Profile of Cervical Cancer in England

Incidence, Mortality and Survival

October 2012

NHS
Trent Cancer Registry

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Authors

This report has been produced by Trent Cancer Registry, the National Cancer Intelligence Network's lead registry in England for gynaecological cancers, in collaboration with the NHS Cervical Cancer Screening Programme.

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Further information on the work of the National Cancer Intelligence Network (NCIN) can be found at www.ncin.org.uk

Erratum

This document, issued 09 November 2012, is a corrected version of the report, which was published on 8th October 2012. In the original, Figure 24 was found to have the five-year survival columns in the incorrect order, so that the columns did not match with the data in the table. This is the sole change that has been made to the publication.

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FOREWORD

This report results from collaboration between the NHS Cervical Screening Programme and Trent Cancer Registry as the National Cancer Intelligence Network's lead registry for gynaecological cancers. It shows the latest time trends, trends by age and deprivation, and regional variations in incidence, mortality and survival for invasive cervical cancer in England. There is also a separate section on these cases stratified according to their main morphological groups. It should be of interest to all those involved in the commissioning and delivery of services to prevent and treat cervical cancer.

This annual report is part of a suite of statistical information that is available about cervical cancer. Each year the Information Centre publishes the Cervical Screening Programme Statistical Bulletin, providing invaluable, detailed information about the screening programme. It is intended that this report will complement the screening bulletin. A web-based analytical tool, the newly-released Gynaecological Cancer Hub **www.ncin.org.uk/gynaehub**, is also available, providing data and intelligence on a range of gynaecological cancers in England including cervical cancer and screening data along with several metrics measuring associated risk factors. The Hub is aimed at a wide range of professionals working in the field, including NHS providers, commissioners, Cancer Networks, charities, gynaecologists and nurse specialists. It also provides information and helpful links for patients and the general public who would like to understand more about these cancers.

More information on the work of the NCIN, including other publications and cancer information tools is available from the NCIN website (**http://www.ncin.org.uk**).

Any feedback on this report would be most welcome and should be sent to Jason Poole. Suggestions for further work would be particularly well received.

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EXECUTIVE SUMMARY

The key findings are:

- Over the last 20 years the incidence of cervical cancer in England has decreased by a third whilst mortality has more than halved. Between 2008 and 2009 there was a marked increase in the incidence of cervical cancer due to the diagnosis and subsequent death of the celebrity Jade Goody.
- Incidence rates are now higher than 20 years ago in the under 35s due to marked increases over the last decade. Mortality rates for women aged 20-24 and 30-39 have remained stable over the last few years, although they have risen slightly in those aged 25-29.
- The number of cervical cancer cases diagnosed increased around the time of Jade Goody's diagnosis of cervical cancer (August 2008) and subsequent death (March 2009). This increase is most notable among women aged between 25 and 39.
- Incidence and mortality rates tend to be lowest for those Strategic Health Authorities (SHA) and Cancer Networks (CN) in the south and east of England, and highest in the north and the midlands. At CN level, the highest incidence rate is more than double that of the lowest rate.
- There is strong evidence that both incidence and mortality are worse in patients living in the more deprived PCTs. For example, the average mortality rate among the 30 most deprived PCTs is almost twice as high as in the most affluent 30 PCTs. This may be linked to higher rates of smoking, lower screening coverage and other factors associated with deprivation.
- Squamous cell carcinoma is the most common morphology, accounting for over two thirds of cervical cancers. Around a fifth of cases are adenocarcinomas.
- There is some variation in the morphology groups by age and deprivation. For example, women living in more deprived areas are more likely to be diagnosed with squamous cell carcinoma, possibly associated with the higher rate of smoking in more deprived areas.
- Survival following a diagnosis of cervical cancer has improved in England since the late 1980s, from 83% to 88% for one-year relative survival and from 64% to 70% for five-year relative survival. However, there is some variation at CN level with, for example, five-year survival varying from 52% to 82%.
- There is strong evidence that cervical cancer survival is worse in older women. For example, one-year relative survival in those aged 15-39 is 97% compared with 52% in those aged 80 or older. This may relate to many factors, including possible late presentation in older women, differences in treatments, and differences in pathology.
- There is evidence that cervical cancer survival is worse in women living in the most deprived fifth of areas nationally compared with the least deprived fifth. This equates to a 6% gap in relative survival one-year after diagnosis and an 11% gap for five-year relative survival.

OVERALL TRENDS IN CERVICAL CANCER INCIDENCE AND MORTALITY

Further details on the definition of cervical cancer used and the age-standardisation of incidence and mortality rates can be found in Appendix 1.

Trends in incidence and mortality, England, 1989 to 2009/2010

Incidence and mortality rates in England have fallen considerably over the past 20 years. During this period, incidence rates decreased by over a third (from 15.0 to 9.8 per 100,000 female population) and mortality rates reduced by 60% (from 5.8 to 2.2 per 100,000 female population in 2008 and 2009). There were over 2,700 cervical cancer cases diagnosed in 2009 and around 750 deaths from cervical cancer in 2010.

The Cervical Screening Programme (CSP) aims to reduce the number of women who go onto develop cervical cancer by detecting and treating pre-invasive disease which may otherwise lead to cancer. Incidence fell sharply following the establishment of the CSP in 1988, but this reduction has slowed in recent years (see Figure 1). Between 2008 and 2009 there was a marked increase (14%) in the incidence of cervical cancer from 8.5 to 9.8 per 100,000 female population. This is likely to be due to earlier detection of cancers linked to increased screening coverage, particularly in women who may never have had a smear, or not attended regularly for cervical screening. This increased screening coverage was a result of the media attention around the diagnosis and subsequent death of the British reality TV celebrity Jade Goody [1]. Analysis of stage data and trends in disease stage have not been included in this report, but a further publication that examines the stage of disease and correlates this with a range of factors is planned. It is hoped that this will supplement the present report and give greater insight into the trends and variations observed.

The downward trend in mortality rates reflects the success of the screening programme in reducing the number of invasive cervical cancers that are diagnosed in women who attend for screening. It is estimated that cervical screening saves around 5000 lives each in the UK [2]. Earlier detection of invasive disease through screening has also impacted on mortality rates with more women diagnosed at a treatable stage. A reduction in mortality rates may also be related to advances in treatment, such as the widespread use of chemoradiation and, more generally, improved management of the disease following reconfiguration of cancer services, with the establishment of the network of specialist gynaecological cancer centres throughout the UK [3].

Table 1 Trends in incidence and mortality, England, 1989 to 2009/2010

	England - Incidence				England - Mortality		
Year	**Total Cases**	**ASIR**	**95% CI**		**Total Cases**	**ASMR**	**95% CI**
1989	3,881	15.0	(14.5,	15.5)	1,664	5.8	(5.5, 6.1)
1990	4,018	15.6	(15.1,	16.1)	1,612	5.6	(5.3, 5.9)
1991	3,404	12.9	(12.5,	13.4)	1,508	5.2	(4.9, 5.4)
1992	3,199	11.9	(11.5,	12.4)	1,498	5.0	(4.8, 5.3)
1993	3,123	11.7	(11.2,	12.1)	1,371	4.7	(4.4, 4.9)
1994	2,999	11.1	(10.7,	11.5)	1,270	4.1	(3.9, 4.4)
1995	2,909	10.6	(10.2,	11.0)	1,242	4.1	(3.9, 4.4)
1996	2,800	10.1	(9.7,	10.5)	1,236	4.1	(3.8, 4.3)
1997	2,697	9.8	(9.4,	10.2)	1,149	3.7	(3.5, 3.9)
1998	2,620	9.3	(9.0,	9.7)	1,077	3.5	(3.3, 3.7)
1999	2,626	9.3	(9.0,	9.7)	1,030	3.2	(3.0, 3.5)
2000	2,477	8.8	(8.4,	9.2)	1,033	3.3	(3.1, 3.5)
2001	2,493	8.9	(8.5,	9.2)	952	3.0	(2.8, 3.2)
2002	2,363	8.3	(7.9,	8.6)	929	2.8	(2.6, 3.0)
2003	2,384	8.3	(8.0,	8.7)	888	2.7	(2.5, 2.9)
2004	2,280	8.0	(7.7,	8.4)	895	2.7	(2.5, 2.9)
2005	2,299	8.2	(7.8,	8.5)	841	2.5	(2.3, 2.7)
2006	2,422	8.5	(8.2,	8.9)	769	2.3	(2.1, 2.5)
2007	2,366	8.3	(8.0,	8.7)	756	2.3	(2.2, 2.5)
2008	2,422	8.5	(8.2,	8.9)	759	2.3	(2.1, 2.4)
2009	2,735	9.8	(9.4,	10.2)	773	2.2	(2.1, 2.4)
2010					753	2.2	(2.1, 2.4)

ASIR is (directly) age-standardised incidence rate per 100,000 female population
ASMR is (directly) age-standardised mortality rate per 100,000 female population
95% CI is 95% confidence interval for calculated
Source: UK Cancer Information Service

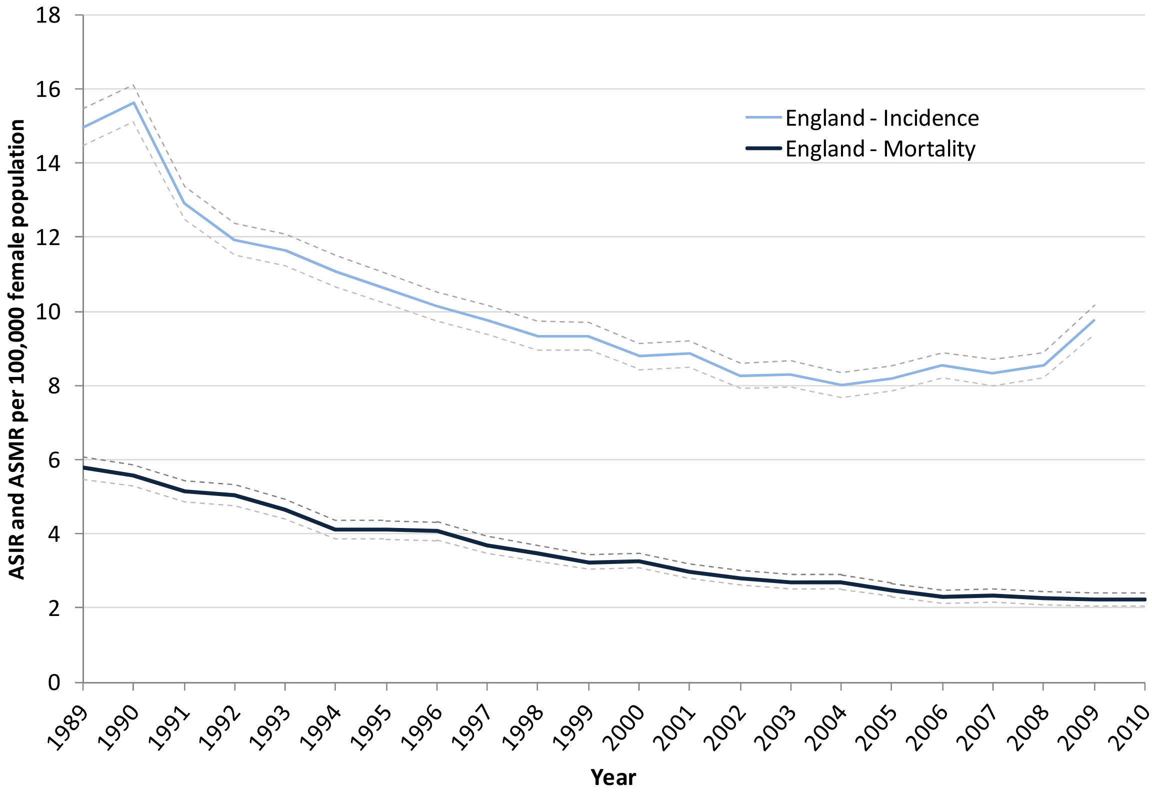


Figure 1 Trends in incidence and mortality, England, 1989 to 2010

Dotted line is 95% confidence interval for calculated rates
Source: UK Cancer Information Service

CERVICAL CANCER INCIDENCE

The results in this section must be interpreted with caution as regional variations in the incidence of invasive cervical cancer may be partly due to differences in diagnostic and coding practice, as well as variations in the underlying risk of disease.

In addition to the tables of figures giving 95% confidence intervals, funnel plots are also presented in the following sections. These funnel plots are a visual tool which allow an interpretation of data points falling outside of the two standard deviations (SD) and three SD control limits around the national average, represented by the horizontal line. Only Strategic Health Authorities (SHAs) and Cancer Networks (CNs) that are outside the three SD control limits are labelled. Further details on funnel plots are provided in Appendix 1.

Incidence by Strategic Health Authority, 2005-2009

Cervical cancer incidence rates tend to be lower in the south and east of England but higher in the north and the Midlands. There is strong evidence that rates are lower than the national average for residents of three SHAs (East of England, South East Coast and London), and likewise higher than nationally for five SHAs (Yorkshire and The Humber, East Midlands, North East, North West and West Midlands), ranging from 6.8 to 11.3 per 100,000 female population.

In the funnel plot below, all of the SHAs fall outside of the 2 standard deviation funnel. This strongly suggests that there is more variation in incidence rates between SHA areas than can be explained by random variation, even after standardising for age. This is known as overdispersion and indicates that there is some extra source of variability between areas not accounted for.

The Human Papilloma Virus (HPV), a sexually transmitted infection, is considered a necessary condition for the development of cervical cancer, and HPV types 16 and 18 are found in the vast majority of cervical cancers [4]. Therefore, HPV infection may be more likely in women who begin having sex early and who have many sexual partners, or a partner who has had many sexual partners. However, most women who are infected with HPV do not go on to develop cervical cancer. Other factors which make it more difficult for the immune system or cells in the cervix to fight off the infection may also need to be present; factors such as smoking and immunosuppressant illnesses such as HIV/AIDS [2]. In terms of early onset of sexual activity, HPV is not the only factor. Research suggests that pregnancy before the age of 17, compared to having a first pregnancy at the age of 25 or over, doubles the risk of cervical cancer [2].

Therefore, the geographical variation may be due to several factors, such as smoking, poorer uptake of screening, early onset of sexual activity (evident in the high under 18 conception rates) and HIV, known to be associated with socio-economic deprivation. Analyses later in this report do indeed confirm the relationship between deprivation and the incidence of cervical cancer [5] [6] [7].

Table 2 Incidence by SHA, 2005-2009

SHA	Total Cases	ASIR	95% CI
England	**12,244**	**8.7**	**(8.5, 8.8)**
North East	780	11.3	(10.5, 12.2)
North West	1,883	9.9	(9.5, 10.4)
Yorkshire & The Humber	1,485	10.7	(10.1, 11.3)
East Midlands	1,213	10.4	(9.8, 11.0)
West Midlands	1,376	9.6	(9.1, 10.1)
East of England	1,128	7.2	(6.8, 7.6)
London	1,412	6.8	(6.5, 7.2)
South East Coast	807	6.8	(6.3, 7.3)
South Central	872	8.0	(7.5, 8.6)
South West	1,288	9.2	(8.7, 9.8)

ASIR is (directly) age-standardised incidence rate
95% CI is 95% confidence interval for calculated rate
Source: UK Cancer Information Service

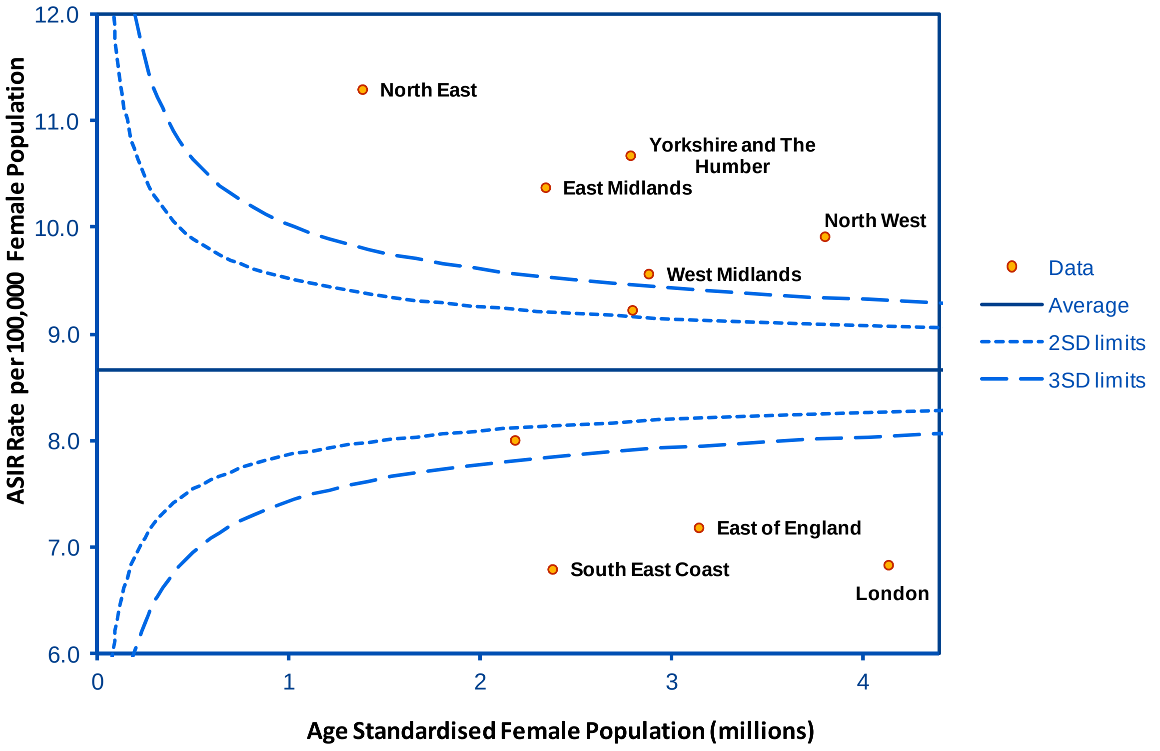


Figure 2 Funnel plot of incidence by SHA, 2005-2009

Source: UK Cancer Information Service

Incidence by Cancer Network, 2005-2009

Incidence rate patterns among the Cancer Networks (CNs) broadly reflect those seen for the SHAs, with rates also markedly low in and around London (see Figure 4). At CN level, the highest incidence rate is more than double that of the lowest rate. There is strong evidence that incidence rates are higher than the England average in several CNs, but particularly in the Humber & Yorkshire Coast CN (see Figure 3).

The North East Yorkshire & the Humber Quality Assurance Reference Centre (NEYH QARC) are currently investigating screening uptake and screening outcomes as well as the population risk factors that may be contributing to the particularly high incidence rate of cervical cancer in the Humber & Yorkshire Coast CN. It is important to note that cervical cancer outcomes are only a part of the picture and need to be considered in light of these other measures.

Table 3 Incidence by CN, 2005-2009

Cancer Network	Total Cases	ASIR	95% CI
England	**12,244**	**8.7**	**(8.1, 8.4)**
3 Counties	208	7.2	(6.2, 8.4)
Anglia	546	7.8	(7.1, 8.5)
Arden	235	8.9	(7.8, 10.2)
Avon, Somerset & Wiltshire	528	10.3	(9.4, 11.3)
Central South Coast	454	8.7	(7.9, 9.6)
Dorset	164	8.6	(7.2, 10.2)
East Midlands	1,120	10.5	(9.9, 11.2)
Essex	237	5.8	(5.1, 6.7)
Greater Manchester & Cheshire	767	9.0	(8.4, 9.7)
Greater Midlands	511	10.3	(9.3, 11.2)
Humber & Yorkshire Coast	385	13.9	(12.5, 15.5)
Kent & Medway	328	7.4	(6.6, 8.3)
Lancashire & South Cumbria	442	10.8	(9.7, 11.9)
Merseyside & Cheshire	570	10.4	(9.5, 11.3)
Mount Vernon	282	7.3	(6.5, 8.3)
North East London	270	6.7	(5.9, 7.6)
North London	292	6.8	(6.0, 7.6)
North of England	904	11.2	(10.4, 12.0)
North Trent	486	10.1	(9.2, 11.0)
North West London	320	6.3	(5.6, 7.1)
Pan Birmingham	514	10.1	(9.2, 11.0)
Peninsula	397	8.9	(8.0, 9.9)
South East London	338	8.0	(7.2, 9.0)
South West London	315	6.9	(6.1, 7.7)
Surrey, West Sussex & Hampshire	222	6.5	(5.7, 7.5)
Sussex	216	6.6	(5.7, 7.6)
Thames Valley	481	7.4	(6.8, 8.1)
Yorkshire	712	9.8	(9.1, 10.6)

ASIR is (directly) age-standardised incidence rate
95% CI is 95% confidence interval for calculated rate
Source: UK Cancer Information Service

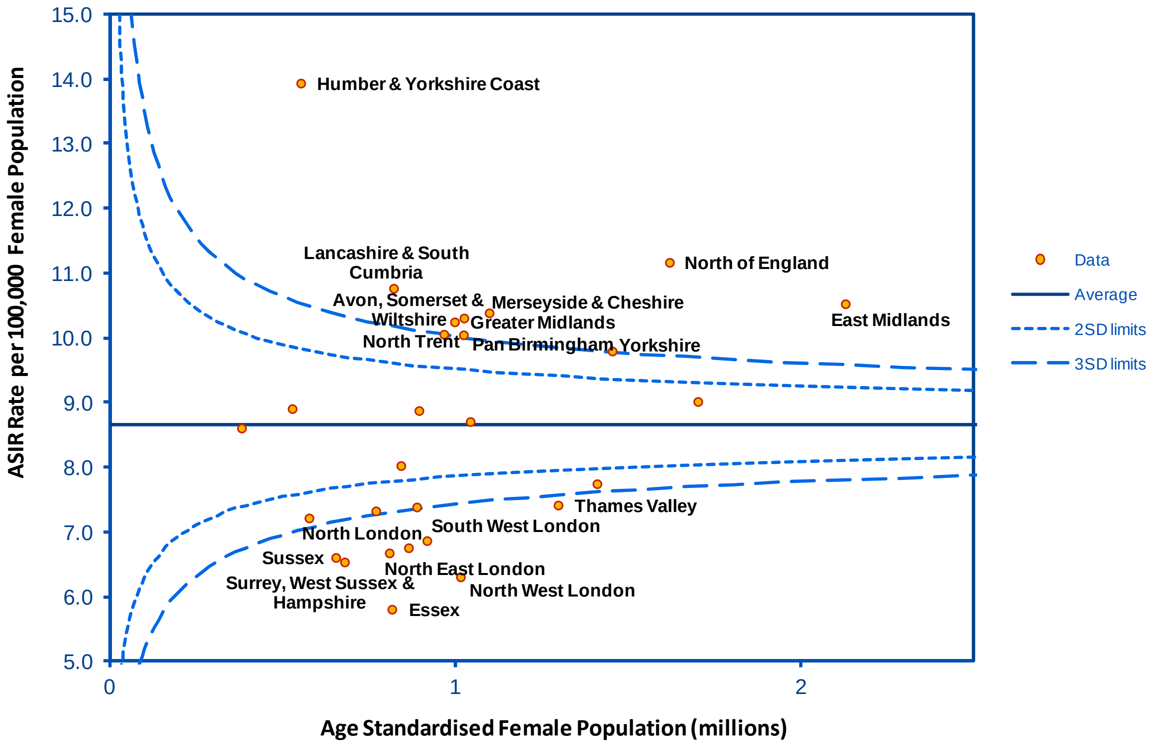


Figure 3 Funnel plot of incidence by CN, 2005-2009

Source: UK Cancer Information Service

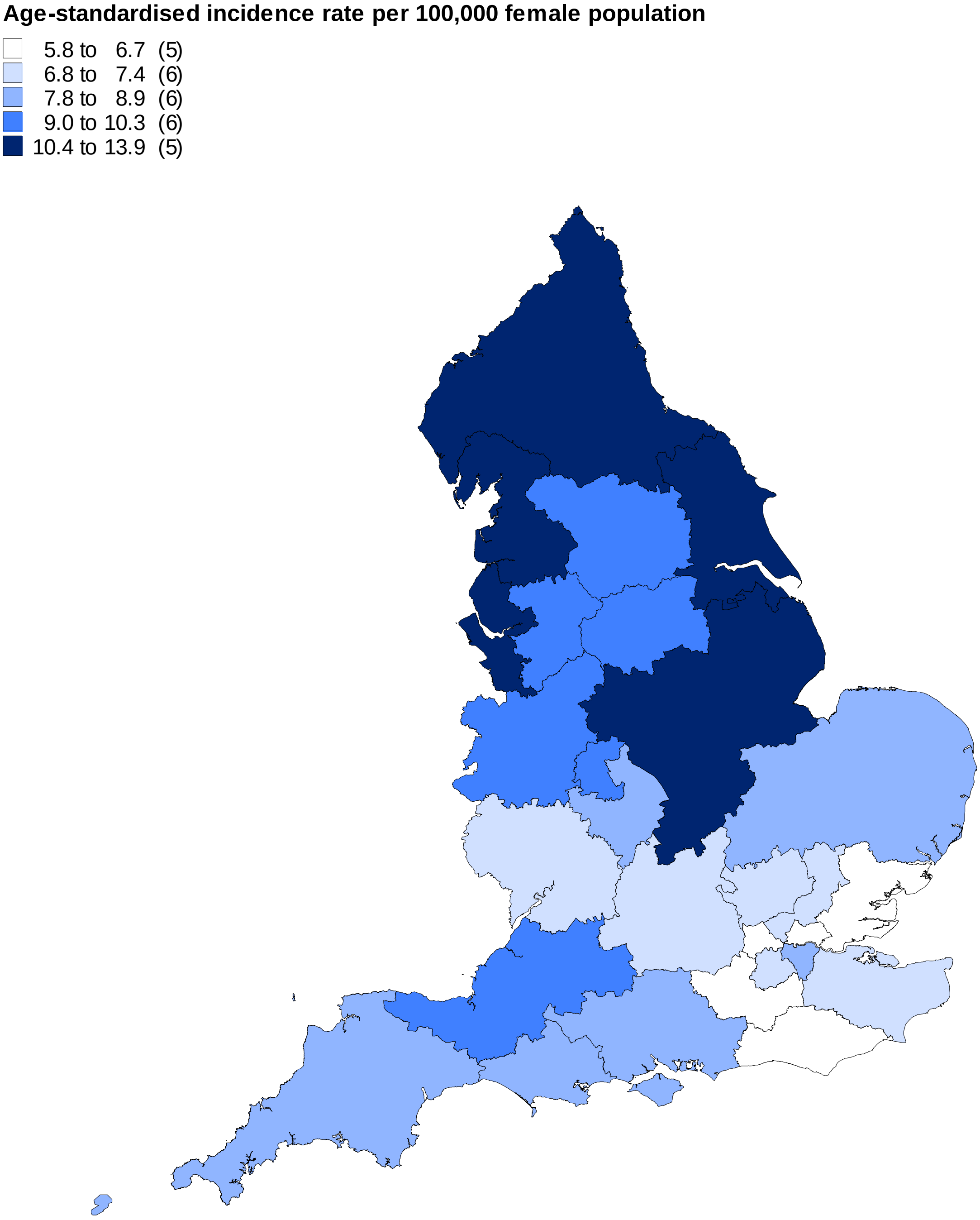


Figure 4 Map of incidence by CN, 2005-2009

The bracketed numbers in the key above are the number of Cancer Networks included in each quintile

Incidence by age, 2009

The age-specific incidence rate peaks among women in their early 30s. Following a gradual reduction in the rate in women in their 40s, rates rise again in women in their 70s and 80s. As a result of the screening programme many cervical cancers are detected in younger women, with around 60% of cases occurring in women aged 25-49. The cessation of screening when women reach 65 may contribute to the rise in incidence rates after this age; although cervical screening can be very problematic in older women due to anatomical changes and the hormonal environment.

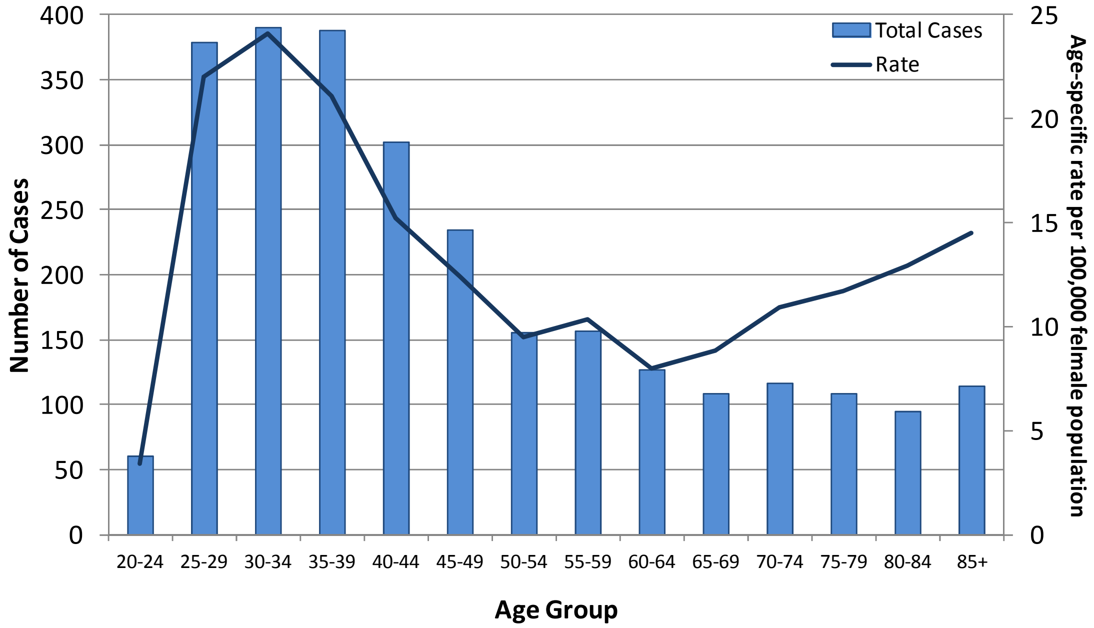


Figure 5 Age-specific incidence rates and number of cases diagnosed by five year age group, England 2009

Source: UK Cancer Information Service

Trends in incidence by age, England 1989 to 2009

Compared to 20 years ago, the incidence of cervical cancer in 2009 has fallen in all age groups except in those aged 20-24, 25-29, and 30-34. Between 1999 and 2009, incidence rates in women aged 20-24 and 25-29 have more than doubled. Similarly, the incidence in women aged 30-34 increased by two thirds and the incidence in women aged 35-39 by a quarter.

During this time there has also been a downward trend in the coverage of screening, particularly amongst women aged under 35, which may contribute to the increasing incidence of cervical cancers in young women [8]. There may also be other factors related to this rise in cervical cancer, such as the effect of unscreened female immigrant workers [3]. However, at present there is little supporting evidence for the latter and investigations are ongoing.

Although incidence may have increased in younger women, the proportion of cases that are detected at an early stage of disease may have changed. It also remains to be seen what effect, if any, the raising of the minimum screening age from 20 to 25 in England in 2003 has had on the stage of disease at presentation in young women. Recent research looking at the differences in the incidence of cervical cancer between two cohorts, those screened from the age of 20 and those screened from the age of 25, showed that the increase in incidence in young women may also be due to an increasing risk of exposure to factors associated with an increased risk of developing cervical cancer in young women [9].

Table 4 Trends in age-specific incidence rates by five-year age group, England, 1989 to 2009

	1989		1994		1999		2004		2009	
Age group	**Total Cases**	**Rate**	**Total Cases**	**Rate**	**Total Cases**	**Rate**	**Total Cases**	**Rate**	**Total Cases**	**Rate**
20-24	36	1.9	53	3.2	24	1.7	47	3.0	60	3.5
25-29	192	10.1	182	9.4	170	9.7	151	9.7	379	22.0
30-34	379	22.9	356	18.7	287	14.6	290	16.0	390	24.1
35-39	482	30.3	364	21.9	315	16.6	337	17.0	388	21.1
40-44	395	23.1	306	19.3	309	18.6	238	12.5	302	15.2
45-49	328	24.0	284	16.7	213	13.5	208	12.6	234	12.4
50-54	269	21.0	210	15.6	218	13.0	162	10.4	155	9.5
55-59	264	21.2	191	15.2	167	12.6	173	10.6	157	10.3
60-64	328	26.1	188	15.7	171	14.1	123	9.6	127	8.0
65-69	425	31.7	187	15.9	146	12.9	100	8.6	108	8.9
70-74	293	29.4	246	20.5	161	15.1	93	8.9	117	10.9
75-79	220	22.8	179	21.4	187	18.4	121	13.2	108	11.7
80-84	149	21.6	149	20.8	150	23.7	141	18.0	95	13.0
85+	120	22.9	104	16.9	105	15.5	95	14.2	114	14.5

Rate is age-specific rate per 100,000 female population
Source: UK Cancer Information Service

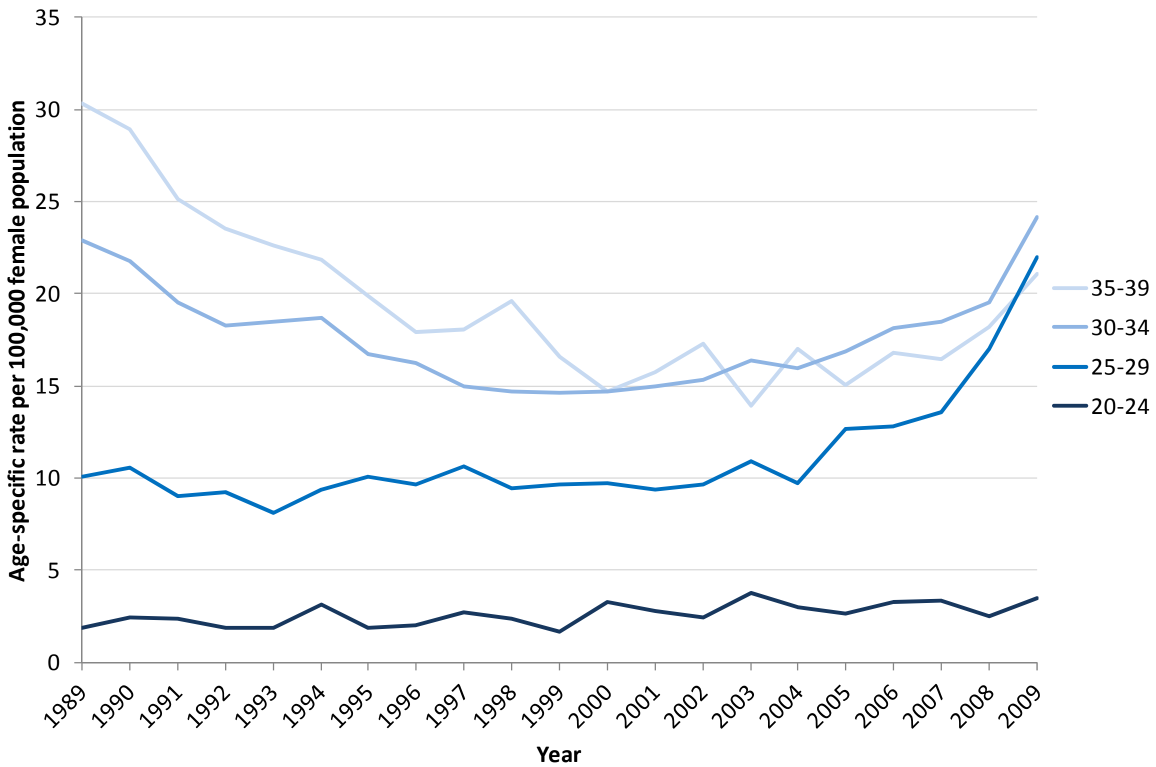


Figure 6 Trends in incidence in women under 40, England, 1989 to 2009

Source: UK Cancer Information Service

Monthly incidence by age, 2007-2009

The recent increase in the incidence of invasive cervical cancer in 2008 and 2009 in England, particularly in younger women, warrants further investigation. A recent study reported about half a million extra cervical screening attendances between mid-2008 and mid-2009 in England [10]. During this period the celebrity Jade Goody was diagnosed with cervical cancer (August 2008) and died (March 2009). At its peak in March 2009, attendance was 70% higher than expected. Furthermore, in women aged 25-49, 28% of the extra attendances were overdue.

The monthly number of cervical cancer cases diagnosed over the most recently available three years by broad age group: under 25, 25-39 and 40 and over (Figure 7) shows a marked spike in October 2008, particularly among women aged 25-39. Compared to October 2007 this spike translates into a 61% increase (43 extra cases) in women diagnosed aged 25-39. This result follows Jade Goody's cervical cancer diagnosis in August 2008. The (2 month) time lag is likely to reflect time for screening, referral to secondary care and subsequent diagnosis, and possibly lower screening uptake during the summer holiday period.

Following the announcement in February 2009 that Jade was terminally ill, her subsequent death a few weeks later and the media attention around this, incidence was again seen to increase from March onwards for several months. Between March and June 2009, there was a 58% increase (168 extra cases) in women aged 25-39 compared to 2008.

Future analyses will focus on whether these extra diagnoses of invasive cervical cancer, potentially diagnosed at an earlier stage of disease, translated into improved patient survival, in other words into lives being saved.

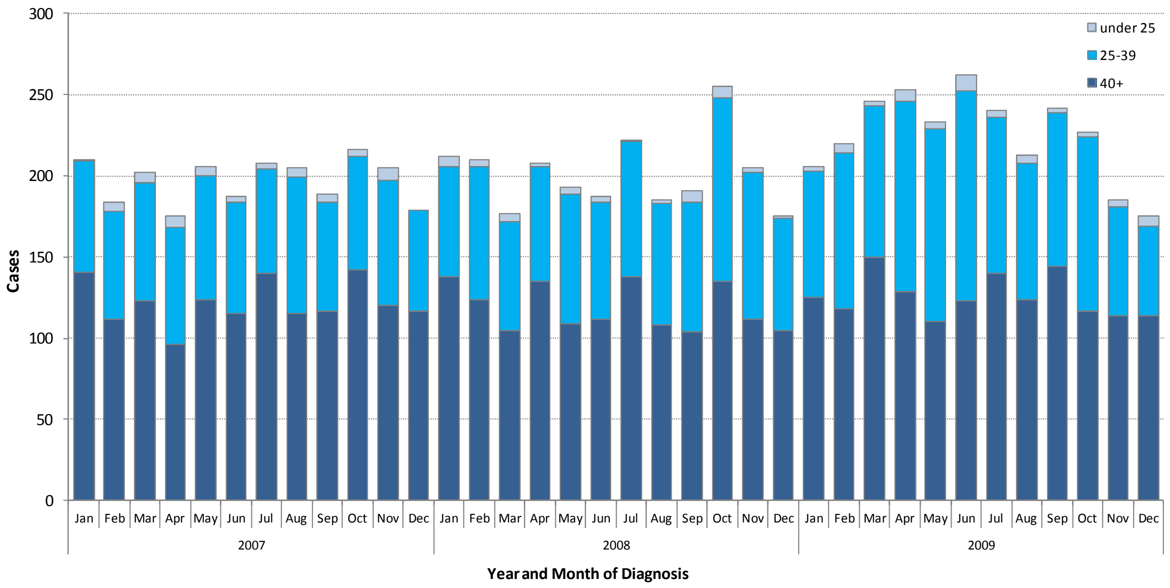


Figure 7 Number of cases by month, England, 2007 to 2009

Source: 2009 National Cancer Data Repository (NCDR)

Comparing incidence and deprivation by Primary Care Trust, 2005-2009

There is very strong evidence of a relationship between deprivation (as measured by the income score of the Index of Multiple Deprivation - see Appendix 1 for further details) and incidence of cervical cancer among the 151 PCTs in England (see Figure 8), with a correlation coefficient of 0.33 (p-value <0.001). For example, the average incidence rate in the 30 most deprived PCTs is 10.4 per 100,000 females compared to 7.8 per 100,000 in the 30 most affluent PCTs.

It has been suggested by Blanks et al [11] that an association between deprivation and incidence of cervical cancer may be underestimated by the inclusion of low-risk, high ethnic mix, high deprivation level, PCT populations. When 22 such PCTs are removed from the scatter plot the relationship also strengthens, with an increased correlation coefficient of 0.39.

A combination of factors associated with deprivation may be contributing to the higher rate of cervical cancer in women living in more deprived areas such as: cigarette smoking, earlier onset of sexual intercourse (evident in higher rates of under 18s conceptions) and poorer uptake of cervical screening. Other factors associated with deprivation, such as women who are HIV-positive or immigrant workers may also contribute to the higher incidence of cervical cancer in more deprived areas [3].

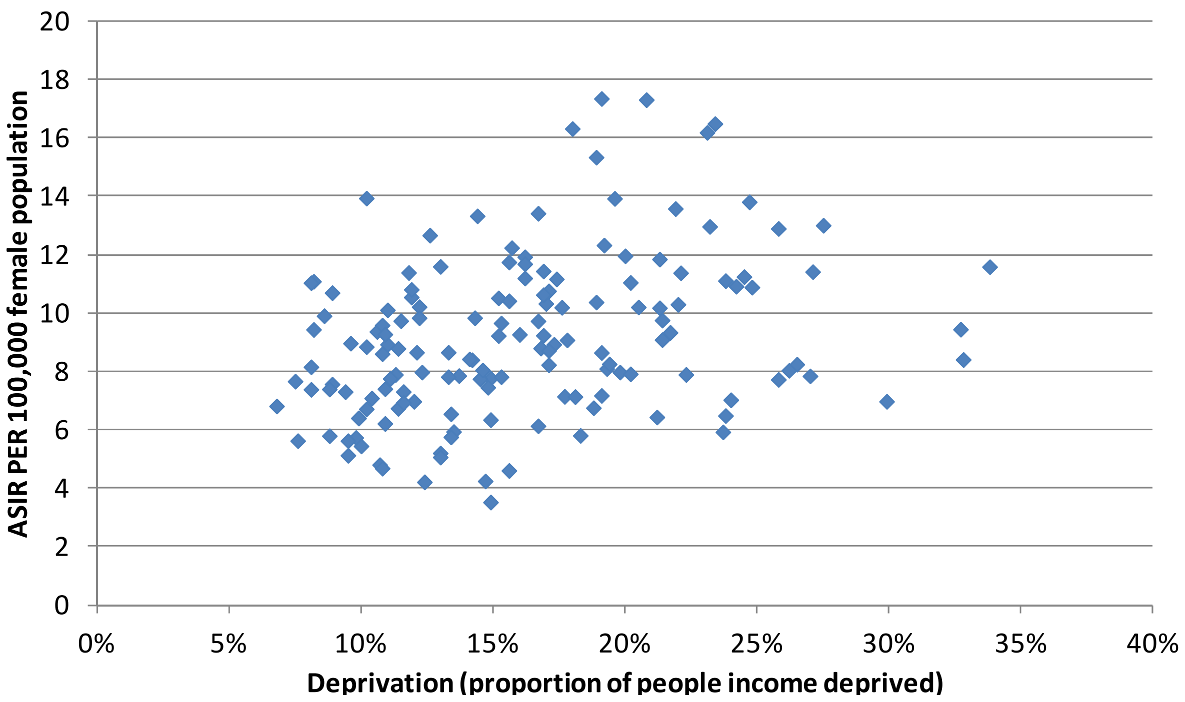


Figure 8 Scatter plot of incidence against measure of deprivation by PCT, 2005-2009

Source: UK Cancer Information Service

Morphology

In this section cervical cancer cases have been grouped by the morphological type of the tumour. For cervical cancer, analysis by morphological grouping is relevant, both clinically and epidemiologically. The way in which the tumour types have been grouped reflects similarities in the clinical or epidemiological characteristics. Please see the 'morphology' section in Appendix 1 for further details on which tumour types are included in each morphological group.

Trends in Incidence by Morphology, 1988-2009

The most common morphology in cervical cancer is squamous cell carcinoma (SCC), accounting for over two thirds of cervical cancers (in most years). The number of SCCs almost halved between the establishment of the CSP (in 1988) and the mid 2000s; in recent years, however, it has risen again with an 11% increase between 2008 and 2009. Adenocarcinomas are the second most common cervical cancer, accounting for around a fifth of all tumours in recent years. The number of adenocarcinomas has remained fairly stable, although there was a 20% increase between 2008 and 2009. Unclassified epithelial tumours have also decreased, falling by over 80% between 1988 and 2009; this may be due to improvements in coding or diagnostic practices. Adenosquamous cases account for around 4% of all tumours, with some variation across the period. The remaining morphology groups account for a small percentage of all cervical cancers. The number of neuroendocrine and 'other' tumours has increased and the number of other epithelial tumours has remained fairly stable during the period analysed.

Table 5 Trends by morphology, England, 1989 to 2009

	Year of Diagnosis									
	1989		1999		2004		2008		2009	
Morphology group	**Cases**	**%**	**Cases**	**%**	**Cases**	**%**	**Cases**	**%**	**Cases**	**%**
Squamous cell carcinoma	2,749	70.9%	1,776	67.7%	1,513	66.4%	1,652	68.3%	1,832	67.8%
Adenocarcinoma	439	11.3%	431	16.4%	434	19.1%	479	19.8%	575	21.3%
Unclassified epithelial	551	14.2%	180	6.9%	147	6.5%	88	3.6%	99	3.7%
Adenosquamous	76	2.0%	127	4.8%	100	4.4%	95	3.9%	95	3.5%
Neuroendocrine	10	0.3%	21	0.8%	33	1.4%	27	1.1%	30	1.1%
Other epithelial	10	0.3%	6	0.2%	6	0.3%	10	0.4%	4	0.1%
Other	43	1.1%	84	3.2%	44	1.9%	69	2.9%	67	2.5%
Total	3,878	100%	2,625	100%	2,277	100%	2,420	100%	2,702	100%

Source: 2009 National Cancer Data Repository (NCDR)

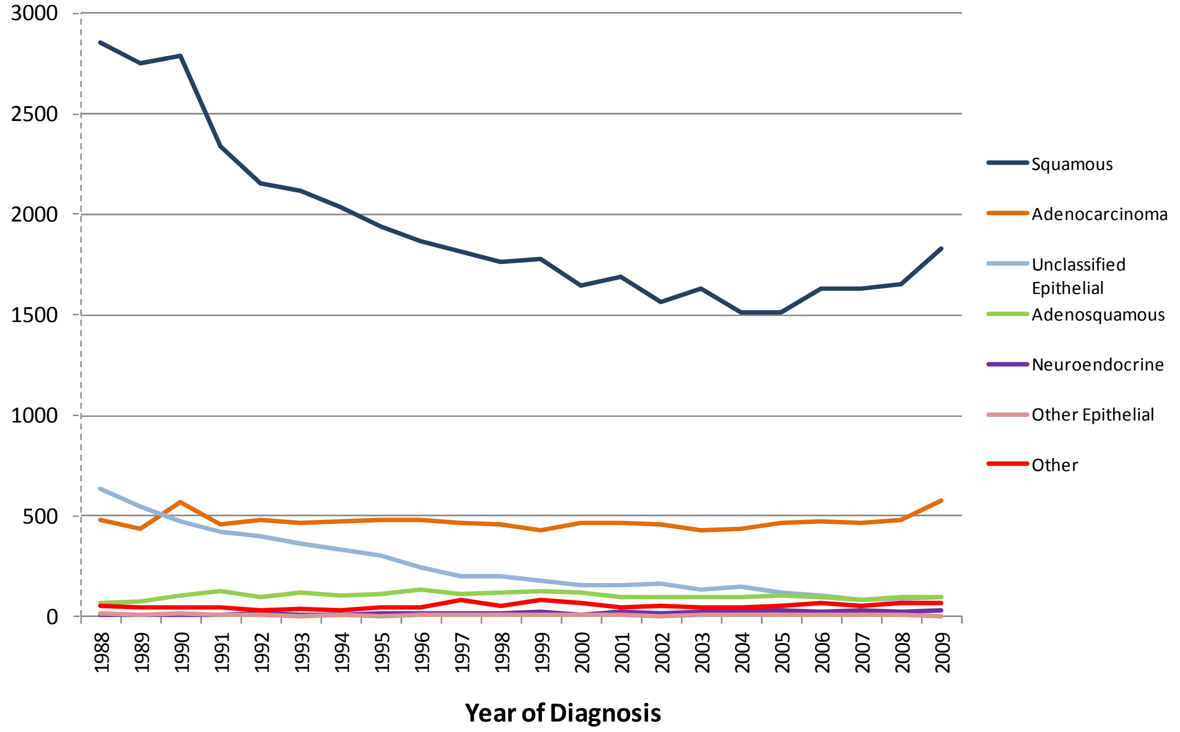


Figure 9 Number of cases by morphology, England, 1988-2009

Source: 2009 National Cancer Repository Data (NCDR)

Incidence by Age and Morphology, 2005-2009

The percentage of SCCs decreases with age from over 70% in women aged 20-39 to 56% in women aged 85 and over. The percentage of adenocarcinomas increases from 13% in women aged 20-24 to 26% in the 45-49 age group; gradually decreasing again to 13% in the 85+ age group. The percentage of adenosquamous is lowest in women aged 75 and over. The proportion of neuroendocrine cases is highest in women aged 20-24 (4%); however this is based on small numbers. The percentage of unclassified epithelial, other epithelial and 'other' tumours generally increases with age, possibly reflecting the higher likelihood of co-morbidities or more advanced stage of disease in older women. This may preclude attaining a histological diagnosis in older patients, as it may not be appropriate to carry out intrusive investigations. It may also be more difficult to discern the precise tumour type in cases where only a small tissue sample is available for examination, particularly in cases where the tumour is poorly differentiated.

The data include DCO cases (where the registration is made from a death certificate only), accounting for 0.7% of all cases overall. The number of DCO cases increases with age with the highest proportion in the 85+ age group; 5.2% of registrations in this age group are DCO. This may account for the higher proportion of unclassified epithelial or miscellaneous and unspecified morphologies as there is no morphology information available on a death certificate.

Table 6 Morphology by Age group, England, 2005-2009

	Morphology Group						
Age group	**Squamous cell carcinoma**	**Adeno carcinoma**	**Unclass. epithelial**	**Adeno squamous**	**Neuro endocrine**	**Other epithelial**	**Other**
All ages	67.7%	20.2%	4.0%	3.9%	1.2%	0.4%	2.6%
20-24	70.4%	12.6%	3.2%	4.7%	4.3%	0.4%	4.3%
25-29	73.2%	16.8%	2.3%	4.6%	1.3%	0.2%	1.5%
30-34	72.4%	20.6%	2.0%	3.6%	0.9%	0.0%	0.6%
35-39	70.0%	22.5%	1.8%	4.0%	0.8%	0.2%	0.8%
40-44	68.4%	22.2%	2.5%	4.4%	1.1%	0.2%	1.3%
45-49	64.1%	25.5%	4.1%	3.5%	0.9%	0.1%	1.8%
50-54	68.1%	19.8%	3.3%	4.8%	1.4%	0.3%	2.4%
55-59	62.9%	22.8%	4.6%	4.9%	1.2%	0.1%	3.5%
60-64	64.6%	21.3%	4.7%	4.7%	2.0%	0.5%	2.3%
65-69	67.4%	19.3%	3.3%	3.5%	1.3%	1.3%	3.9%
70-74	66.1%	18.6%	5.2%	3.4%	1.1%	0.9%	4.7%
75-79	64.4%	17.6%	7.7%	2.4%	1.8%	0.4%	5.7%
80-84	64.3%	15.1%	10.4%	2.5%	1.2%	1.0%	5.5%
85+	56.0%	13.4%	15.5%	1.9%	1.0%	1.5%	10.6%

Source: 2009 National Cancer Data Repository (NCDR)

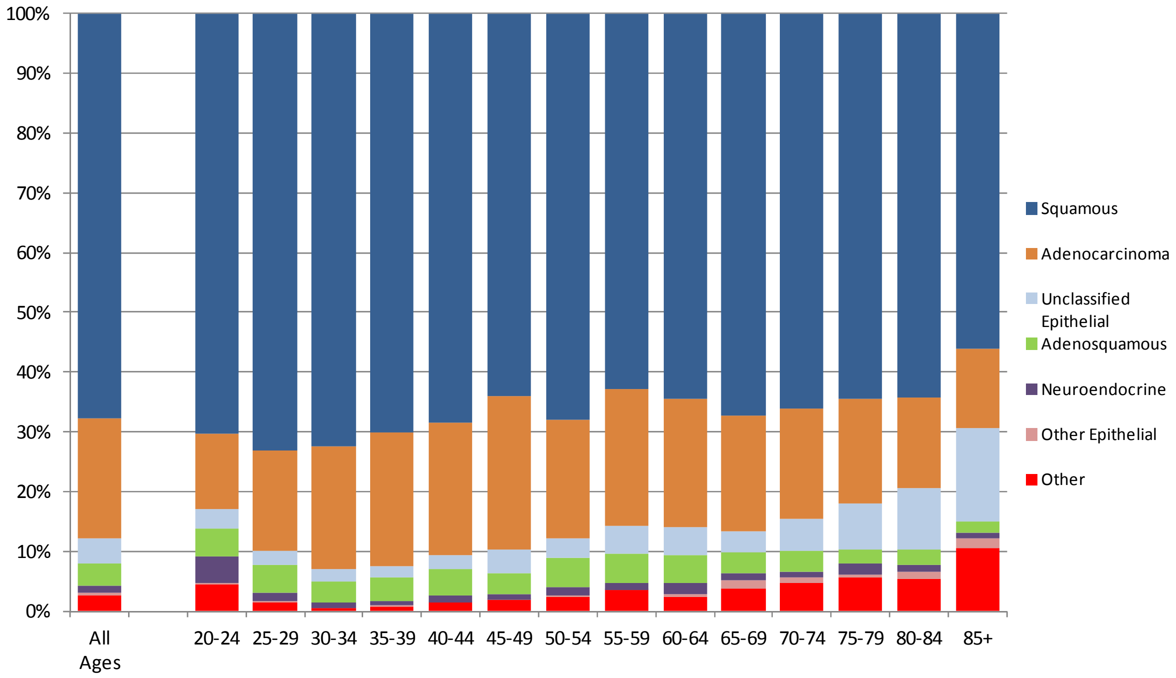


Figure 10 Distribution of morphology by age group, England, 2005-2009

Source: 2009 National Cancer Data Repository (NCDR)

Incidence by Deprivation and Morphology, 2005-2009

There is strong evidence that women living in more deprived areas are more likely to be diagnosed with squamous cell carcinomas than those living in more affluent areas; 73% of cancers in the most deprived fifth of areas are squamous cell carcinomas compared to 64% in the most affluent. Conversely, there is strong evidence that women living in more deprived areas are less likely to be diagnosed with adenocarcinomas than those in more affluent areas, 15% of cancers in the most deprived fifth of areas nationally are adenocarcinomas compared to 26% in the most affluent.

Several studies examining the relationship between cervical cancer risk factors and morphology type report that the majority of risk factors are common to both SCC and adenocarcinoma; however smoking appears to be a risk factor only for squamous cell carcinomas [12][13][14]. There is also some indication that screening contributes to the reduction of both tumour types, but is more effective in detecting squamous cell carcinomas than adenocarcinomas[15]. It is known that both smoking and reduced screening coverage are associated with increased deprivation, therefore these factors may contribute to the higher proportion of SCC in those living in the most deprived areas.

Table 7 Morphology by deprivation, England, 2005-2009

	Deprivation quintile										
	1 - Most Affluent		2		3		4		5 - Most Deprived		p-value
Morphology Group	**Cases**	**%**	**Cases**	**%**	**Cases**	**%**	**Cases**	**%**	**Cases**	**%**	
Squamous	1,169	63.8%	1,353	64.2%	1,555	65.2%	1,871	69.7%	2,308	72.5%	<0.001*
Adenocarcinoma	477	26.0%	487	23.1%	528	22.1%	509	19.0%	464	14.6%	<0.001*
Unclass. Epithelial	55	3.0%	83	3.9%	105	4.4%	95	3.5%	155	4.9%	0.009
Adenosquamous	71	3.9%	91	4.3%	97	4.1%	102	3.8%	115	3.6%	0.334
Neuroendocrine	17	0.9%	21	1.0%	31	1.3%	30	1.1%	47	1.5%	0.077
Other Epithelial	2	0.1%	8	0.4%	10	0.4%	11	0.4%	13	0.4%	0.156
Other	42	2.3%	65	3.1%	60	2.5%	67	2.5%	82	2.6%	0.904
Total	1,833	100%	2,108	100%	2,386	100%	2,685	100%	3,184	100%	

'*' indicates a statistically significant trend once adjusted using the Bonferroni method. Please see the 'Chi-square test for trend' section in Appendix 1 for more detail.
Source: 2009 National Cancer Data Repository (NCDR)

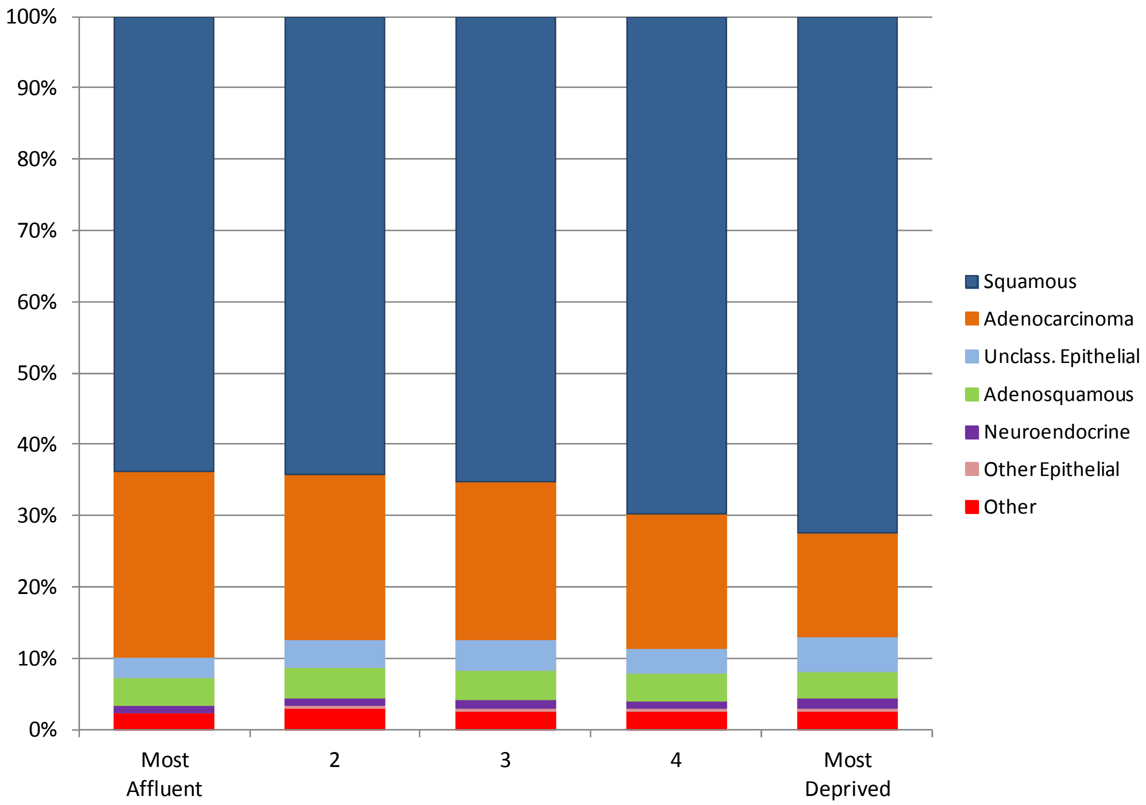


Figure 11 Distribution of morphology by deprivation, England, 2005-2009

Source: 2009 National Cancer Data Repository (NCDR)

CERVICAL CANCER MORTALITY

Mortality by Strategic Health Authority, 2006-2010

As with incidence, cervical cancer mortality rates tend to be lower in the south and east of England and higher in the north. There is strong evidence that rates are lower than the national average for residents of two SHAs (East of England, and South East Coast) and likewise higher than nationally for one SHA (North West), ranging from 1.7 to 3.0 per 100,000 female population.

Table 8 Mortality by SHA, 2006-2010

SHA	Total Deaths	ASMR	95% CI
England	3,810	2.3	(2.2, 2.3)
North East	222	2.6	(2.2, 3.0)
North West	679	3.0	(2.8, 3.3)
Yorkshire & The Humber	433	2.6	(2.4, 2.9)
East Midlands	308	2.1	(1.9, 2.4)
West Midlands	436	2.5	(2.2, 2.7)
East of England	364	1.8	(1.6, 2.1)
London	435	2.1	(1.9, 2.3)
South East Coast	264	1.7	(1.5, 2.0)
South Central	259	2.0	(1.8, 2.3)
South West	410	2.3	(2.0, 2.5)

ASMR is (directly) age-standardised mortality rate per 100,000 female population
Source: UK Cancer Information Service

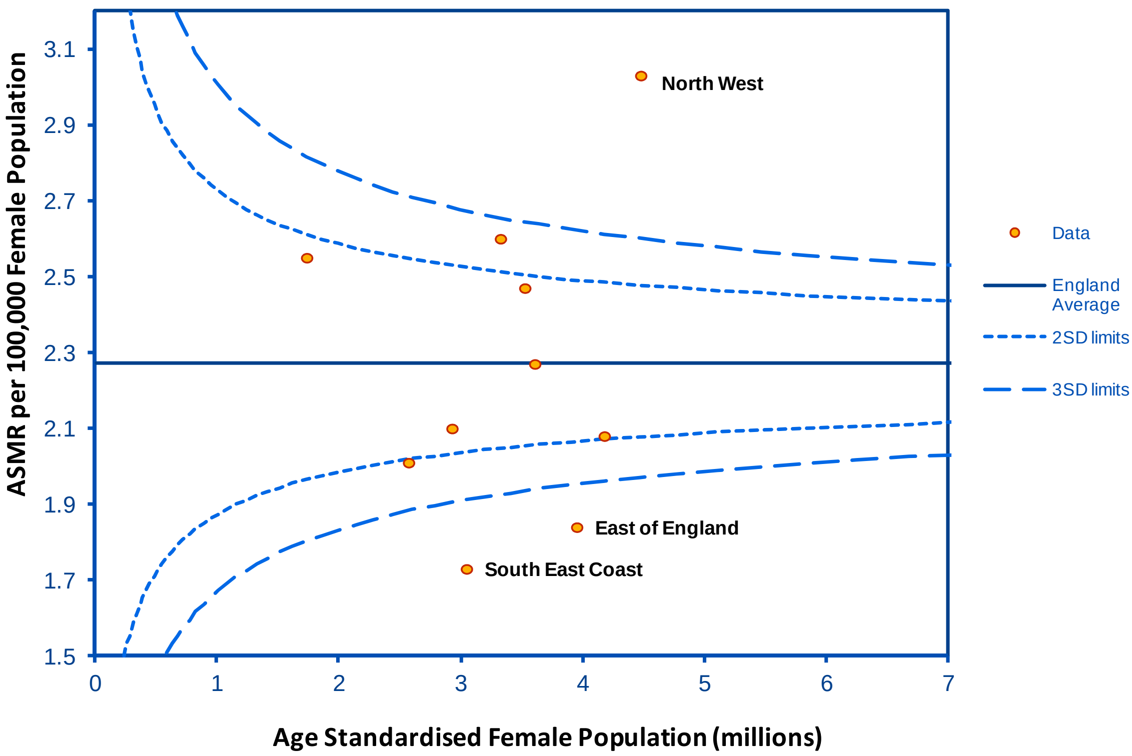


Figure 12 Funnel plot of mortality by SHA, 2006-2010

Source: UK Cancer Information Service

Mortality by Cancer Network, 2006-2010

Mortality rate patterns among the Cancer Networks (CNs) broadly reflect those seen for the SHAs. At CN level, the highest incidence rate is almost double that of the lowest rate. There is strong evidence that mortality rates are higher than the England average in three CNs: Humber & the Yorkshire Coast, Merseyside & Cheshire and Greater Manchester & Cheshire (see Figure 13). There is also strong evidence that rates are lower than the national rate in three CNs: South West London, Surrey, West Sussex & Hampshire and Anglia.

Table 9 Mortality by CN, 2006-2010

Cancer Network	Total Cases	ASMR	95% CI
England	3,810	2.3	(2.2, 2.3)
3 Counties	74	2.1	(1.6, 2.8)
Anglia	157	1.6	(1.3, 1.9)
Arden	81	2.5	(1.9, 3.1)
Avon, Somerset & Wiltshire	139	2.2	(1.9, 2.7)
Central South Coast	141	2.2	(1.8, 2.6)
Dorset	56	1.8	(1.3, 2.6)
East Midlands	284	2.2	(1.9, 2.5)
Essex	105	2.2	(1.8, 2.7)
Greater Manchester & Cheshire	296	3.0	(2.7, 3.4)
Greater Midlands	164	2.6	(2.2, 3.0)
Humber & Yorkshire Coast	115	3.2	(2.6, 3.9)
Kent & Medway	112	2.0	(1.6, 2.4)
Lancashire & South Cumbria	146	2.8	(2.4, 3.4)
Merseyside & Cheshire	209	3.3	(2.8, 3.8)
Mount Vernon	84	2.0	(1.6, 2.5)
North East London	95	2.3	(1.9, 2.9)
North London	81	1.8	(1.4, 2.3)
North of England	255	2.5	(2.2, 2.9)
North Trent	153	2.6	(2.1, 3.0)
North West London	100	1.9	(1.6, 2.4)
Pan Birmingham	151	2.5	(2.1, 3.0)
Peninsula	142	2.4	(2.0, 2.9)
South East London	111	2.6	(2.1, 3.2)
South West London	75	1.5	(1.2, 2.0)
Surrey, West Sussex & Hampshire	60	1.5	(1.1, 1.9)
Sussex	85	1.9	(1.5, 2.4)
Thames Valley	144	2.0	(1.7, 2.4)
Yorkshire	195	2.3	(2.0, 2.7)

ASMR is (directly) age-standardised mortality rate per 100,000 female population
Source: UK Cancer Information Service

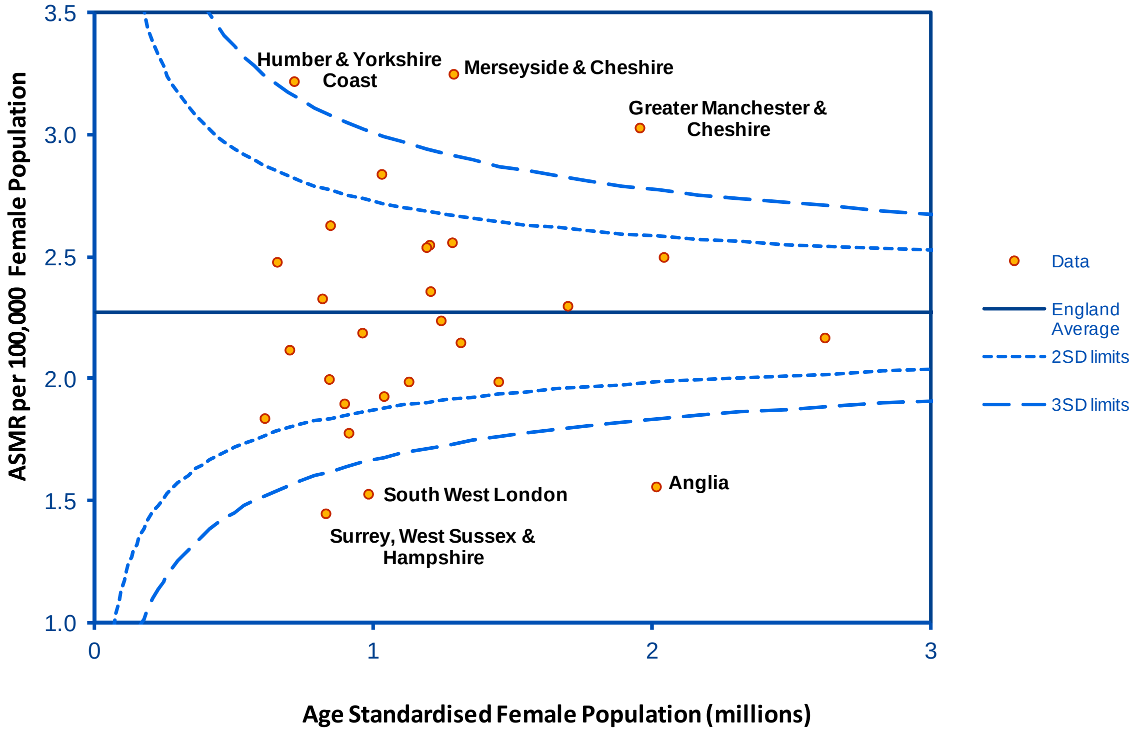


Figure 13 Funnel plot of mortality by CN, 2006-2010

Source: UK Cancer Information Service

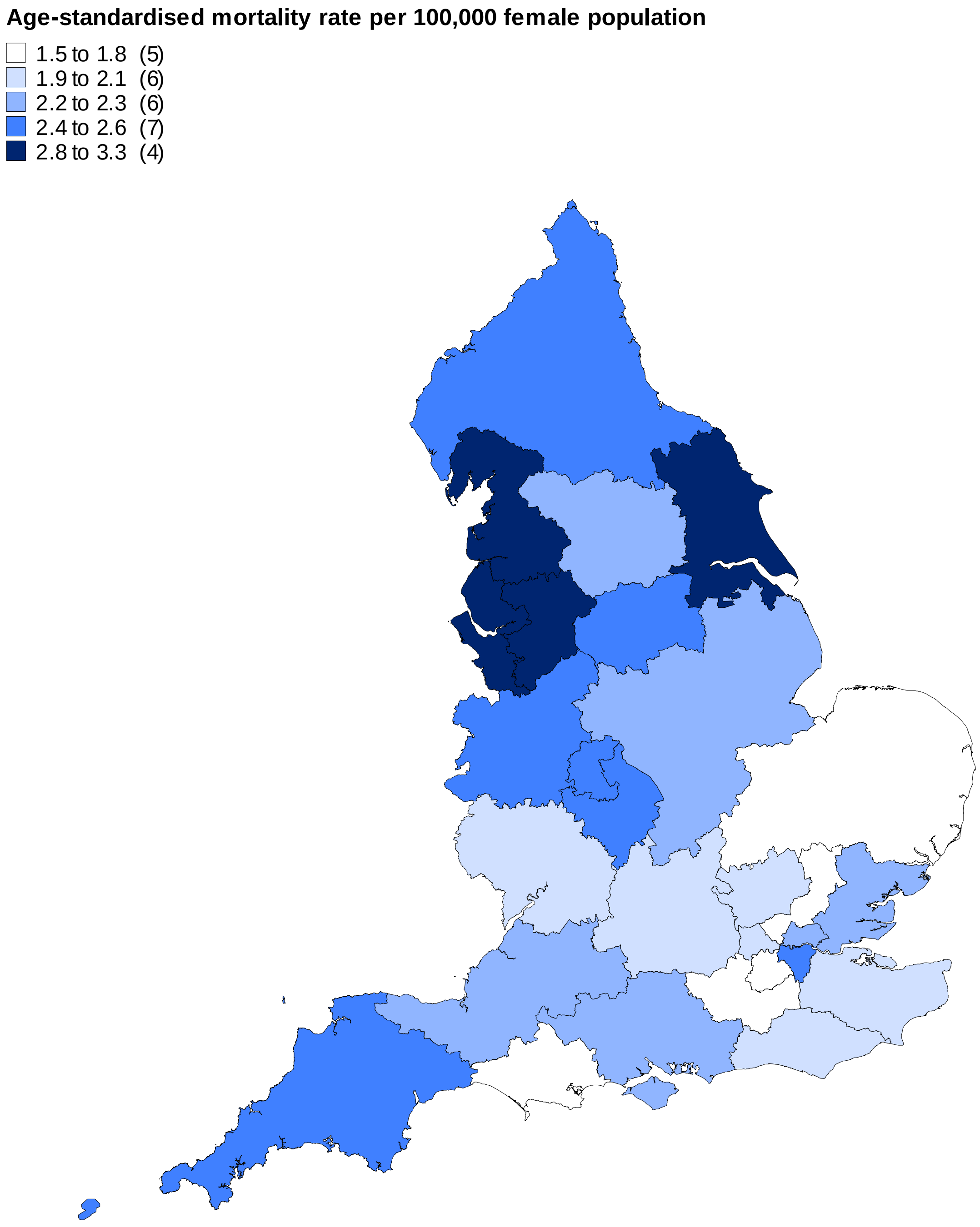


Figure 14 Map of mortality by CN, 2006-2010

The bracketed numbers in the key above are the number of Cancer Networks included in each quintile

Mortality by age, England 2008-2010

For women who died from cervical cancer between 2008 and 2010, the age-specific mortality rate increases with age. There is a gradual increase in the number of deaths for women aged in their early 20s to those in their early 60s. The number of deaths then appears to level off, beginning to increase again in women in their early 80s and above. Low mortality rates in younger women may be attributable to an early stage of disease at diagnosis in these women, which is more amenable to treatment. The increase in the mortality rates after the age of 64 may reflect the cessation of screening in women of this age and therefore a more advanced stage of disease at diagnosis. Higher mortality rates in older women may also be due to difficulties in treating the disease, particularly in women with co-morbidities.

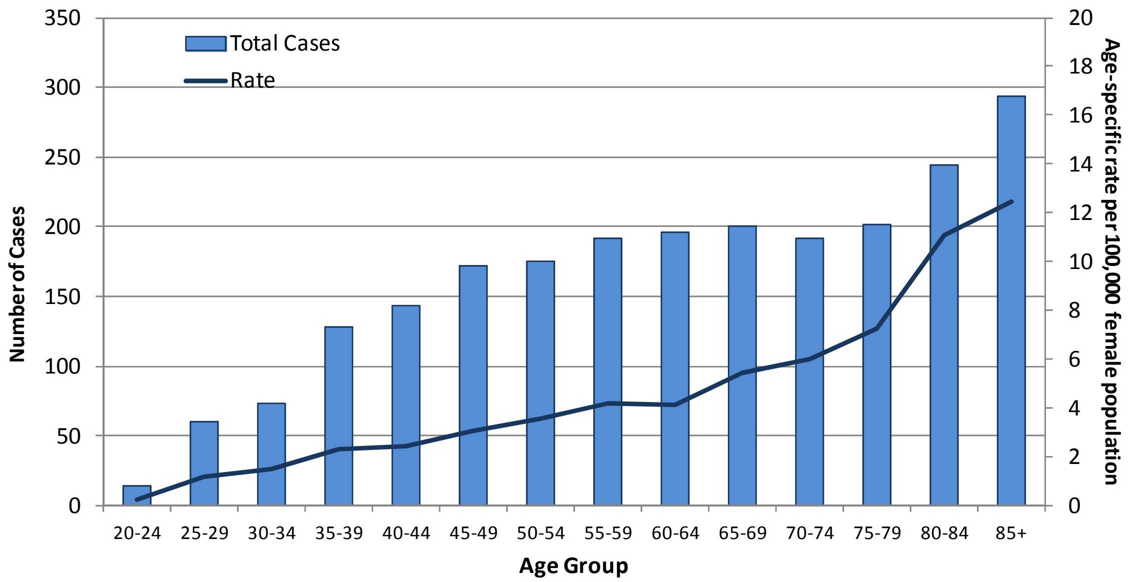


Figure 15 Age-specific mortality rates and number of deaths by five year age group, England, 2008-2010

Source: UK Cancer Information Service

Trends in mortality by age, England, 1988-1990 to 2008-2010

Compared to 20 years ago, cervical cancer mortality (for patient deaths between 2008 and 2010) is lower in women aged 30 and over. For women in the youngest age groups mortality rates are the same as 20 years ago. During this time, the numbers of deaths in those aged 20-24 has remained consistently low, with 14 deaths in the most recent three-year period. Over the last few years, rates in those aged 30-39 seem to have stabilised, whereas recent rates in those aged 25-29 appear to have risen slightly (see Figure 16).

Table 10 Trends in age-specific mortality rates by five year age group, England, 1988-1990 to 2008-2010

	1988-1990		1993-1995		1998-2000		2003-2005		2008-2010	
Age group	**Cases**	**Rate**	**Cases**	**Rate**	**Cases**	**Rate**	**Cases**	**Rate**	**Cases**	**Rate**
20-24	19	0.3	11	0.2	11	0.3	16	0.3	14	0.3
25-29	71	1.2	64	1.1	48	0.9	35	0.7	60	1.2
30-34	216	4.3	158	2.8	93	1.6	100	1.8	73	1.5
35-39	352	7.4	224	4.5	179	3.2	133	2.2	128	2.3
40-44	370	7.2	297	6.2	240	4.8	162	2.9	143	2.4
45-49	332	8.1	295	5.8	239	5.0	175	3.5	172	3.0
50-54	338	8.8	293	7.2	265	5.3	201	4.3	175	3.6
55-59	362	9.7	259	6.9	230	5.8	231	4.7	192	4.2
60-64	475	12.6	287	8.0	226	6.2	176	4.6	196	4.1
65-69	699	17.8	350	9.9	272	8.0	235	6.8	200	5.5
70-74	578	18.7	545	15.4	317	9.9	237	7.6	192	6.0
75-79	529	18.3	446	17.2	432	14.4	292	10.6	201	7.3
80-84	391	19.0	358	16.6	294	15.0	326	14.1	244	11.1
85+	323	20.6	296	16.0	294	14.4	303	14.9	294	12.4

Rate is age-specific rate per 100,000 female population
Source: UK Cancer Information Service

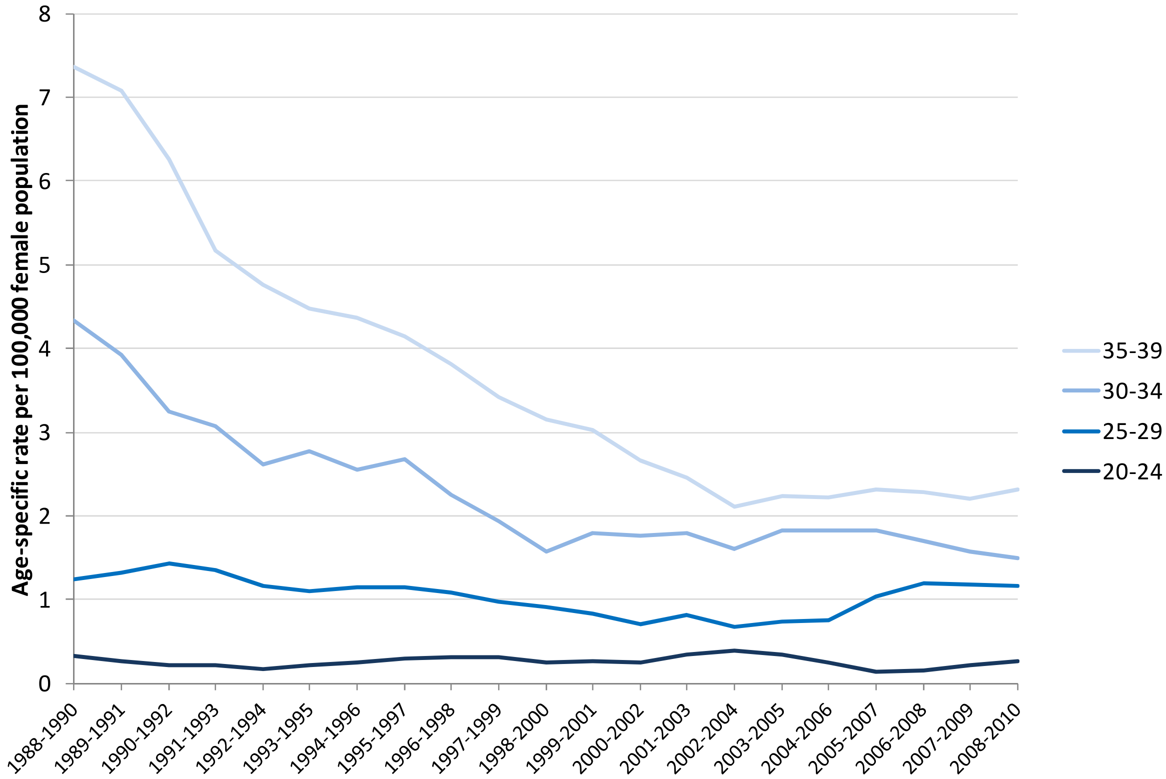


Figure 16 Trends in mortality in women under 40, England, 1988-1990 to 2008-2010

Dotted line is 95% confidence interval for calculated rates
Source: UK Cancer Information Service

Comparing mortality and deprivation by Primary Care Trust, 2006-2010

There is very strong evidence of a relationship between deprivation (as measured by the income score of the Index of Multiple Deprivation - see Appendix 1 for further details) and mortality from cervical cancer among the 151 PCTs in England (see Figure 17), with a correlation coefficient of 0.58 (p-value <0.001). For example, the average mortality rate in the 30 most deprived PCTs is 3.2 per 100,000 females compared to 1.7 per 100,000 in the 30 most affluent PCTs.

The high mortality rates in more deprived areas reflect the higher incidence of cervical cancer, but also the poorer screening uptake in women living in more deprived areas. Women who do not attend for regular screening may be diagnosed with more advanced cervical cancer that cannot be effectively treated.

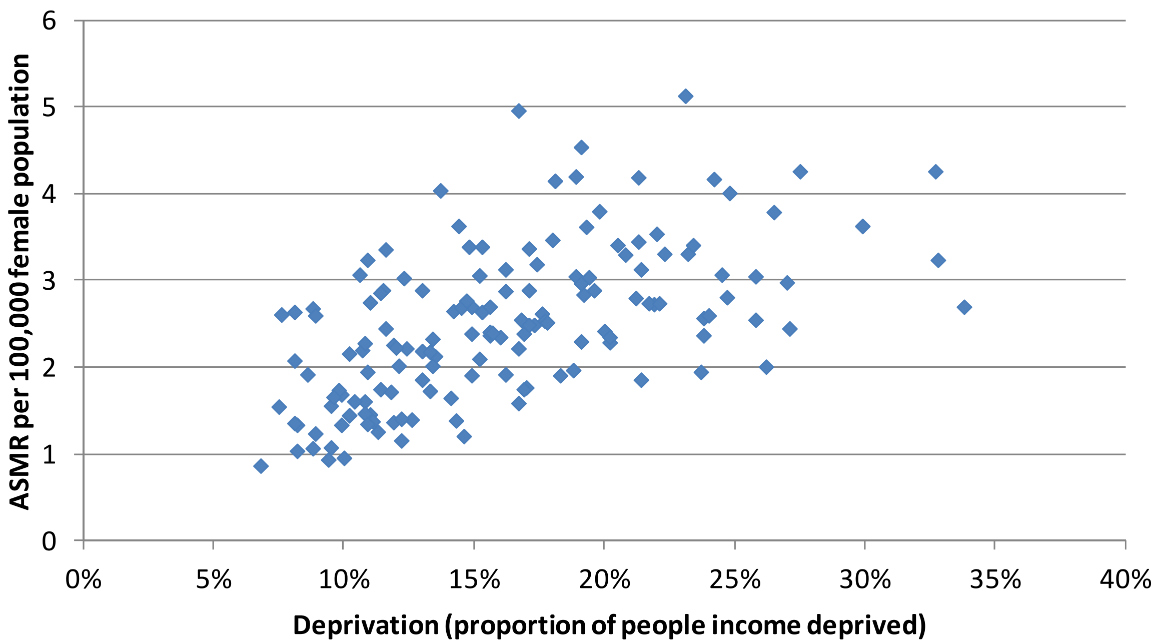


Figure 17 Scatter plot of mortality against measure of deprivation by PCT, 2006-2010

Source: UK Cancer Information Service

CERVICAL CANCER SURVIVAL

Details of the definition of relative survival used can be found in Appendix 1.

Trends in one- and five-year relative survival, England 1987-1989 to 2007-2009/2003-2005

In England, cervical cancer survival has improved since the late 1980s. In 20 years, one-year relative survival has improved from 83.1% to 87.5% (for patients diagnosed between 2007 and 2009), and five-year relative survival from 64.1% to 69.8% (for patients diagnosed between 2003 and 2005).

Whilst there has been some improvement in recent years in one-year relative rates, survival remained fairly stable up to the mid 2000s. This is likely to be a consequence of the stable 20% of women who do not attend for screening [3]. Since the mid 2000s, one-year survival has increased. Increasing one-year survival may indicate a greater proportion of cervical cancers diagnosed at an early stage.

The improvements in five-year relative survival are likely reflect both the success of the screening programme in detecting cases earlier and also improvements in treatment generally, as well as the wider availability of chemoradiation. This treatment has been the recommended standard of care since 2000 [3].

Table 11 Trends in one- and five-year relative survival, England, 1987-1989 to 2007-2009/2003-2005

		One-year Relative Survival			Five-year Relative Survival		
Year	Total Cases	Cumulative Deaths	%	95% CI	Cumulative Deaths	%	95% CI
1987-1989	11,377	2,066	83.1	(82.3, 83.8)	4,635	64.1	(63.1, 65.1)
1988-1990	11,368	1,959	84.0	(83.3, 84.7)	4,436	65.8	(64.8, 66.8)
1989-1991	10,696	1,802	84.4	(83.6, 85.1)	4,067	66.9	(65.9, 67.9)
1990-1992	10,024	1,706	84.2	(83.4, 84.9)	3,837	66.6	(65.6, 67.7)
1991-1993	9,185	1,632	83.5	(82.6, 84.3)	3,609	65.7	(64.6, 66.8)
1992-1994	8,802	1,571	83.4	(82.6, 84.2)	3,465	65.6	(64.5, 66.7)
1993-1995	8,522	1,503	83.6	(82.8, 84.5)	3,318	66.1	(65.0, 67.2)
1994-1996	8,171	1,446	83.6	(82.7, 84.4)	3,175	66.2	(65.0, 67.4)
1995-1997	7,865	1,433	83.0	(82.2, 83.9)	3,097	65.7	(64.5, 66.9)
1996-1998	7,626	1,352	83.5	(82.7, 84.4)	2,939	66.6	(65.4, 67.8)
1997-1999	7,459	1,318	83.6	(82.7, 84.5)	2,842	67.0	(65.8, 68.2)
1998-2000	7,282	1,262	83.9	(83.0, 84.8)	2,712	67.9	(66.7, 69.1)
1999-2001	7,158	1,229	84.0	(83.1, 84.9)	2,607	68.5	(67.2, 69.7)
2000-2002	6,945	1,200	83.9	(83.0, 84.8)	2,491	68.9	(67.7, 70.2)
2001-2003	6,847	1,216	83.4	(82.5, 84.4)	2,481	68.6	(67.4, 69.9)
2002-2004	6,659	1,184	83.4	(82.5, 84.4)	2,420	68.6	(67.3, 69.8)
2003-2005	6,606	1,102	84.5	(83.5, 85.4)	2,312	69.8	(68.5, 71.1)
2004-2006	6,650	1,024	85.7	(84.8, 86.6)			
2005-2007	6,722	990	86.3	(85.4, 87.2)			
2006-2008	6,840	980	86.7	(85.8, 87.6)			
2007-2009	7,146	962	87.5	(86.7, 88.3)			

95% CI is 95% confidence interval for survival estimate

Source: UK Cancer Information Service

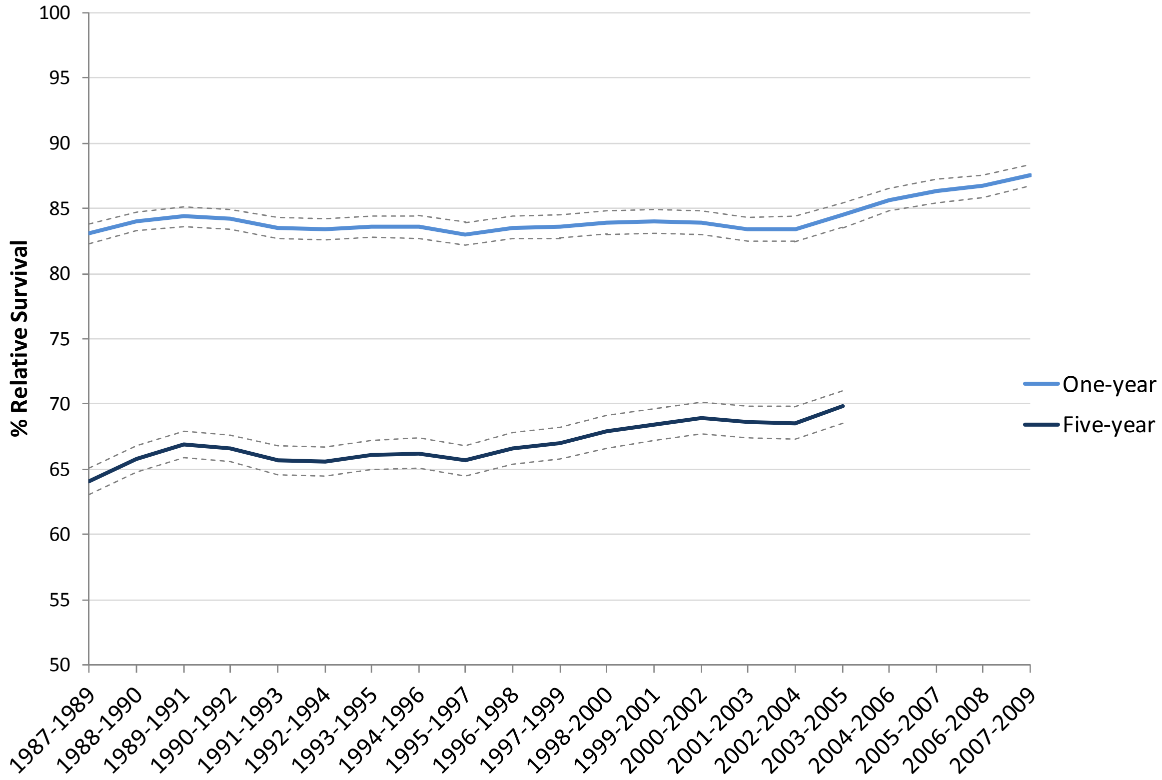


Figure 18 Trends in one- and five-year relative survival, England 1987-1989 to 2007-2009/2003-2005

Dotted lines are 95% confidence intervals for survival estimates
Source: UK Cancer Information Service

Trends in one-year relative survival by Cancer Network, 1987-1989 to 2007-2009

For women diagnosed in the 20-year period between 1987-1989 and 2007-2009, one-year relative survival improved nationally and in all but four of the 28 Cancer Networks. The strongest evidence of an increase is in the South West London, Lancashire & South Cumbria, North Trent, Anglia and East Midlands CNs.

Table 12 Trends in one-year relative survival by CN, 1987-1989 to 2007-2009

Cancer Network	1987-1989	1995-1997	2007-2009	Change	
England	83.1	83.6	87.5	4.4	*
3 Counties	82.7	81.8	84.7	2.0	
Anglia	83.1	82.8	91.0	7.9	*
Arden	85.7	88.3	88.0	2.3	
Avon, Somerset & Wiltshire	82.0	82.2	88.3	6.3	
Central South Coast	86.3	83.5	86.1	-0.2	
Dorset	85.5	81.1	87.8	2.3	
East Midlands	81.5	85.3	87.6	6.1	*
Essex	88.7	86.5	82.9	-5.8	
Greater Manchester & Cheshire	82.0	81.7	84.6	2.6	
Greater Midlands	83.8	82.6	87.8	4.0	
Humber & Yorkshire Coast	88.5	86.6	84.7	-3.8	
Kent & Medway	83.0	81.1	84.5	1.5	
Lancashire & South Cumbria	78.0	75.8	86.9	8.9	*
Merseyside & Cheshire	80.6	80.5	85.9	5.3	
Mount Vernon	78.7	85.8	88.0	9.3	
North East London	81.5	84.8	84.7	3.2	
North London	82.1	88.0	87.9	5.8	
North of England	82.3	84.5	87.7	5.4	
North Trent	81.2	81.0	89.9	8.7	*
North West London	84.6	83.4	85.7	1.1	
Pan Birmingham	80.6	90.3	87.3	6.7	
Peninsula	82.2	79.6	84.8	2.6	
South East London	83.1	86.0	89.1	6.0	
South West London	82.0	79.9	92.5	10.5	*
Surrey, West Sussex & Hampshire	86.7	86.1	89.6	2.9	
Sussex	85.9	79.9	84.6	-1.3	
Thames Valley	88.0	88.1	90.9	2.9	
Yorkshire	84.9	84.7	90.4	5.5	

'Change' is absolute change between 1987-1989 and 2007-2009
'*' Statistically significant difference over this time period
Source: UK Cancer Information Service

One-Year Relative Survival by Cancer Network, 2007-2009

For those patients diagnosed between 2007 and 2009, there is evidence that relative survival up to one year from diagnosis is higher than the national average in the Anglia and South West London CNs.

Variation in the survival rates across Cancer Networks may also reflect differences in other factors that impact on survival, such as: delays in presentation and diagnosis and therefore stage of disease, differences in treatment, differences in comorbidities among patients, or a combination of all these factors. Generally, poor one-year relative survival is considered to be related to delays in presentation and diagnosis.

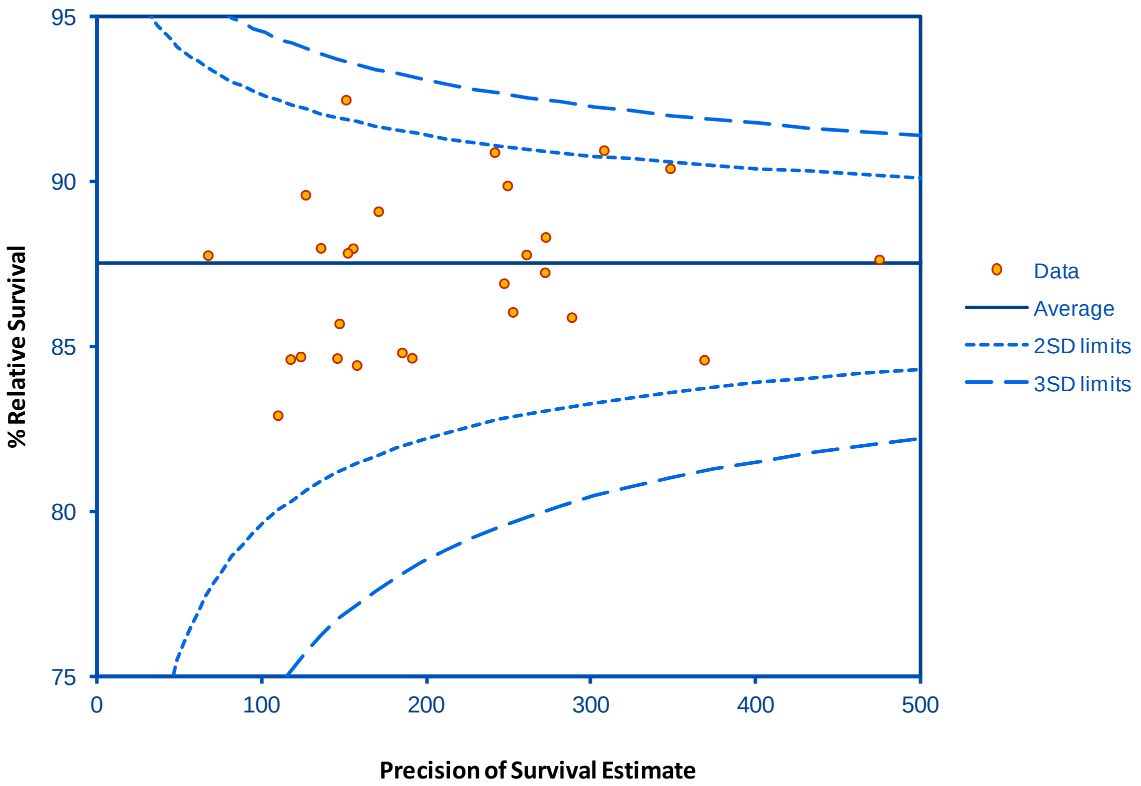


Figure 19 Funnel plot of one-year relative survival by CN, 2007-2009

Source: UK Cancer Information Service

Trends in five-year relative survival by Cancer Network, 1988-1990 to 2003-2005

For women diagnosed in the 15-year period between 1988-1990 and 2003-2005, five-year relative survival improved nationally and in all but seven of the 28 CNs. The strongest evidence of an increase is in the East Midlands CN. There is evidence that relative survival has worsened in Dorset CN with a 21% reduction in survival.

Table 13 Trends in five-year relative survival by CN, 1988-1990 to 2003-2005

Cancer Network	1988-1990	2003-2005	Change
England	65.8	69.8	4.0 *
3 Counties	69.6	69.5	-0.1
Anglia	65.8	69.6	3.8
Arden	67.7	72.7	5.0
Avon, Somerset & Wiltshire	66.8	75.7	8.9
Central South Coast	68.6	74.9	6.3
Dorset	73.1	52.1	-21.0 *
East Midlands	63.2	76.0	12.8 *
Essex	64.8	60.8	-4.0
Greater Manchester & Cheshire	63.6	63.8	0.2
Greater Midlands	68.7	68.7	0.0
Humber & Yorkshire Coast	76.6	82.2	5.6
Kent & Medway	60.0	71.6	11.6
Lancashire & South Cumbria	60.3	60.8	0.5
Merseyside & Cheshire	63.2	63.0	-0.2
Mount Vernon	56.9	65.6	8.7
North East London	59.4	61.0	1.6
North London	69.1	66.3	-2.8
North of England	66.8	68.9	2.1
North Trent	66.4	67.7	1.3
North West London	67.5	68.9	1.4
Pan Birmingham	66.5	68.3	1.8
Peninsula	61.6	69.0	7.4
South East London	60.1	69.5	9.4
South West London	68.3	78.0	9.7
Surrey, West Sussex & Hampshire	68.8	60.2	-8.6
Sussex	62.3	60.9	-1.4
Thames Valley	73.8	76.0	2.2
Yorkshire	66.4	74.4	8.0

'Change' is absolute change between 1986-1988 and 2001-2003
'*' Statistically significant difference over this time period
Source: UK Cancer Information Service

Five-year relative survival by Cancer Network, 2003-2005

For those patients diagnosed between 2003 and 2005, there is evidence that relative survival up to five years from diagnosis is higher than the national average in the Avon, Somerset & Wiltshire, Thames Valley, East Midlands and South West London CNs, and most markedly high in the Humber & Yorkshire Coast CN. Likewise, there is evidence that five-year survival is lower than the national average in Dorset, Greater Manchester & Cheshire, Lancashire & South Cumbria, Merseyside & Cheshire and North East London CNs.

As with one-year relative survival, variation in five-year survival rates can be due to several factors. Generally, poor five-year relative survival is considered to be related to the effectiveness of treatment as well as delays in presentation and diagnosis.

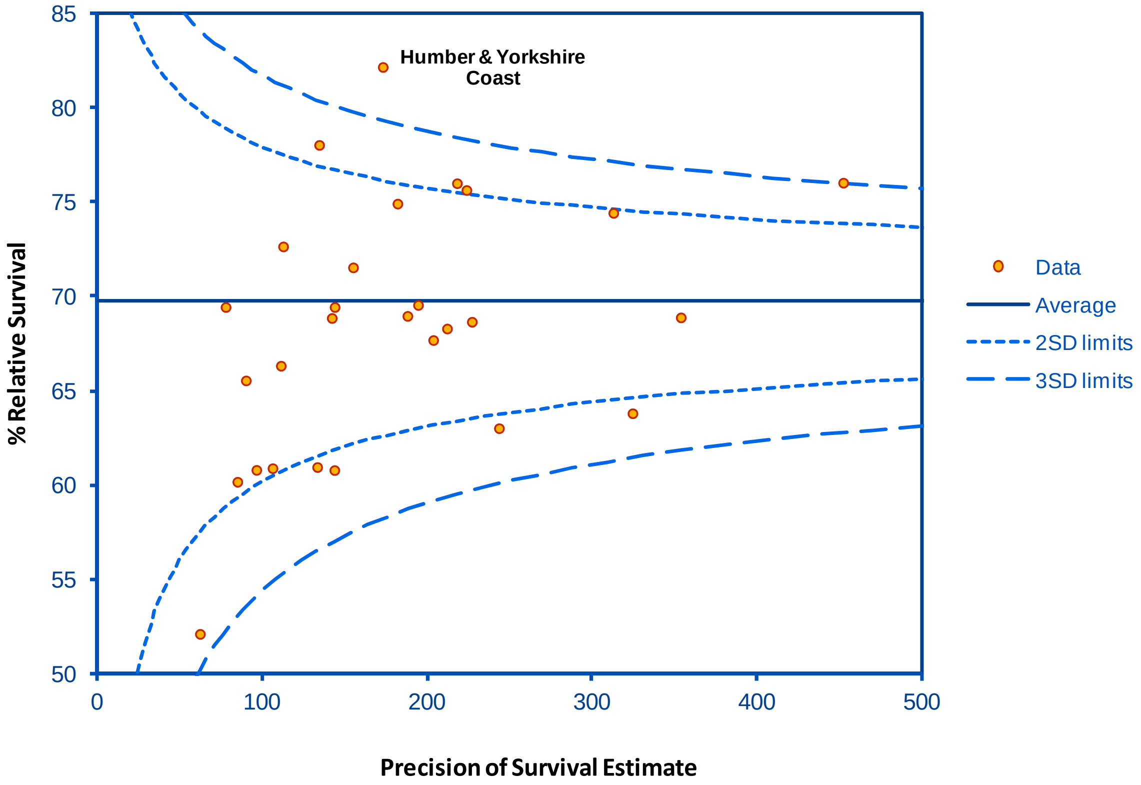


Figure 20 Funnel plot of five-year relative survival by CN, 2003-2005

Source: UK Cancer Information Service

Relative survival by age, England, 2007-2009 and 2003-2005

There is strong evidence that cervical cancer survival is worse in older women. For example, one-year relative survival in those aged 20-39 is 96.6% compared with 51.9% in those aged 80 or older. Similarly, five year survival in those aged 20-39 is 87.2% compared with 27.0% in those aged 80 and over.

As with many cancers, this marked difference may, in part, be due to difficulties in treating the disease in older women, particularly women with co-morbidities. The cessation of screening in women over the age of 64 may also result in older women presenting later with their disease. Differences in tumour biology may also be a factor in poorer survival among older women [16].

Table 14 Age-specific relative survival, England, 2007-2009 and 2003-2005

	One-year relative survival				Five-year relative survival			
Age group	**Cases**	**Deaths**	**%**	**95% CI**	**Cases**	**Deaths**	**%**	**95% CI**
All females	7,146	962	87.5	(86.7, 88.3)	6,606	2,312	69.8	(68.5, 71.1)
20-39	3,067	107	96.6	(95.9, 97.2)	2,441	319	87.2	(85.8, 88.6)
40-49	1,454	122	91.7	(90.3, 93.2)	1,314	291	78.6	(76.2, 80.9)
50-59	854	129	85.2	(82.8, 87.7)	946	400	59.1	(55.8, 62.3)
60-69	650	137	79.7	(76.4, 82.9)	690	353	51.8	(47.7, 55.8)
70-79	600	192	70.0	(66.1, 73.9)	596	427	34.0	(29.6, 38.4)
80+	518	275	51.9	(47.1, 56.8)	612	521	27.0	(21.7, 32.2)

95% CI is 95% confidence interval for survival estimate

Source: UK Cancer Information Service

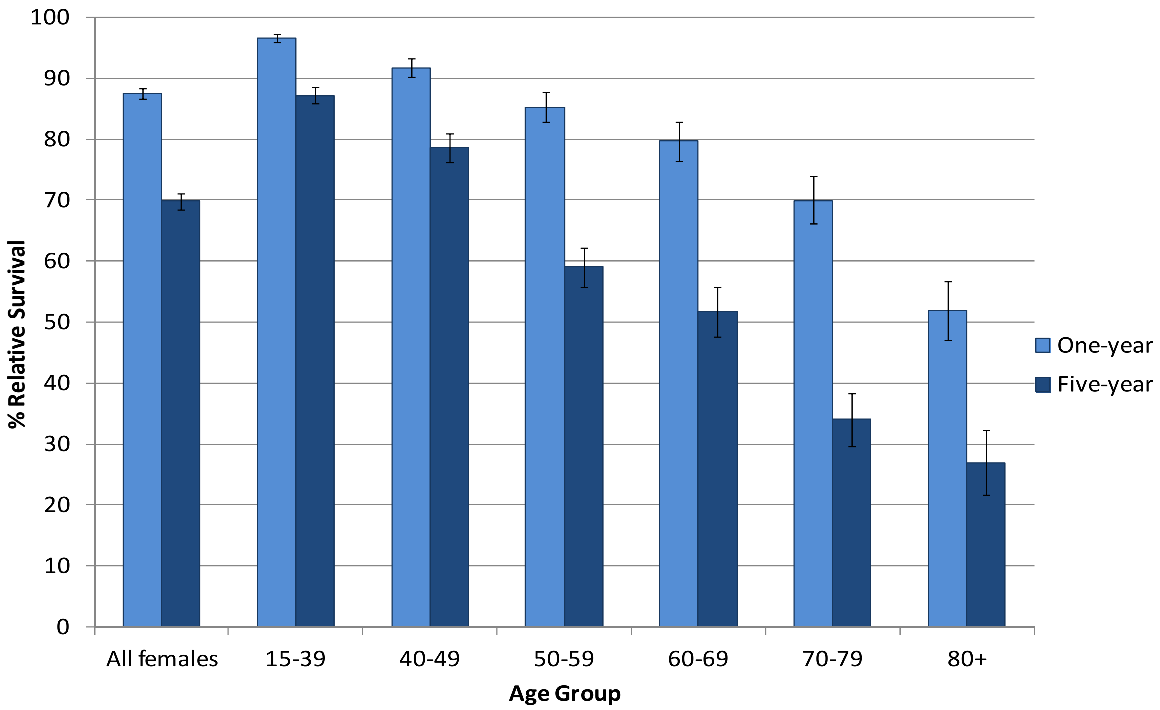


Figure 21 Age-specific relative survival, England, 2007-2009 and 2003-2005

Error bars are 95% confidence intervals for survival estimates

Trends in one-year relative survival by age, England, 1987-1989 to 2007-2009

Over the last 20 years, one-year relative survival has improved in all age groups, particularly for women aged 20-39, increasing from 93.0% in 1987-1989 to 96.6% in 2007-2009.

Table 15 Trends in age-specific one-year relative survival, England, 1987-1989 to 2007-2009

Age group	1987-1989	1997-1999	2007-2009	Change	
All Females	83.1	83.6	87.5	4.4	*
20-39	93.0	95.1	96.6	3.6	*
40-49	90.4	90.5	91.7	1.3	
50-59	83.6	85.5	85.2	1.6	
60-69	79.3	79.1	79.7	0.4	
70-79	68.8	64.6	70.0	1.2	
80+	44.6	48.8	51.9	7.3	

'Change' is absolute change between 1987-1989 and 2007-2009.
'*' Statistically significant difference over this time period
Source: UK Cancer Information Service

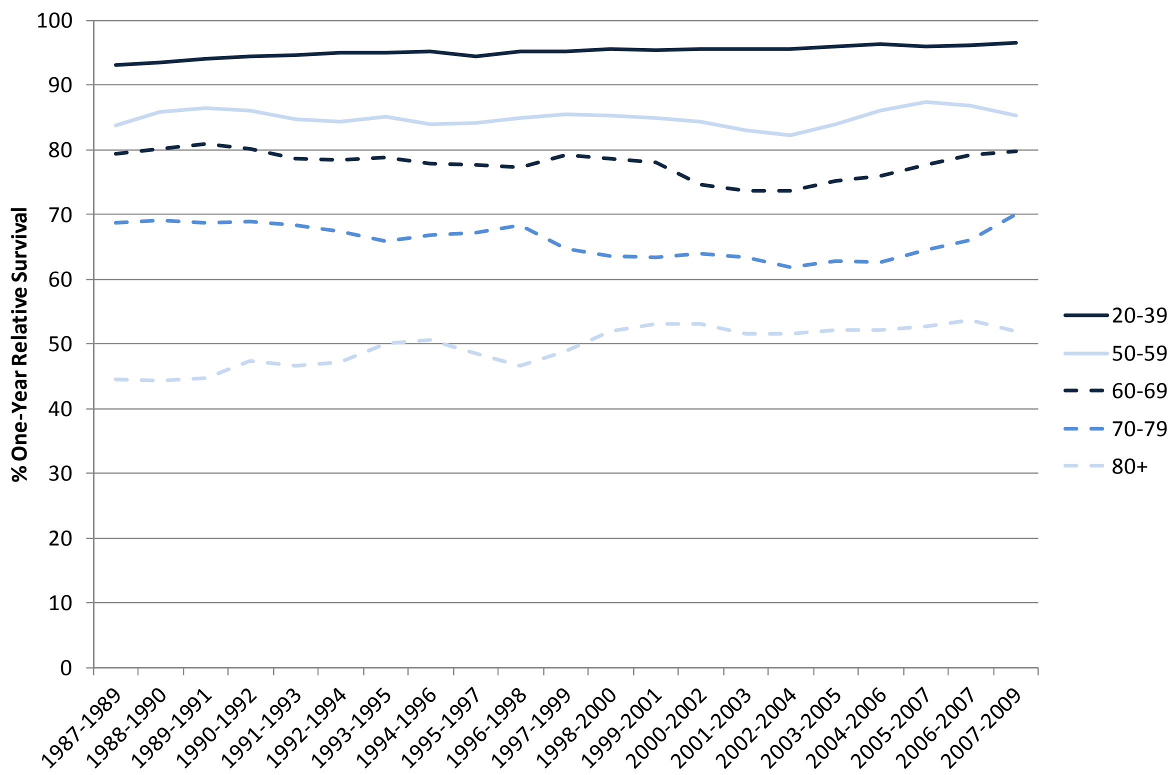


Figure 22 Trends in age-specific one-year relative survival, England, 1987-1989 to 2007-2009

Source: UK Cancer Information Service

Trends in five-year relative survival by age, England, 1988-1990 to 2003-2005

Over the last 15 years, there is evidence that five-year relative survival improved in women under the age of 50 with the greatest increase in women aged 20-39, from 79.1% in 1988-1990 to 87.2% in 2003-2005. Survival also increased by 4.8% in women aged 80 and over. For women aged between 50 and 79, survival rates have decreased slightly.

Table 16 Trends in age-specific five-year relative survival, England, 1988-1990 to 2003-2005

Age group	1988-1990	2003-2005	Change
All Females	65.8	69.8	4.0 *
20-39	79.1	87.2	8.1 *
40-49	74.2	78.6	4.4 *
50-59	64.0	59.1	-4.9
60-69	57.4	51.8	-5.6
70-79	41.2	34.0	-7.2
80+	22.2	27.0	4.8

'Change' is absolute change between 1988-1990 and 2003-2005.
'*' Statistically significant difference over this time period
Source: UK Cancer Information Service

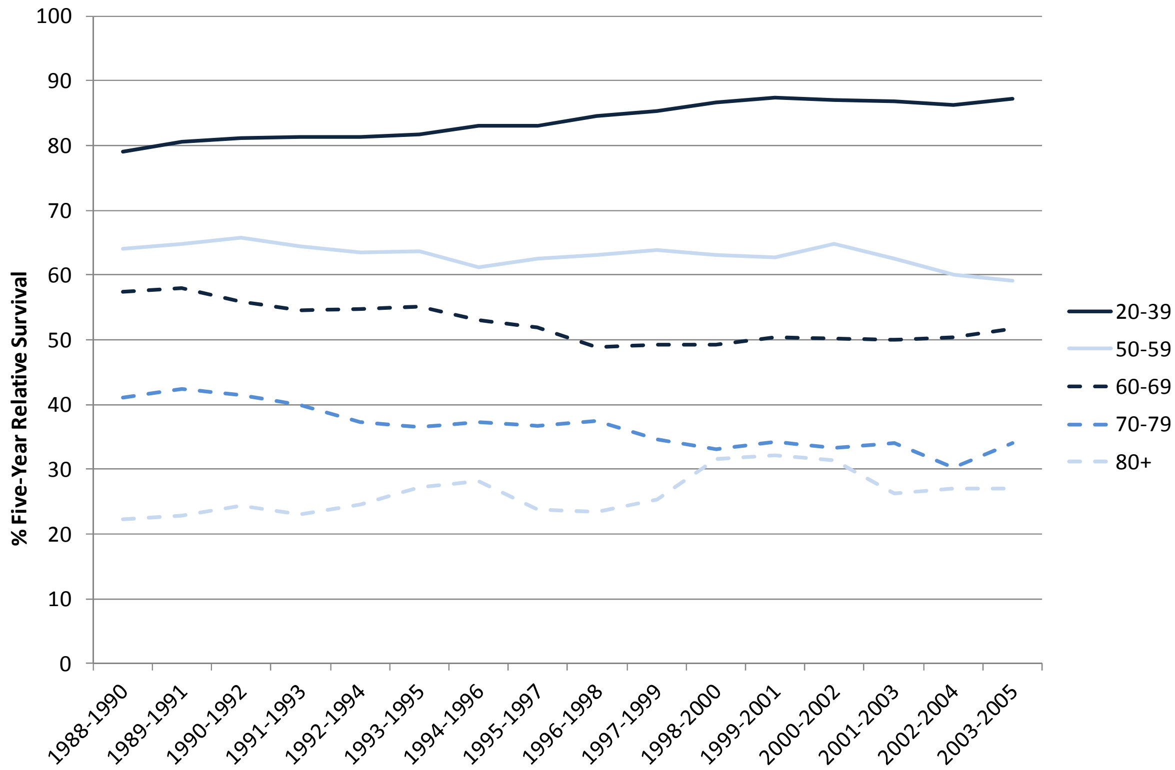


Figure 23 Trends in age-specific five-year relative survival, England, 1988-1990 to 2003-2005

Source: UK Cancer Information Service

Relative survival by deprivation, England, 2007-2009 and 2003-2005

There is evidence that survival up to one year after diagnosis is higher in women living in the most affluent fifth of areas when compared to the most deprived fifth of areas nationally, with a one-year relative survival gap of 6.0% (90.9% vs. 84.9%). Similarly, when comparing the most affluent with the most deprived fifth of areas nationally, the five-year relative survival gap is even greater at 10.5% (76.8% vs. 66.3%).

A major contributing factor in poorer survival among women living in more deprived areas is likely to be lower screening uptake, resulting in more advanced, harder to treat disease at presentation. The reconfiguration of cancer services, with the establishment of the network of specialist gynaecological cancer centres throughout the UK, means that optimal care should be provided to women of all deprivation groups [3].

Table 17 Relative survival by deprivation, England, 2007-2009 and 2003-2005

	One-Year Relative Survival				Five-Year Relative Survival			
Deprivation Quintile	**Cases**	**Deaths**	**%**	**95% CI**	**Cases**	**Deaths**	**%**	**95% CI**
All Females	7,146	962	87.5	(86.7, 88.3)	6,606	2,312	69.8	(68.5, 71.1)
1 - Most Affluent	1,072	106	90.9	(89.1, 92.8)	999	278	76.8	(73.8, 79.9)
2	1,240	141	89.6	(87.8, 91.5)	1,116	380	71.0	(67.9, 74.0)
3	1,391	184	87.9	(86.0, 89.7)	1,307	461	69.8	(67.0, 72.7)
4	1,590	234	86.3	(84.5, 88.1)	1,499	551	68.1	(65.4, 70.8)
5 - Most Deprived	1,853	297	84.9	(83.2, 86.6)	1,685	642	66.3	(63.8, 68.8)

95% CI is 95% confidence interval for survival estimate
Source: UK Cancer Information Service

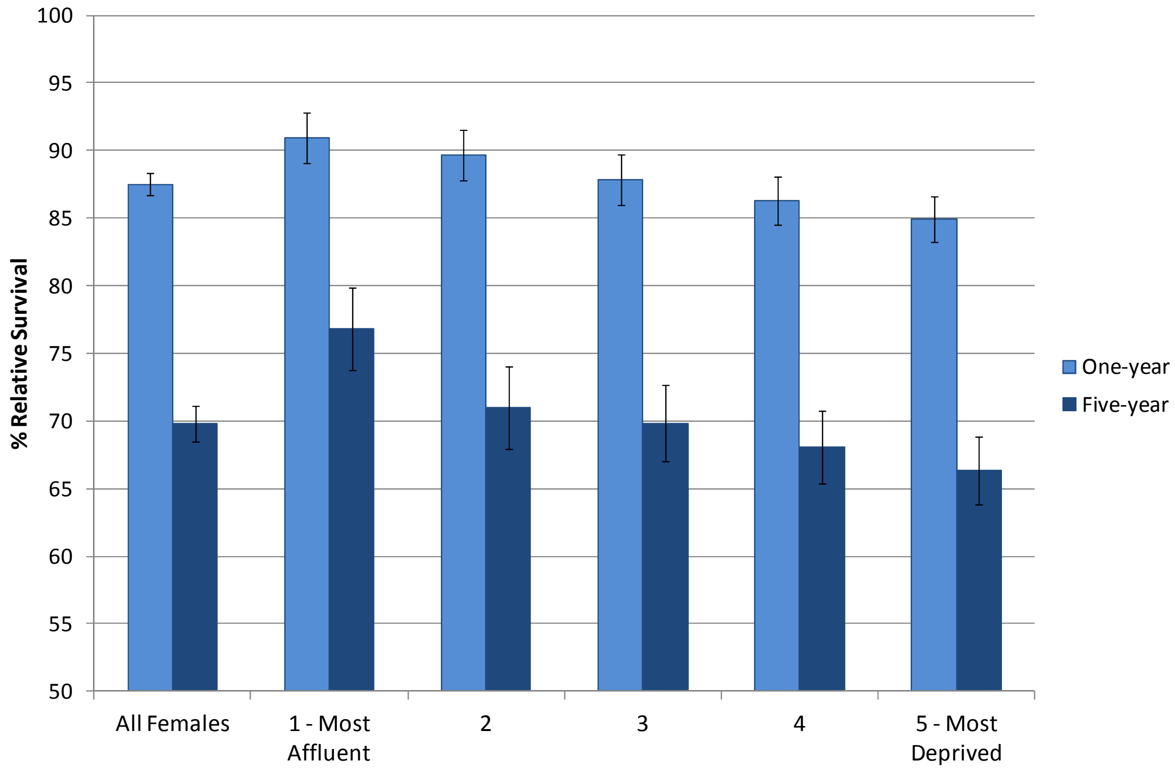


Figure 24 Relative survival by deprivation, England, 2007-2009 and 2003-2005

Error bars are 95% confidence intervals for survival estimates
Source: UK Cancer Information Service

APPENDIX 1: METHODOLOGY

Source of Results

All incidence, mortality and survival results were extracted from the UK Cancer Information Service (UKCIS) in April 2012. The morphology incidence data was extracted from the 2009 National Cancer Data Repository (NCDR) database provided by the National Cancer Intelligence Network (NCIN) in November 2011. This data set holds merged data from the eight cancer registries in England.

Definition of Cervical Cancer

All results presented in this report are based on invasive cervical cancer, defined using the International Classification of Diseases version 10 (ICD-10) code C53 for 'Malignant neoplasm of cervix uteri'.

The definition of cervical cancer in the morphology section is also based on these ICD 10 codes. However, cervical cancer has been further defined by the behaviour of the tumour, by including only those cases with a behaviour code of malignant (primary site) or micro-invasive. The incidence data taken from the UKCIS has not been further restricted by behaviour code. This is the reason for the higher number of cases each year in the incidence section compared to the morphology section.

Definition of Morphology

The cancer morphology data is available as a five digit code, where the first four digits refer to the morphology and the fifth digit to the tumour behaviour code; only behaviour codes 3 (malignant, primary site) and 5 (micro-invasive) are included. The coding is based on the ICD-O-2[17]. The various cervical cancer morphologies were grouped into seven groups: squamous cell carcinoma, adenocarcinoma, unclassified epithelial carcinoma, adenosquamous carcinoma, neuroendocrine tumour, 'other epithelial' and 'other'. The description and ICD-O-2 codes for each morphology group are given in Table A1. The majority (over 97%) of cervical tumours are epithelial and in this report these have been separated into six subcategories: squamous cell carcinoma, adenocarcinoma, adenosquamous, neuroendocrine, 'other epithelial' and unclassified epithelial. The latter group includes all the epithelial tumours that have not been classified by a pathologist according to one of the other recognised epithelial subcategories. Finally, the four non-epithelial categories: mesenchymal, mixed epithelial and mesenchymal, melanocytic and miscellaneous tumours according to the WHO classification have been amalgamated together with the unspecified malignant neoplasm in the group 'other'.

The cancer morphology groups were derived with the collaboration of Dr Lynn Hirschowitz (Consultant Pathologist, Birmingham Women's NHS Trust) and Mr Andrew Nordin (Chair, NCIN Gynaecological Site Specific Clinical Reference Group).

Table A1 ICD-O-2 Morphology codes

Morphology Group	Code	Description
Squamous cell carcinoma	8050	Papillary carcinoma, NOS
	8051	Verruccous carcinoma, nos
	8052	Papillary squamous cell carcinoma
	8070	Squamous cell carcinoma, NOS
	8071	Squamous cell carcinoma, keratinizing, NOS
	8072	Squamous cell carcinoma, large cell, nonkeratinizing, NOS
	8073	Squamous cell carcinoma, small cell, nonkeratinizing
	8074	Squamous cell carcinoma, spindle cell
	8076	Squamous cell carcinoma, micro-invasive
	8082	Lymphoepithelial carcinoma
	8083	Basaloid squamous cell carcinoma
	8084	Squamous cell carcinoma, clear cell type
	8120	Transitional cell carcinoma, NOS
	8123	Basaloid carcinoma
	8130	Papillary transitional cell carcinoma (C67.)
Adenocarcinoma	8140	Adenocarcinoma, NOS
	8141	Scirrhous adenocarcinoma
	8144	Adenocarcinoma, intestinal type (C16.)
	8201	Cribiform carcinoma, NOS
	8210	Adenocarcinoma in adenomatous polyp
	8211	Tubular adenocarcinoma
	8255	Adenocarcinoma with mixed subtypes
	8260	Papillary adenocarcinoma, NOS
	8262	Villous adenocarcinoma
	8263	Adenocarcinoma in tubulovillous adenoma
	8310	Clear cell adenocarcinoma, NOS
	8323	Mixed cell adenocarcinoma
	8380	Endometroid adenocarcinoma, NOS
	8384	Adenocarcinoma, endocervical type
	8440	Cystadenocarcinoma, NOS
	8441	Serous cystadenocarcinoma, NOS (C56.9)
	8450	Papillary cystadenocarcinoma, NOS
	8460	Papillary serous cystadenocarcinoma
	8470	Mucinous cystadenocarcinoma, NOS (C56.9)
	8480	Mucinous adenocarcinoma
	8481	Mucin-producing adenocarcinoma
	8482	Mucinous adenocarcinoma, endocervical type
	8490	Signet ring cell carcinoma
	8570	Adenocarcinoma with squamous metaplasia
	8574	Adenocarcinoma with neuroendocrine differentiation
	9110	Mesonephroma, malignant
Adenosquamous	8560	Adenosquamous carcinoma

table continued …

Morphology Group	Code	Description
Neuroendocrine	8240	Carcinoid tumour, NOS
	8249	Atypical carcinoid tumour
	8041	Small cell carcinoma, NOS
	8013	Large cell neuroendocrine carcinoma
	8243	Goblet cell carcinoid
	8246	Neuroendocrine carcinoma, NOS
Other epithelial	8015	Glassy cell carcinoma
	8200	Adenoid cystic carcinoma
	8098	Adenoid basal carcinoma
	8020	Carcinoma, undifferentiated, NOS
	8021	Carcinoma, anaplastic, NOS
	8230	Solid carcinoma, NOS
Unclassified epithelial	8010, 8011, 8012, 8022, 8031, 8032, 8034, 8040, 8042, 8090, 8092, 8143, 8147, 8320, 8430, 8550, 8562	Various unclassified epithelial
Other	8000-8001, 8033, 8720, 8772, 8800-8805, 8810, 8890-8891, 8896, 8900-8901, 8910, 8930, 8931, 8933, 8935, 8940, 8950- 8951, 8960, 8980, 8990, 9071, 9080, 9100, 9120, 9260, 9364, 9473, 9540, 9581	Mesenchymal, mixed epithelial and mesenchymal, melanocytic and miscellaneous, unspecified malignant neoplasm

Age-standardisation

Cervical cancer incidence and mortality vary greatly with age. Incidence and mortality rates are directly age-standardised to take account of differing age profiles of cancer patients in different geographical areas over time. Comparisons between areas and years are consequently unbiased.

Rates are presented per 100,000 female population using the European Standard Population weights, as outlined in the Table A2.

Table A2 European standard population weights

Age	Population	Age	Population	Age	Population
0	1,600	30-34	7,000	65-69	4,000
1-4	6,400	35-39	7,000	70-74	3,000
5-9	7,000	40-44	7,000	75-79	2,000
10-14	7,000	45-49	7,000	80-84	1,000
15-19	7,000	50-54	7,000	85+	1,000
20-24	7,000	55-59	6,000		
25-29	7,000	60-64	5,000	Total	100,000

Chi-squared test for trend

To compare how the different morphologies are affected by deprivation, a Chi–squared test for trend was used. The significance level of the subsequent multiple comparisons was adjusted using the Bonferroni method [18]; once adjusted, the p-values that remain significant are indicated by an asterisk*.

Confidence intervals

Confidence intervals (CIs) are a way of expressing how certain we are about a figure, such as an estimated cancer incidence rate. All CIs in this report have been calculated at the 95% level of statistical significance and thus define a 95% chance that the interval contains the true value.

When comparing the rates of different groups, the CIs can be compared to determine if the range of values overlap. If the CIs do not overlap then the difference between the rates is said to be statistically significant.

Correlation

Correlation is a way to measure the association between two continuous variables. Pearson's correlation coefficient is a number between -1 and 1 that quantifies the degree of 'straight line' relationship between two variables. A value of -1 indicates a perfect negative association (i.e. as one variable increases the other decreases) and +1 a perfect positive association. A value closer to 0 indicates that there is no linear association between the two variables. In this way, the spread of the data points around an underlying linear trend is quantified; the greater the spread of data points, the lower the correlation.

Funnel Plots

Funnel plots[19] have become a preferred method of presenting comparisons between geographical areas or institutions in public health. This is opposed to the more conventional use of 'caterpillar' plots which visually imply a ranking of areas based on good or bad performance. In any process or system, variation is to be expected; the funnel plot approach makes it easier to identify which data points indicate areas that may be worthy of further investigation. Simple statistical methods are used to define limits of expected variation known as control limits. The group average is used as the estimate of expected 'performance' and the best estimate of expected variation, around this average, is 3 standard deviations (SDs); the 'warning' 2SD control limits are also included. The area within the 95% (≈2SD) and the 99.8% (≈3SD) control limits is where, respectively, 95% and 99.8% of the data is expected to be. Those areas that fall outside of the 99.8% control limits are deemed to be statistically significantly different from the group average (i.e. have 'special cause' of variation). More information on funnel plot methodology can be found in the APHO technical briefing no. 2[20].

Deprivation

The Income Domain of the Indices of Multiple Deprivation 2010 (IMD2010) was used to assess the relationship between incidence, mortality, relative survival and deprivation nationally. IMD2010 is a Super Output Area (SOA) level measure of multiple deprivation made up of seven SOA level domain indices.

Deprivation was analysed at the smallest population level available, Lower SOA, with an average population of 1500 in England. National LSOAs were split into five equally sized quintile groups according to ranked Income Domain scores. At PCT level the score of the Income Domain was used as published by the Association of Public Health Observatories [21]. These were calculated by aggregating the LSOA income scores using population weighting.

Relative survival

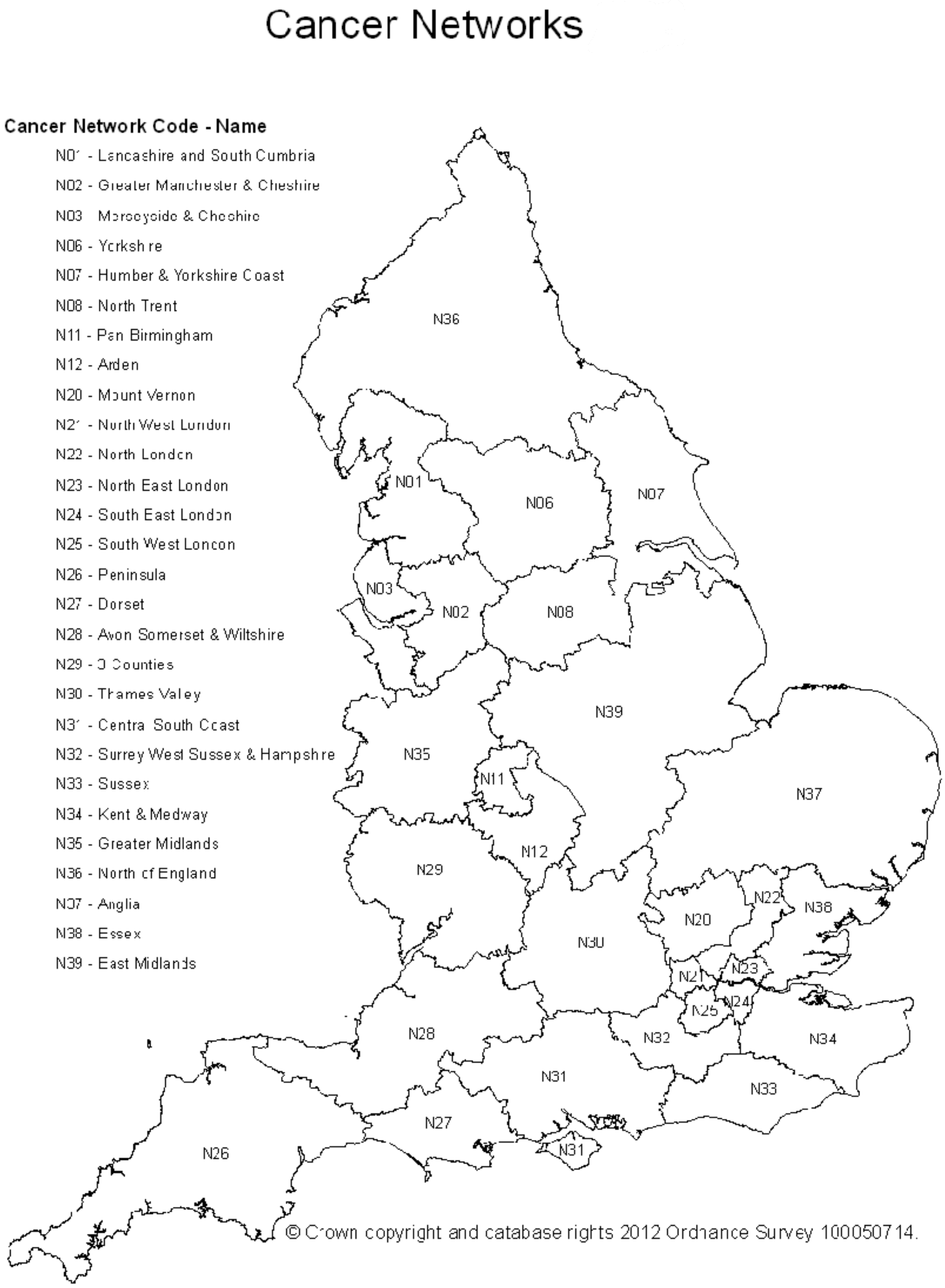
Crude survival is measured by the percentage of the original cohort of cancer patients, diagnosed in a particular period, who remain alive at a specified time after diagnosis. The relative survival rate is the ratio of the survival rate observed among the cancer patients and the survival that would have been expected if they had the same overall mortality rate as the general population in which they live, who are of the same sex and age. Therefore, relative survival can be interpreted as the survival of cancer patients relative to, or compared with, that of the population. For example, if five-year survival is 40% among a group of cancer patients of whom 80% would have been expected to survive that long, then their relative survival is 40/80 = 50%.

National life tables have been used in the calculation of relative survival to provide the recent age and sex specific mortality profile of the background population.

Quality Assurance References Centre (QARCs)

There are several regional QARCs in England set up with the aim to maintain minimum standards for cancer screening programmes, while encouraging excellence. The process of quality assurance ensures the quality systems are in place and that set standards are met.

APPENDIX 2: GUIDE TO CANCER NETWORKS AND STRATEGIC HEALTH AUTHORITIES


Cancer Networks
Cancer Network Code - Name
N01 - Lancashire and South Cumbria
N02 - Greater Manchester & Cheshire
N03 - Merseyside & Cheshire
N06 - Yorkshire
N07 - Humber & Yorkshire Coast
N08 - North Trent
N11 - Pan Birmingham
N12 - Arden
N20 - Mount Vernon
N21 - North West London
N22 - North London
N23 - North East London
N24 - South East London
N25 - South West London
N26 - Peninsula
N27 - Dorset
N28 - Avon Somerset & Wiltshire
N29 - 3 Counties
N30 - Thames Valley
N31 - Central South Coast
N32 - Surrey West Sussex & Hampshire
N33 - Sussex
N34 - Kent & Medway
N35 - Greater Midlands
N36 - North of England
N37 - Anglia
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SHA Boundaries

REFERENCES

1. NHS Cancer Screening Programme, May 2012. *NHSCSP Audit of Invasive Cervical Cancer National Report 2007- 2011*.

2. http://info.cancerresearchuk.org.

3. Kitchener HC, 2008. Survival from cancer of the uterine cervix in England and Wales up to 2001. *British Journal of Cancer*, 99: S63-S64.

4. Bosch FX *et al*, 2002. The causal relation between human papillomavirus and cervical cancer. *Journal of Clinical Pathology*, 55: 244–265.

5. McFadden K *et al*, 2004. Socioeconomic deprivation and the incidence of cervical cancer in New Zealand: 1988-1998. *The New Zealand Medical Journal*, 117(1206): U1172.

6. Quinn MJ, Wood H, Cooper N, Rowan S eds, 2005. *Cancer atlas of the United Kingdom and Ireland 1991–2000. Studies on Medical and Population Subjects No. 68*. London: Palgrave Macmillan.

7. Singh GK, Miller BA, Hankey BF and Edwards BK, 2004. Persistent area socioeconomic disparities in U.S. incidence of cervical cancer, mortality, stage, and survival, 1975-2000. *Cancer*, 101: 1051-1057.

8. http://www.ncin.org.uk/publications/data_briefings/cervical_incidence_and_screening.aspx.

9.Patel et al, 2012. Cervical cancer incidence in young women: a historical and geographic controlled UK regional population study. *British Journal of Cancer,* 106:1753-1759

10. Lancucki L *et al*, 2012. The impact of Jade Goody's diagnosis and death on the NHS cervical screening programme. *Journal of Medical Screening*, 19: 89-93.

11. Blanks RG, Moss SM and Denton K, 2006. Improving the NHS cervical screening laboratory performance indicators by making allowance for population age, risk and screening interval. *Cytopathology*, 17: 323-38.

12. International Collaboration of Epidemiological Studies of Cervical Cancer, 2007. Comparison of risk factors for invasive squamous cell carcinoma and adenocarcinoma of the cervix: Collaborative reanalysis of individual data on 8,097 women with squamous cell carcinoma and 1,374 women with adenocarcinoma from 12 epidemiological studies. *International Journal of Cancer*, 120: 885-891.

13. Berrington de Gonzalez A, Sweetland S and Green J, 2004. Comparison of risk factors for squamous cell carcinoma and adenocarcinoma of the cervix: a meta-analysis. *British Journal of Cancer*, 90: 1787-1791.

14. Green J *et al*, 2003. Risk Factors for adenocarcinoma and squamous cell carcinoma of cervix in women aged 20-44 year: the UK national Case – control study of cervical cancer. *British Journal of Cancer*, 89: 2078-2086.

15. Sasieni P, Castanon A and Cuzick J, 2009. Screening and adenocarcinoma of the cervix. *International Journal of Cancer*, 125: 525-529.

16. http://info.cancerresearchuk.org/cancerstats/types/cervix/survival/#age.

17. Tavassoli FA and Devilee P eds, 2003. World Health Organisation Classification of Tumours: Pathology and Genetics: Tumours of the Breast and Female Genital Organs. Lyon: IARC Press.

18. Altman DG, 1999. *Practical Statistics for Medical Research*. Boca Raton: Chapman & Hall/CRC.

19. Spiegelhalter DJ 2005. Funnel plots for comparing institutional performance. *Statistics in Medicine*, 24: 1185-1202.

20. Association of Public Health Observatories (APHO), August 2009. *Statistical Process Control Methods in Public Health Intelligence*, Technical Briefing no. 2. Available at http://www.apho.org.uk/resource/item.aspx?RID=39445. Accessed 01.12.2011.

21. Association of Public Health Observatories (APHO). Deprivation - IMD 2010 income domain. Available at http://www.apho.org.uk/resource/item.aspx?RID=97316. Accessed 07.03.2012.

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