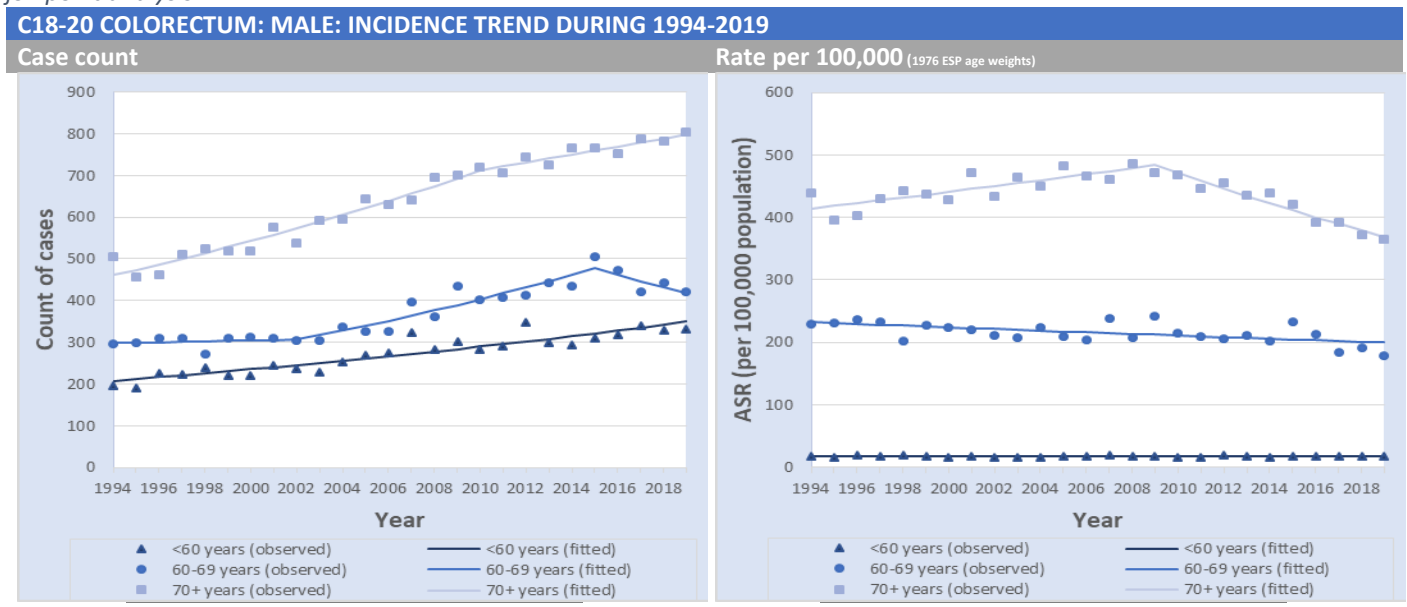
Incidence by age and sex

In order to clarify the possible effects of bowel screening on the incidence of colorectal cancer, the data were stratified into three age groups based on screening eligibility criteria: pre-screening age group (<60 years); screening age group (60-69 years) and post-screening age group (70+ years).

The age-standardised rate in men in the post-screening age group has decreased significantly (by 2.7% per year) since 2009 (Figure 18). The rates in men in the screening age group have also shown a decreasing trend (by 0.6% per year), but this decrease appears to be ongoing since 1994. The incidence rate in men in the pre-screening age group has remained stable since 1994. If case counts are examined, all age groups have shown increases over time, but with a downturn in the trend in men in the screening age group from 2015 onwards.

The trends by age group women are slightly different to those in men. The age-standardised incidence rates in women in both the pre-screening and screening age groups have shown no significant trend across 1994-2019. There did appear to be a significant downturn from 2010-2014 in women in the oldest age group (70+ years) following an earlier increase, but rates appear to have levelled off since 2014 (Figure 19). Case counts for all three age groups in women have increased over time.

Figure 18. Trends in colorectal cancer case counts and age-standardised rates (ASR), males by age group, 1994-2019, based on joinpoint analysis[7]

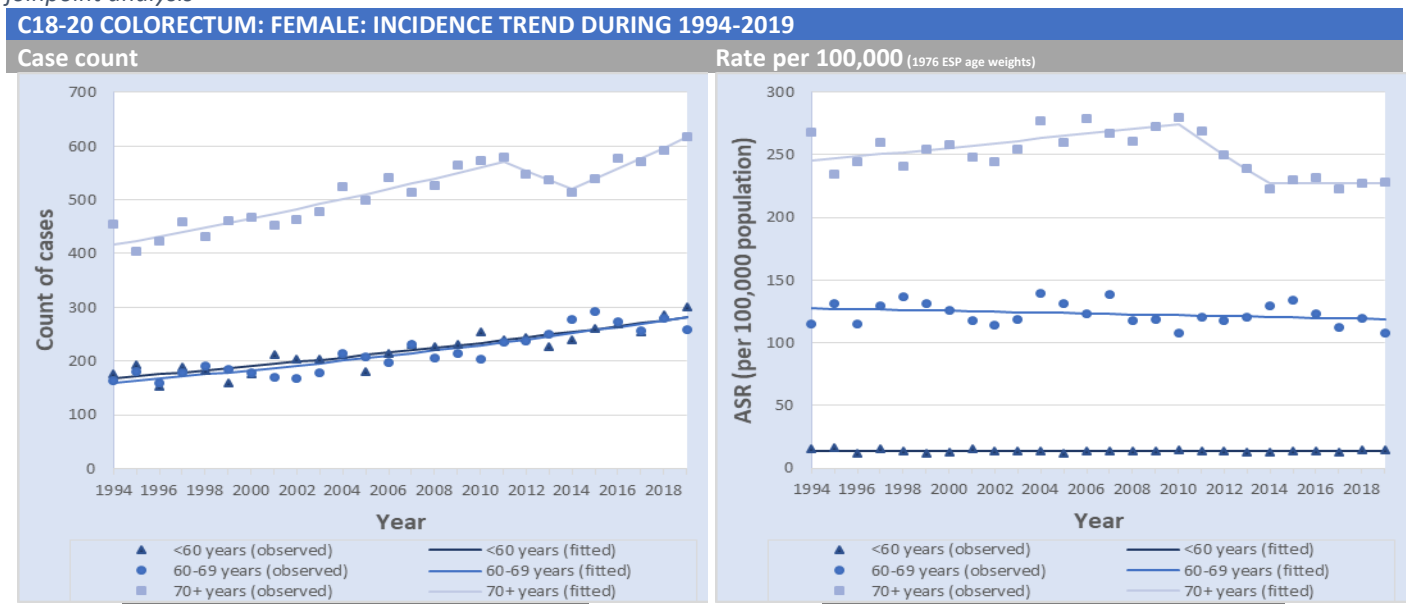


Age group	from-to	apc	ci	trend
<60 years	1994-2019	2.1	[1.7,2.5]	↑
60-69 years	1994-2002	0.4	[-1.6,2.4]	↔
	2002-2015	3.5	[2.5,4.5]	↑
	2015-2019	-3.4	[-7.9,1.4]	↔
70+ years	1994-2010	2.8	[2.4,3.2]	↑
	2010-2019	1.3	[0.5,2.1]	↑

Age group	from-to	apc	ci	trend
<60 years	1994-2019	-0.1	[-0.4,0.3]	↔
60-69 years	1994-2019	-0.6	[-1.0,-0.3]	↓
70+ years	1994-2009	1.0	[0.6,1.4]	↑
	2009-2019	-2.7	[-3.3,-2.1]	↓

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Figure 19. Trends in colorectal cancer case counts and age-standardised rates (ASR), females by age group, 1994-2019, based on joinpoint analysis[7]



Age group	from-to	apc	ci	trend
<60 years	1994-2019	2.1	[1.7,2.5]	↑
60-69 years	1994-2019	2.3	[1.9,2.7]	↑
70+ years	1994-2011	1.9	[1.5,2.3]	↑
	2011-2014	-3.0	[-12.8,7.8]	↔
	2014-2019	3.5	[1.1,5.9]	↑

Age group	from-to	apc	ci	trend
<60 years	1994-2019	-0.2	[-0.6,0.3]	↔
60-69 years	1994-2019	-0.3	[-0.7,0.1]	↔
70+ years	1994-2010	0.7	[0.3,1.1]	↑
	2010-2014	-4.6	[-9.5,0.7]	↔
	2014-2019	0.0	[-2.3,2.3]	↔

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Stage and method of presentation

Data on stage relates to cancers diagnosed up to 2018. Overall, 22% of colorectal cancers during 2014-2018 were diagnosed at ages <60 years, 28% at 60-69 years and 50% at 70 years and over. There was a slight difference between the sexes: 24% of women vs 21% of men were aged <60 years, 25% of women vs 29% of men were aged 60-69 years and 51% of women vs 50% of men were aged 70 years and over (these proportions were the same as the age and sex breakdown for all colorectal cancer data 1994-2019). Of people diagnosed with colorectal cancers 2014-2018, 13.4% were stage unknown or unstaged (by age group 17.0%, 9.0% and 14.2% for <60 years, 60-69 years and 70+ years respectively). A small number (n=7) of cases were staged as stage 0 and these have been included in the stage I category.

Stage breakdown was similar for men and women within each age group (Table 3). A slightly greater proportion of cases were detected by screening in men than in women (9% vs 7% overall and 25% vs 22% in 60-69 year olds). While the overall proportion of diagnoses which were early stage (stage I or II) was higher in those in the screening age group (45%) compared to the pre-screening age group (37%), 47% of those in the post-screening age group were also diagnosed early. Corresponding reductions in late stage cancers (stage III and IV) are seen in the screening age group compared to the pre-screening age group, though the lowest proportion is in the post screening age group.

When the stage data are broken down by method of presentation in the screening age group, a much larger difference in the proportion of early stage cancers diagnosed can be seen, with 64% of cancers in men and 62% of cancers in women detected by screening being early stage, compared to 37% and 39% of cancers in men and women respectively detected through other routes (Figure 20). Corresponding reductions in the proportion of late stage cancers (stage III and IV) are clearly evident in those cases detected by screening in this cohort.

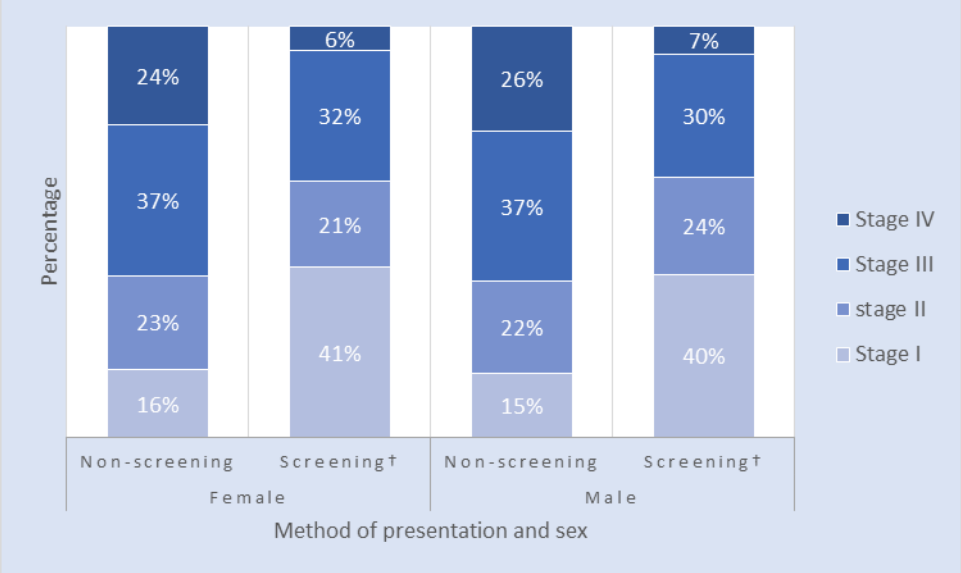
Table 3. Method of presentation and stage of colorectal cancers diagnosed 2014-2018, overall and by age group and sex

	<60 years			60-69 years			70+ years			All age groups		
	Female	Male	**All**	Female	Male	**All**	Female	Male	**All**	Female	Male	**All**
Method of presentation												
Screening†	1%	2%	**2%**	22%	25%	**24%**	2%	3%	**2%**	7%	9%	**8%**
Other	88%	86%	**87%**	68%	65%	**66%**	86%	87%	**86%**	82%	80%	**81%**
Unknown	11%	12%	**11%**	11%	10%	**10%**	12%	11%	**11%**	11%	11%	**11%**
Stage												
Stage I	15%	14%	**15%**	22%	22%	**22%**	16%	17%	**16%**	17%	18%	**17%**
stage II	23%	21%	**22%**	23%	23%	**23%**	32%	30%	**31%**	27%	26%	**27%**
Stage III	34%	39%	**37%**	35%	35%	**35%**	29%	30%	**30%**	32%	33%	**33%**
Stage IV	28%	26%	**27%**	20%	21%	**20%**	23%	23%	**23%**	23%	23%	**23%**

† Includes opportunistic & unspecified screening (see glossary for more details)

Figure 20. Stage of colorectal cancers diagnosed 2014-2018 in 60-69 year olds by sex and method of presentation

C18-20 COLORECTUM: STAGE AND METHOD OF PRESENTATION OF SCREENING AGE GROUP 2014-2018

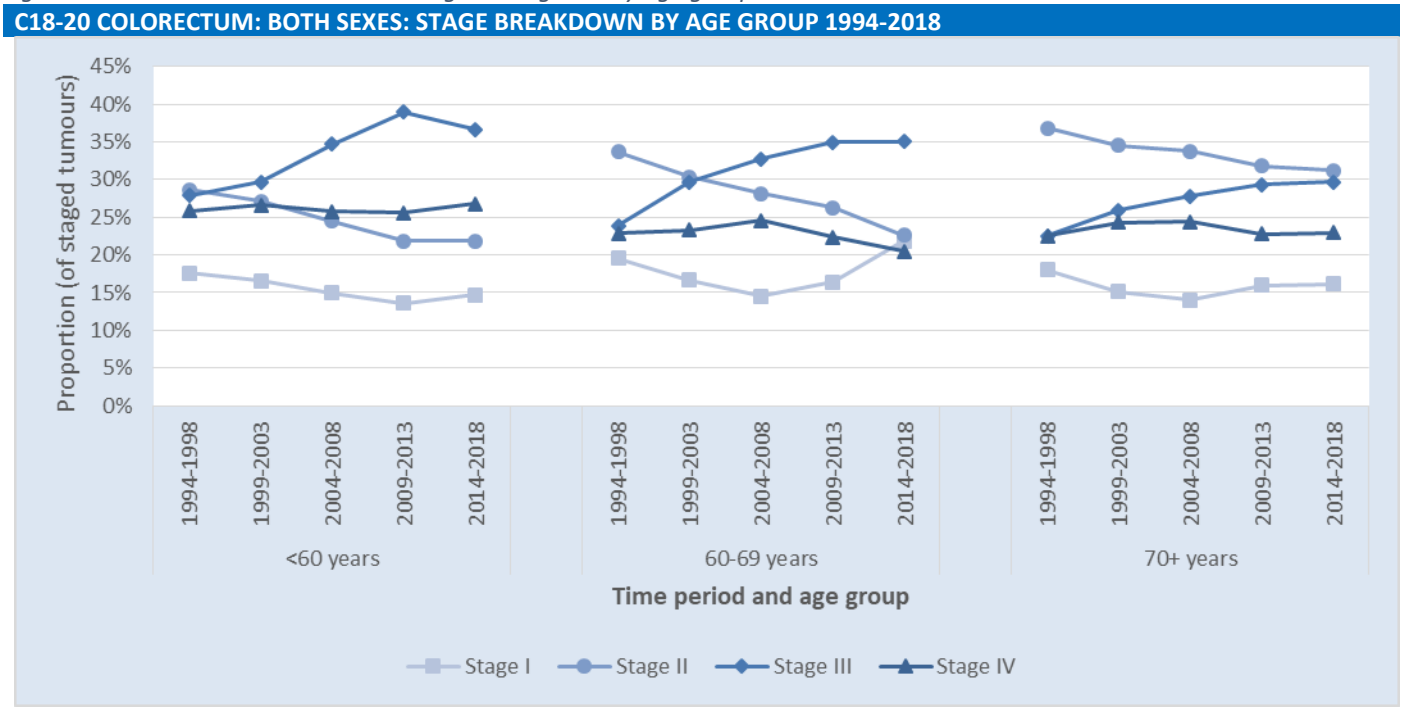


† Includes opportunistic & unspecified screening (see glossary for more details)

When the breakdown of stage at diagnosis over time is examined, a number of trends can be seen (Figure 21). There is evidence of a shift to earlier stage at diagnosis in recent periods in those in the screening age group, with the proportion of tumours diagnosed at stage I increasing from 15% in 2004-2008 to 22% in 2014-2018, while the proportion diagnosed at stage II has shown a decrease from 34% in 1994-1998 to 23% in 2014-2018.

On joinpoint analysis (details not shown), a significant increasing trend in the proportion of stage I tumours in people in the screening age-group was detected starting around 2007, alongside a significant decreasing trend in the proportion of stage II tumours which started in 1997. The proportion of stage III tumours in this age group has remained stable since 2007 while the proportion of stage IV tumours has been decreasing since 1994. The trends in the other age groups were mixed, with a significant decreasing trend in proportion of stage I cancers in the pre-screening age group, but no significant trend in the post-screening age group. The proportion of stage II tumours showed a significant decreasing trend in both the pre- and post- screening groups, and both of these groups also showed significant increasing trends in the proportion of stage III cancers (from 1994 to 2008 for pre-screening age group, and 1994 to 2012 for post-screening age group) but with no significant trends in more recent years. The proportion of stage IV tumours has not changed over time in any age group.

Figure 21. Trends in colorectal cancer stage at diagnosis by age group 1994-2018

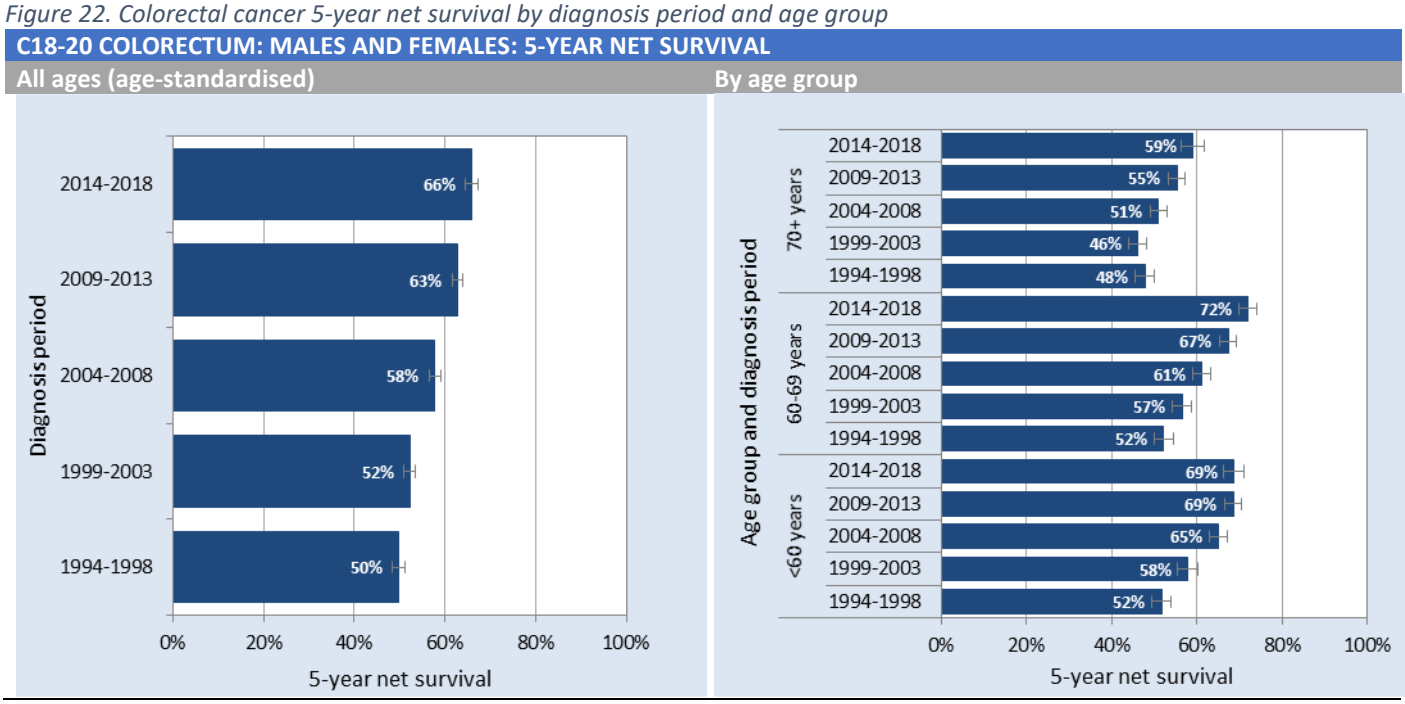


Due to coding changes a small number of tumours have been excluded from the calculation of proportions over time

Survival

Five-year net survival (age-standardised) was calculated for successive diagnosis periods from 1994-1998 to 2014-2018.[11] To minimise potential biases resulting from changes in international coding guidelines over time, a small number of cancers (carcinoid tumours of the appendix) have been excluded from survival estimates. Overall 5-year net survival for colorectal cancer has increased from 50% in patients diagnosed in 1994-1999 to 66% for those diagnosed in 2014-2018. The largest increase has occurred in those in the screening age-group which shows an increase in survival of 20 %-points from the earliest to the most recent diagnosis period. Survival in the pre-screening age group also increased considerably (by 17 %-points) between 1994-1999 and 2009-2013, with no further increase in 2014-2018. In those in the post-screening age group, following an initial small decrease in survival from 48% in 1994-1998 to 46% in 1999-2003, survival increased by 11 %-points (up to 59%) between 1994-1998 and 2014-2018 (Figure 22).

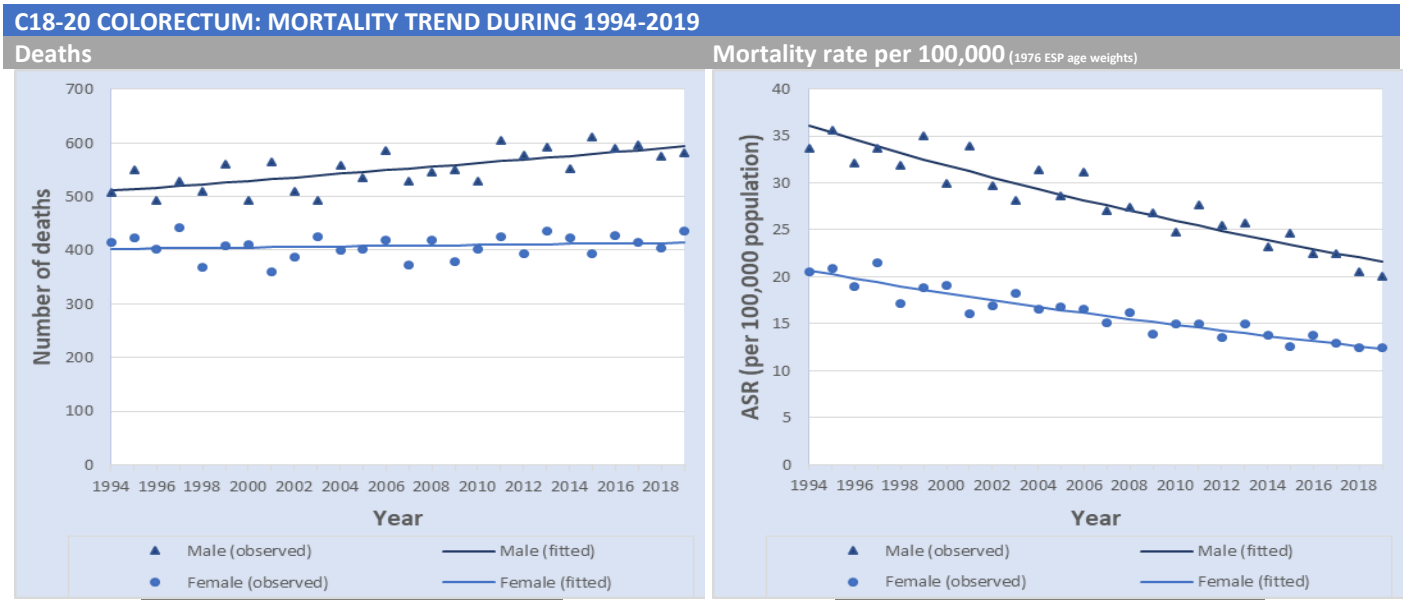
Figure 22. Colorectal cancer 5-year net survival by diagnosis period and age group



Mortality

While the number of deaths due to colorectal cancer appear to have been stable (in women) or increasing (in men) since 1994, the age-standardised mortality rates show a significant decreasing trend in both sexes of -2% annually since 1994 (Figure 23).

Figure 23. Trends in colorectal cancer deaths and age-standardised mortality rates by sex, 1994-2019, based on joinpoint analysis[7]



Sex	from-to	apc	ci	trend
Male	1994-2019	0.6	[0.3,0.9]	↑
Female	1994-2019	0.1	[-0.2,0.4]	↔

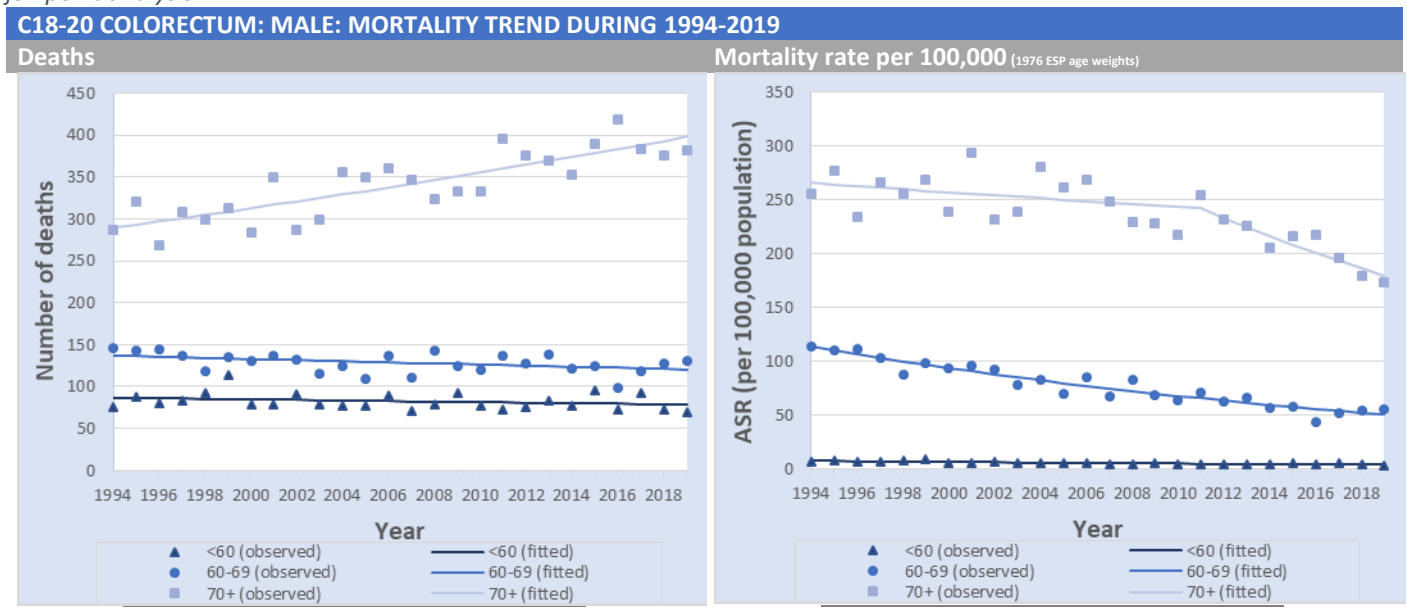
Sex	from-to	apc	ci	trend
Male	1994-2019	-2.0	[-2.3,-1.7]	↓
Female	1994-2019	-2.0	[-2.3,-1.7]	↓

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Mortality by age and sex

Significant decreases in age-standardised mortality rates due to colorectal cancer have occurred in both sexes and across all age groups since 1994, with the exception of 70+ year old men, in whom mortality rates were stable (non-significant decrease) during 1994-2011 but subsequently decreased significantly by 3.7% per year (Figure 24 and Figure 25). [Note: scale issues mean that rate trends in the pre-screening group are less apparent from the graphs, but see the tabulations below graphs.] In men, numbers of deaths have decreased significantly (by 0.5% per year) in the screening age group between 1994 and 2019, but increased significantly in the 70+ group over the same period. In women, no significant trends in numbers of deaths were seen for any age-group.

Figure 24. Trends in colorectal cancer deaths and age-standardised mortality rates, males by age group, 1994-2019, based on joinpoint analysis[7]

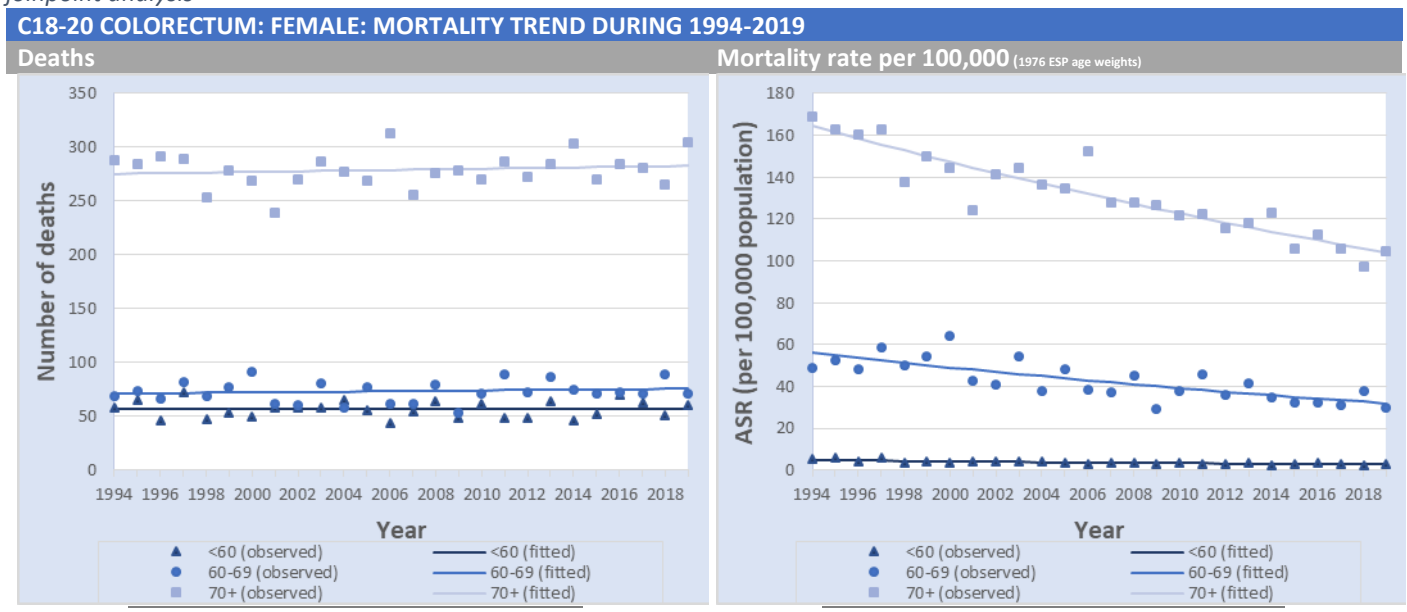


Age group	from-to	apc	ci	trend
<60 years	1994-2019	-0.4	[-1.0,0.2]	↔
60-69 years	1994-2019	-0.5	[-1.0,-0.1]	↓
70+ years	1994-2019	1.3	[0.9,1.6]	↑

Age group	from-to	apc	ci	trend
<60 years	1994-2019	-2.6	[-3.3,-2.0]	↓
60-69 years	1994-2019	-3.2	[-3.6,-2.8]	↓
70+ years	1994-2011	-0.6	[-1.3,0.2]	↔
	2011-2019	-3.7	[-5.7,-1.6]	↓

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Figure 25. Trends in colorectal cancer deaths and age-standardised mortality rates, females by age group, 1994-2019, based on joinpoint analysis[7]



Age group	from-to	apc	ci	trend
<60 years	1994-2019	0.0	[-0.8,0.8]	↔
60-69 years	1994-2019	0.2	[-0.5,1.0]	↔
70+ years	1994-2019	0.1	[-0.2,0.4]	↔

Age group	from-to	apc	ci	trend
<60 years	1994-2019	-2.4	[-3.1,-1.6]	↓
60-69 years	1994-2019	-2.2	[-2.9,-1.5]	↓
70+ years	1994-2019	-1.8	[-2.1,-1.5]	↓

from-to=range of years; **apc** =annual percentage change over range (%); **ci** =95% confidence intervals of **apc** for each distinct range;
trend: ↑=significant increase, ↓=significant decrease, ↔ =no change, at the 95% level

Conclusion

This report summarises the most recent data available on incidence, mortality, stage at diagnosis and survival for the three cancers for which national screening programmes currently exist, i.e. breast (female), cervical, and colorectal cancer, with the aim of assessing the impact of the three current national screening programmes on the epidemiology of these cancers.

For breast cancer, where it would not be anticipated that screening would reduce the incidence, incidence rates in women in the screening age group show variable (but non-significant) trends around the time of screening roll-out between 1999 and 2008, but since 2008 incidence rates have remained stable. In contrast, age-standardised rates for women in the pre- and post-screening age-groups both show significant increasing trends since 1994 (Figure 2).

For cervical cancer, where it would be anticipated that screening would reduce incidence, the significant increasing trend in incidence rates in the screening age group (averaging 4.2% per year 1999-2011) ended following the introduction of cervical screening in 2008, after which the trends have fluctuated (as would be expected following the introduction of a screening programme). In contrast, incidence rates in women in the post-screening age group remained stable between 1994 and 2019 (Figure 10).

For colorectal cancer, where it would also be anticipated that screening would reduce incidence, a significant decreasing trend was identified in men in the screening age group, which preceded the introduction of organised screening (Figure 18). In women, incidence rates in the screening age group have remained stable over the full period examined (Figure 19). Incidence rates have also remained stable in both men and women in the pre-screening age group, while incidence in men in the post-screening age group shows a significant decreasing trend (by -2.7% per year) starting in 2009 (Figure 18). Incidence rates in women in the post-screening age group show some evidence of a decreasing trend between 2010 and 2014, but this was not statistically significant (Figure 19).

One of the purposes of screening is to increase the proportion of cancers diagnosed at an early stage, as earlier intervention should improve prognosis. Analyses presented in this report show that a much greater proportion of tumours identified by screening in the years 2014-2018 were diagnosed at stage I or II in people in the screening age group compared to tumours identified by other means in the same age group and by any means in the other age groups, for all three cancers included in this report (Figure 4, Figure 12 and Figure 20). There has been a significant decreasing trend in the proportion of tumours diagnosed at stage IV in people in the screening age groups between 1994 and 2018 for both breast (by 2.5% per year) and colorectal cancer (by 0.7% per year). However, for cervical cancer, a significant increase in the proportion of stage IV tumours in women in the screening age group was identified over the same period. There are a number of possible explanations for this increase, the most likely of which is the occurrence of advanced disease in women who do not participate (or regularly participate) in cervical screening. In addition, screening is not effective for certain sub-types of cervical cancer, such as adenocarcinomas. More detailed investigation of this trend would be required to identify the causes of this apparent increase.

Survival is also higher, and has improved more markedly, in the screening age groups for all three cancers, but improvements have also been seen in the pre-and post- screening age groups for both breast and colorectal cancer (Figure 6, Figure 14 and Figure 22) and began before rollout of the national screening programmes. In contrast to this, there is no clear evidence that survival from cervical cancer has improved over time in the older age group. It should, however, be noted that we have made no attempt to adjust survival results presented in this report for lead-time bias, which could potentially inflate survival figures for screen-detected cancers (through earlier knowledge of cancer diagnosis without, necessarily, direct benefits in terms of earlier or more effective treatment) or other factors which could affect survival estimates (such as over-detection, length-time bias or selection bias).

There have been decreases in mortality rates in all three cancers in this report, but most of these most of these trends started prior to the introduction of screening programmes and will also reflect general improvements in cancer care and treatment and cannot be solely considered a consequence of screening, as further evidenced by decreases of similar magnitude in some non-screening age groups.

Overall, there have been positive changes in the epidemiology of all three of the cancers included in this report. These likely reflect a combination of factors such as improvements in care, new treatments, better awareness of symptoms, and changes in the underlying risk exposure of the population, in addition to screening. Nonetheless, there is temporal evidence in this report that some of that improvement can be attributed to the introduction and continued delivery of the three national screening programmes.

Glossary

Abbreviation/Term	Definition and notes
APC	Annual percentage change
ASR	Age-standardised rate. May refer to incidence or mortality. Rates in this report are standardised using the European 1976 reference population.
Lead-time bias	In lead-time bias, screening advances the time of diagnosis so there is an artificial increase in survival time from diagnosis whatever the effect (or lack of effect) on the ultimate time of death.
Length-time bias	Length-time bias is the phenomenon whereby slower-growing cancers remain in the preclinical detectable phase longer than faster-growing cancers. Therefore screening will inevitably detect proportionally more slower-growing, better-prognosis cancers than those seen in the symptomatic population.
Opportunistic screening	For the purpose of this report, opportunistic screening has been defined as any screening which occurs outside one of the 3 national population-based screening programmes (i.e. BreastCheck, CervicalCheck and BowelScreen). A further subcategory (unspecified screening) is used by NCRI where it is unclear, based on current data, whether or not screening, within relevant age-ranges, was provided as part of one of these programmes. To allow for uncertainties or possible misclassification, figures presented in this report refer to all subcategories of screening combined, although the majority (at least 80%-90% of all screen-detected cancers over the period 2017-2019) were detected though one of the organised screening programmes.
Method of presentation	e.g. Autopsy, unspecified screening, organised screening, opportunistic screening, incidental, symptoms, unknown
Selection bias	People who choose to participate in screening programmes often differ from those who do not. Selection bias can work both ways (i.e. either people who are at high risk being more likely to attend for screening or people at low risk more likely to attend for screening).[17]
TNM/staging	Tumours registered by NCRI 1994-2013 were staged using TNM 5th edition[18] Tumours registered by NCRI 2014-2019 were staged using TNM 7th edition[19] Although some changes in staging criteria occurred between the 5th edition of TNM and the 7th edition of TNM, this is not expected to have substantially influenced the trends in breakdown by stage categories I-IV for the cancer sites included in this report.

References

1. National Cancer Registry Ireland. *Cancer in Ireland 1994-2019: Annual Report of the National Cancer Registry*. NCRI; 2021. https://www.ncri.ie/sites/ncri/files/pubs/NCRI_Annual%20Report_2021.pdf

2. National Cancer Registry Ireland. *Cancer Incidence Projections for Ireland 2020-2045*. NCRI; 2019. https://www.ncri.ie/sites/ncri/files/pubs/CancerIncidenceProjections_NCRI_fullreport_09042019_final.pdf

3. National Cancer Registry Ireland. *Cancer in Ireland 1994-2015 with Estimates for 2015-2017: Annual Report of the National Cancer Registry.* NCRI; 2017. https://www.ncri.ie/sites/ncri/files/pubs/NCRReport_2017_full%20report.pdf

4. National Cancer Registry Ireland. *Cancer Trends 37 Breast Cancer 1994-2016*.; 2019. https://www.ncri.ie/sites/ncri/files/pubs/Trendsreport_Breastcancer_20191107_0.pdf

5. National Cancer Registry Ireland. *Cancer Trends No. 35 Cervical Cancer*.; 2017. https://www.ncri.ie/sites/ncri/files/pubs/CervicalCaTrendsReport_MP.pdf

6. World Health Organization. International classification of diseases for oncology (ICD-O). Published online 2013.

7. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Stat Med*. 2000;19(3):335-351. doi:10.1002/(sici)1097-0258(20000215)19:3<335::aid-sim336>3.0.co;2-z

8. National Screening Service. *BreastCheck Programme Report 2007/08*.; 2008. https://www.breastcheck.ie/sites/default/files/bcheck/documents/programme_report_2007-08.pdf

9. National Screening Service. *BreastCheck Programme Report 2018 and 2019*.; 2021. https://www.screeningservice.ie/publications/BreastCheck-Programme-Report_2018_and_2019.pdf

10. Ellis L, Woods LM, Estève J, Eloranta S, Coleman MP, Rachet B. Cancer incidence, survival and mortality: explaining the concepts. *Int J Cancer*. 2014;135(8):1774-1782. doi:10.1002/ijc.28990

11. Perme MP, Stare J, Estève J. On Estimation in Relative Survival. *Biometrics*. 2012;68(1):113-120. doi:10.1111/j.1541-0420.2011.01640.x

12. Health Information and Quality Authority. *HTA of HPV Testing for Cervical Cancer Screening*.; 2017. https://www.hiqa.ie/reports-and-publications/health-technology-assessment/hta-hpv-testing-cervical-cancer-screening

13. National Screening Service. *CervicalCheck Programme Report September 2017 – March 2020*. https://www.screeningservice.ie/publications/CervicalCheck-ProgrammeReport-September-2017-March-2020.pdf

14. IARC. *Cervical Cancer Screening. IARC Handbooks of Cancer Prevention*. Vol 18.; 2022. https://publications.iarc.fr/604

15. IARC. *Colorectal Cancer Screening. IARC Handbooks of Cancer Prevention*. Vol 17.; 2019. http://publications.iarc

16. National Screening Service. *BowelScreen Programme Report 2018-2019 Round Three*.; 2022. https://www.bowelscreen.ie/_fileupload/Programme%20Reports/BowelScreen%20Programme%20Report%20Round%20Three.pdf

17. Bailey L, Vardulaki K, Langham J, Chandramohan D. *Introduction to Epidemiology*. Open University Press; 2005.

18. Sobin LH, Wittekind Ch (Christian). *TNM Classification of Malignant Tumours*. 5th ed. 1997. Wiley-Blackwell; 1997.

19. Sobin LH, Gospodarowicz MK (Mary K), Wittekind Ch (Christian). *TNM Classification of Malignant Tumours*. 7th ed. 2009. Wiley-Blackwell; 2010.

Appendix 1.

Table 4. C50 breast cancer, number of cases by age group, stage and year of incidence

Year of incidence	<50 years					50-69 years					70+ years				
	Stage I	Stage II	Stage III	Stage IV	Unstaged	Stage I	Stage II	Stage III	Stage IV	Unstaged	Stage I	Stage II	Stage III	Stage IV	Unstaged
1994	83	221	55	14	26	144	372	100	60	65	88	160	77	37	62
1995	92	214	55	22	38	156	307	82	69	49	80	216	63	41	77
1996	84	238	54	17	32	171	357	100	58	48	74	204	72	44	79
1997	102	213	63	26	29	169	411	98	44	42	77	200	83	34	77
1998	105	248	51	24	20	198	408	85	64	38	89	224	65	50	73
1999	108	259	66	27	18	208	437	89	58	40	101	200	80	32	77
2000	119	245	46	23	20	253	472	81	60	34	87	229	85	53	104
2001	118	280	50	24	19	325	488	97	62	34	108	241	82	50	76
2002	125	275	53	26	16	368	549	124	64	34	102	243	73	61	76
2003	140	292	92	28	24	394	504	114	73	40	118	228	82	46	65
2004	155	294	84	31	17	380	426	133	73	28	109	251	100	62	60
2005	154	281	84	34	12	379	478	115	83	19	126	235	78	72	70
2006	164	294	67	36	15	371	485	116	62	24	156	257	83	73	74
2007	179	321	81	31	15	463	519	135	85	32	141	273	100	63	66
2008	185	345	113	46	12	578	606	138	94	35	158	260	99	70	83
2009	177	316	117	40	24	561	610	145	56	31	165	300	122	63	65
2010	187	298	104	56	24	590	568	174	69	27	140	300	102	57	64
2011	177	351	112	45	26	570	564	175	72	44	161	325	109	76	64
2012	185	344	120	40	14	580	583	168	83	29	192	325	108	65	52
2013	159	349	96	52	21	638	588	135	94	29	191	407	107	90	39
2014	194	319	107	34	20	654	492	191	79	19	211	370	111	75	50
2015	218	337	120	37	18	734	569	157	70	20	219	387	119	89	30
2016	237	383	134	38	32	735	542	157	84	51	206	401	122	96	52
2017	195	295	123	40	120	626	462	138	70	341	212	372	127	73	160
2018	209	333	120	35	135	772	519	158	64	253	193	391	132	62	204

Table 5. C53 cervical cancer, number of cases by age group, stage and year of incidence

Year of incidence	25-60 years					61+ years				
	Stage I	Stage II	Stage III	Stage IV	Unstaged	Stage I	Stage II	Stage III	Stage IV	Unstaged
1994	68	22	27	11	24	9	16	5	<5	10
1995	55	20	25	8	13	7	5	13	<5	<5
1996	97	17	34	7	13	11	10	9	<5	12
1997	53	19	32	11	12	7	6	10	<5	17
1998	70	24	24	9	13	16	<5	11	6	10
1999	63	15	23	6	13	15	5	<5	<5	6
2000	73	17	31	6	10	12	17	10	<5	11
2001	68	30	31	12	9	7	8	5	5	9
2002	81	19	37	15	13	11	9	10	6	9
2003	75	20	43	10	16	6	16	8	6	<5
2004	88	21	30	10	13	9	6	9	6	6
2005	88	24	61	21	14	7	7	9	16	11
2006	88	27	44	8	16	10	7	7	10	8
2007	123	23	51	18	16	8	14	10	19	8
2008	103	22	46	27	17	10	8	12	10	8
2009	172	33	46	27	11	11	15	15	15	7
2010	155	34	56	15	9	10	12	18	20	8
2011	175	25	47	22	13	14	13	10	14	5
2012	136	26	48	26	6	8	14	18	16	<5
2013	128	28	39	21	<5	9	10	20	18	7
2014	120	25	39	20	5	13	15	17	16	7
2015	110	25	44	24	<5	13	9	7	10	<5
2016	143	32	43	20	<5	10	8	17	10	<5
2017	126	33	55	16	8	7	11	17	20	<5
2018	122	25	45	32	18	9	11	21	15	8

Table 6. C18-C20 colorectal cancer, number of cases by age group, stage and year of incidence

Year of incidence	< 60 years					60-69 years					70+ years				
	Stage I	Stage II	Stage III	Stage IV	Unstaged	Stage I	Stage II	Stage III	Stage IV	Unstaged	Stage I	Stage II	Stage III	Stage IV	Unstaged
1994	56	94	92	76	55	87	128	114	89	41	156	301	175	160	166
1995	50	96	101	90	48	84	146	98	119	32	142	260	150	156	153
1996	52	92	87	97	49	92	145	101	100	32	119	250	170	171	175
1997	73	102	104	78	55	88	158	111	94	37	147	282	172	189	178
1998	70	108	94	102	46	75	158	97	96	36	124	311	193	184	145
1999	54	105	95	79	47	85	155	118	100	37	117	291	188	198	187
2000	54	97	109	86	51	81	137	139	105	29	120	278	211	187	190
2001	74	102	101	118	61	65	135	130	113	37	142	284	231	211	161
2002	65	100	116	104	55	68	127	132	107	38	127	283	241	212	140
2003	59	97	126	104	45	77	130	150	100	26	134	326	227	221	162
2004	64	101	134	111	56	76	150	153	140	33	164	326	240	237	153
2005	59	79	148	101	63	70	155	158	111	39	128	356	291	233	136
2006	61	115	145	104	64	64	121	154	125	58	129	339	280	247	176
2007	74	123	165	117	76	74	167	205	143	39	160	320	272	251	151
2008	61	105	150	118	74	92	135	176	117	47	125	364	319	263	152
2009	52	107	177	125	72	94	157	206	144	49	179	357	310	241	179
2010	67	101	185	108	77	80	149	188	146	43	172	340	340	290	150
2011	78	92	167	125	69	104	150	211	123	54	168	372	330	261	155
2012	68	100	208	118	98	99	162	223	129	39	219	365	328	234	144
2013	54	109	172	122	69	116	171	223	129	54	157	346	334	250	175
2014	63	89	166	138	77	129	152	251	140	41	184	344	322	293	135
2015	77	104	179	141	69	154	159	269	174	43	194	355	353	250	155
2016	75	113	187	128	83	171	163	240	131	41	180	358	370	267	154
2017	65	107	182	112	130	131	129	197	115	105	175	351	326	269	236
2018	74	112	168	125	135	142	150	209	122	99	186	373	322	228	263