Overview of Ovarian Cancer in England: Incidence, Mortality and Survival

November 2012

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

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Foreword

This report presents the latest time trends, trends by age and deprivation, and regional variations in incidence, mortality and survival for invasive ovarian cancer in England. There is also a separate section on these cases stratified according to their main morphological groups. A National Cancer Intelligence Network (NCIN) Data Briefing, which highlights some of the key findings in this report, is available from the following web address: **http://www.ncin.org.uk/publications/data_briefings/default.aspx.** This report and briefing have been produced by Trent Cancer Registry, the NCIN's lead registry for gynaecological cancers, on behalf of the NCIN Gynaecological Site Specific Clinical Reference Group (SSCRG). These data should be of interest to all those involved in the commissioning and delivery of services to prevent, diagnose, and treat ovarian cancer.

Further information on ovarian cancer is available from the newly-released Gynaecological Cancer Hub **www.ncin.org.uk/gynaehub .** This is a new web-based resource providing data and intelligence on a range of gynaecological cancers in England. 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 the content of 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 ovarian cancer in England has remained fairly stable, although it has decreased slightly during the last few years. Mortality rates were stable between 1989 and 2002 but fell by over 20% between 2002 and 2010. During the last 10 years incidence has decreased most notably in women aged 50-69 and mortality has decreased most notably in women aged 40-69.

- There is little evidence of any geographical patterns in the incidence and mortality of ovarian cancer.

- Almost half of all women diagnosed with ovarian cancer in 2009 were in their 60s or 70s, and over 80% of ovarian cancer deaths between 2008 and 2010 were in women aged 60 or over.

- There is no evidence to suggest a difference in either incidence or mortality between patients living in more or less deprived areas. However, there is evidence of a difference by deprivation for some morphology groups.

- Serous carcinoma is the most common morphological group of ovarian cancers, accounting for 32% of all cases in 2009, and is especially common in women aged 45-74 at diagnosis. Unclassified epithelial is the second most common morphology group overall (25% of cases) and is most common in women aged 75 or over. Borderline is the third most common group overall (14% of cases) and is most common in women aged under 45.

- Trends over the last 10 years by morphology group show a reduction in the proportion of unclassified epithelial cases, and a rise in the proportions of serous carcinoma, borderline and miscellaneous & unspecified cases.

- Survival following a diagnosis of ovarian cancer has improved in England overall since the mid-1980s, from 57% to 73% for one-year relative survival and from 33% to 44% for five-year relative survival. However, there has been little or no improvement in both one- and five-year survival rates for the oldest women over the last 20 years.

- There is some variation in recent survival between Cancer Network areas. One-year relative survival varies from 57% to 79%, and five-year relative survival from 35% to 49%.

- There is strong evidence that ovarian cancer survival is worse in older women. For example, one-year relative survival in those aged 15-39 is 96% compared with 24% in those aged 85 or over. Similarly, five-year survival in those aged 15-39 is 84% compared with 14% in those aged 85 or over. This may relate to many factors, including possible late presentation in older women, differences in surgical and chemotherapy treatments, and differences in pathology (including a higher proportion of borderline tumours in young women).

Overall Trends in Ovarian Cancer Incidence and Mortality

Please read the 'definition of ovarian cancer' section in Appendix 1 for important information on the definition of ovarian cancer used in this report. Further details on age standardisation of incidence and mortality rates can also be found in the appendix.

Trends in incidence and mortality, England, 1989-2010

The age-standardised incidence rate of ovarian cancer was consistently between 17 and 18 per 100,000 female population from 1989 to 1994. The rate then rose to around 19 per 100,000 for 1995 to 2003 and has since returned to between 17 and 18 per 100,000, as in the early 1990s. There were just fewer than 5,900 cases in 2009.

There is evidence that the risk of developing epithelial ovarian cancers may be related to the number of ovulations during a woman's lifetime. Any event which inhibits or prevents ovulation such as child bearing, breast feeding, early menopause and the oral contraceptive pill may be protective against ovarian cancer. Stabilisation of the incidence rate may be due to the widespread availability of the oral contraceptive pill since the 1960s. [1] [2]

The age-standardised mortality rate remained stable between 11 and 12 per 100,000 from 1989-2002 before steadily falling each year to 8.8 per 100,000 in 2010. There were just under 3,500 deaths from ovarian cancer in 2010.

As well as reflecting the downward trend in incidence, the recent fall in mortality rates may be due to improved awareness of the symptoms of ovarian cancer along with better access to treatments. The reduction in mortality since 2000 may reflect improved detection and management of the disease following reconfiguration of cancer services, with the establishment of specialist gynaecological cancer centres throughout the UK[3].

Table 1 Trends in incidence and mortality, England, 1989-2010

	England - Incidence			England - Mortality		
Year	**Total Cases**	**ASIR**	**95% CI**	**Total Cases**	**ASMR**	**95% CI**
1989	5,037	17.7	(17.2,18.2)	3,607	11.9	(11.5,12.4)
1990	4,942	17.2	(16.7,17.7)	3,668	12.1	(11.7,12.5)
1991	5,093	17.8	(17.3,18.3)	3,517	11.5	(11.1,11.9)
1992	5,121	17.7	(17.2,18.3)	3,574	11.5	(11.1,11.9)
1993	5,146	17.6	(17.1,18.1)	3,550	11.5	(11.1,11.9)
1994	5,190	17.6	(17.1,18.1)	3,582	11.3	(10.9,11.7)
1995	5,530	18.8	(18.3,19.3)	3,614	11.5	(11.1,11.9)
1996	5,643	19.1	(18.6,19.7)	3,847	12.2	(11.8,12.6)
1997	5,828	19.5	(19.0,20.0)	3,720	11.5	(11.1,11.9)
1998	5,818	19.5	(19.0,20.1)	3,718	11.4	(11.0,11.8)
1999	5,780	19.0	(18.5,19.6)	3,644	11.0	(10.6,11.3)
2000	5,771	18.8	(18.3,19.3)	3,644	10.9	(10.6,11.3)
2001	6,090	19.6	(19.1,20.1)	3,820	11.2	(10.8,11.6)
2002	5,921	18.8	(18.3,19.3)	3,877	11.3	(10.9,11.7)
2003	5,961	18.8	(18.3,19.4)	3,738	10.7	(10.4,11.1)
2004	5,718	17.9	(17.4,18.4)	3,623	10.3	(9.9,10.7)
2005	5,829	17.9	(17.5,18.4)	3,617	10.1	(9.8,10.5)
2006	5,874	18.2	(17.7,18.7)	3,592	9.9	(9.6,10.3)
2007	5,814	17.8	(17.3,18.3)	3,499	9.5	(9.2,9.9)
2008	5,674	17.1	(16.7,17.6)	3,550	9.4	(9.1,9.8)
2009	5,861	17.5	(17.0,18.0)	3,478	9.2	(8.8,9.5)
2010				3,453	8.8	(8.5,9.2)

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 rate
Source: UK Cancer Information Service

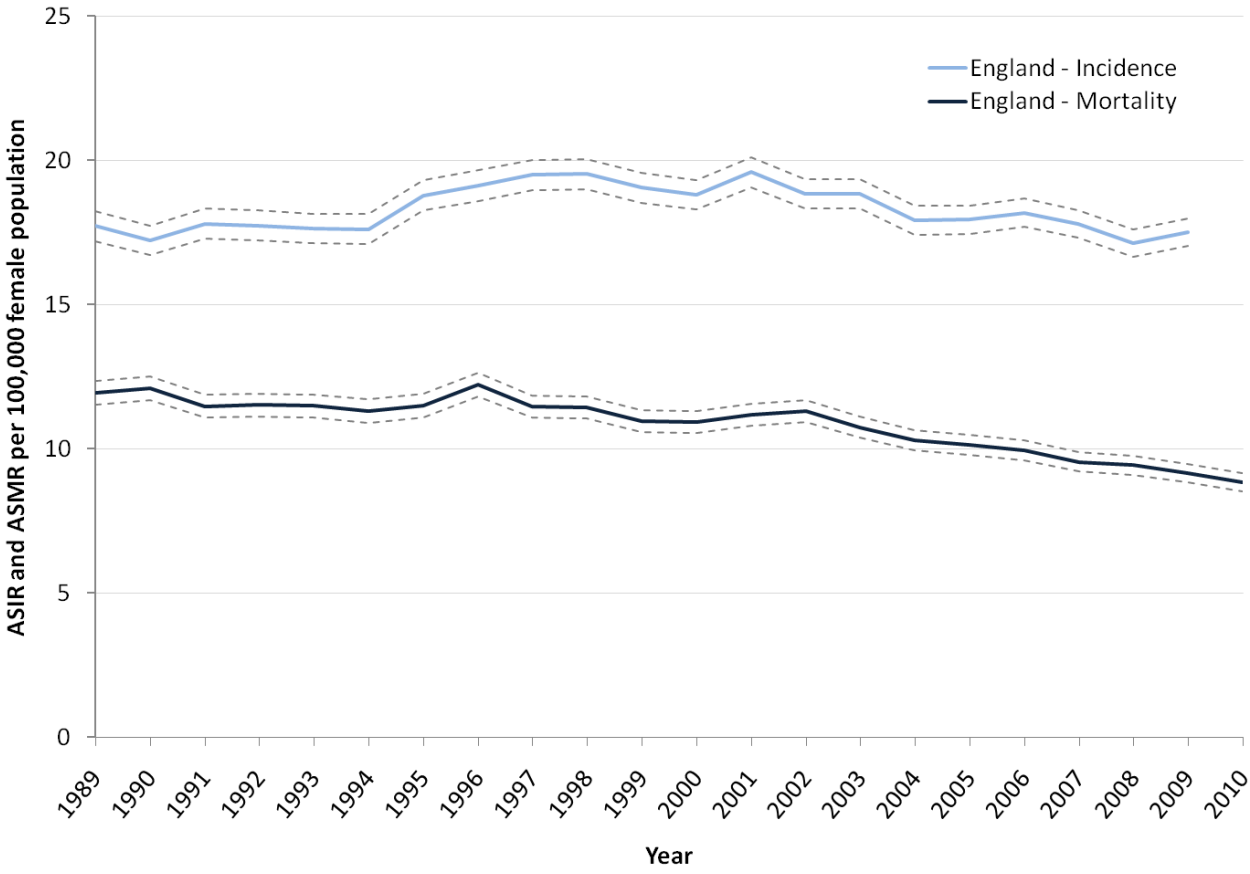


Figure 1 Trends in incidence and mortality, England, 1989-2010

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

Ovarian Cancer Incidence

The results in this section must be interpreted with caution as regional variations in the incidence of invasive ovarian cancer may be partly due to differences in diagnostic and coding practice, as well as differences in the underlying cause of disease. Differences in the age profile of areas have been adjusted for through age-standardising the incidence rates; therefore, any differences in incidence rates between areas do not reflect differences in the age of the female populations.

In addition to the tables of figures showing 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 and three standard deviations [SD] control limits around the national average, represented by the horizontal line. Further details on funnel plots are given in Appendix 1.

Incidence by Strategic Health Authority, 2007-2009

There is evidence that rates are lower than the national average for residents of two SHAs (South East Coast and London), and higher for three SHAs (East Midlands, South West and South Central). Rates vary from 15.6 (London) to 19.2 (South Central) per 100,000 female population.

Table 2 Incidence by Strategic Health Authority, 2007-2009

SHA	Total Cases	ASIR	95% CI
England	17,349	17.5	(17.2, 17.7)
North East	861	16.9	(15.7, 18.1)
North West	2,337	17.3	(16.6,18.1)
Yorkshire & The Humber	1,660	16.7	(15.9,17.6)
East Midlands	1,610	19.0	(18.0,20.0)
West Midlands	1,916	18.2	(17.3,19.0)
East of England	2,073	18.1	(17.3,19.0)
London	1,874	15.6	(14.9,16.4)
South East Coast	1,478	16.1	(15.2,17.0)
South Central	1,478	19.2	(18.2,20.2)
South West	2,062	18.3	(17.5,19.2)

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

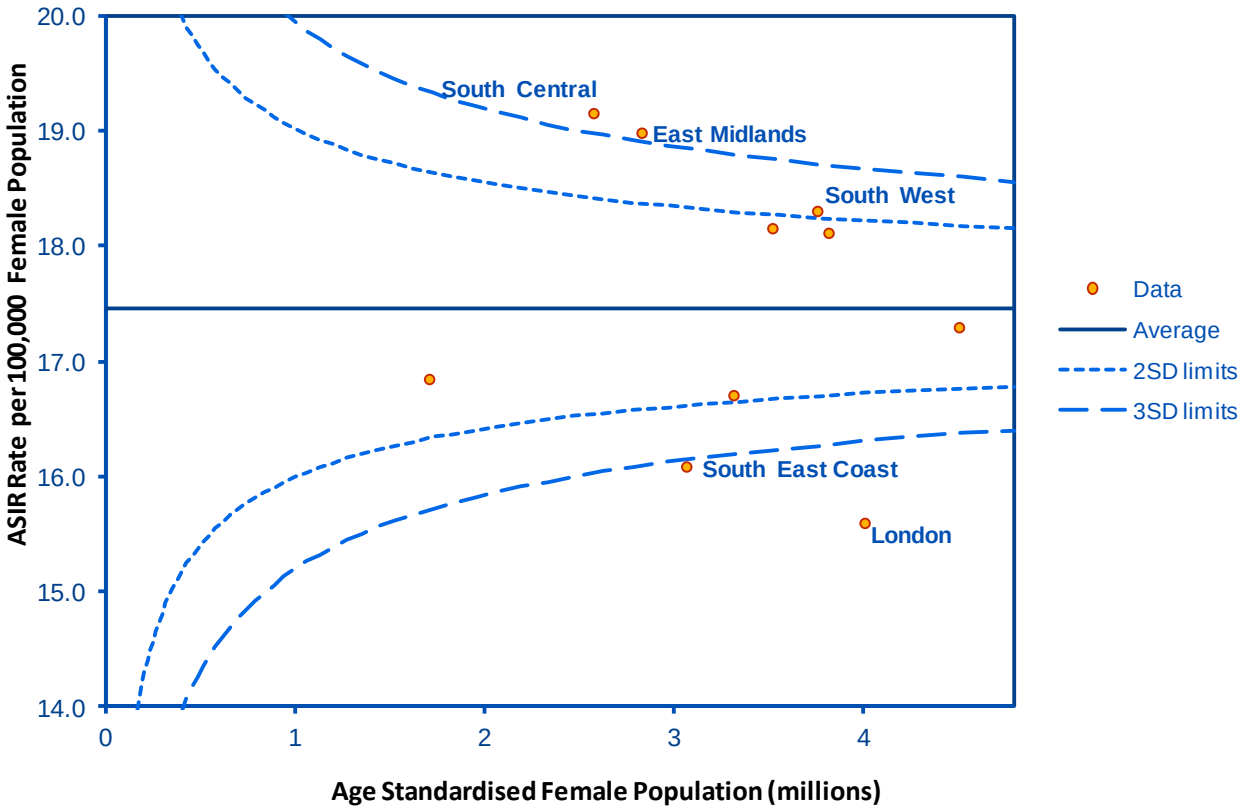


Figure 2 Funnel plot of incidence by SHA, England, 2007-2009

Source: UK Cancer Information Service

Incidence by Cancer Network, 2007-2009

Incidence rate patterns among Cancer Networks (CNs) broadly reflect those for SHAs. There is evidence that rates are higher than the England average in four CNs (Peninsula, Central South Coast, North Trent and East Midlands), and lower than the England average in South East London, South West London, North West London and Yorkshire, and very low in South East London (see figure 3).

Table 3 Incidence by Cancer Network, 2007-2009

Cancer Network	Total Cases	ASIR	95% CI
England	17,349	17.5	(17.2, 17.7)
3 Counties	382	17.0	(15.2,18.9)
Anglia	1,016	18.7	(17.5,20.0)
Arden	345	17.5	(15.5,19.6)
Avon, Somerset & Wiltshire	699	17.8	(16.4,19.3)
Central South Coast	823	19.8	(18.4,21.4)
Dorset	295	17.7	(15.5,20.2)
East Midlands	1,447	18.8	(17.8,19.9)
Essex	490	17.1	(15.6,18.8)
Greater Manchester & Cheshire	932	16.5	(15.4,17.7)
Greater Midlands	741	19.0	(17.6,20.5)
Humber & Yorkshire Coast	365	16.4	(14.6,18.3)
Kent & Medway	552	16.4	(15.0,18.0)
Lancashire & South Cumbria	570	18.5	(16.9,20.2)
Merseyside & Cheshire	720	17.5	(16.2,18.9)
Mount Vernon	466	18.0	(16.3,19.8)
North East London	395	16.9	(15.2,18.7)
North London	427	17.3	(15.6,19.1)
North of England	1,018	16.8	(15.7,17.9)
North Trent	671	19.6	(18.1,21.3)
North West London	464	15.5	(14.1,17.1)
Pan Birmingham	615	17.9	(16.5,19.5)
Peninsula	763	20.2	(18.6,21.8)
South East London	355	13.7	(12.2,15.3)
South West London	402	15.1	(13.6,16.7)
Surrey, West Sussex & Hampshire	381	16.0	(14.3,17.8)
Sussex	450	16.1	(14.5,17.8)
Thames Valley	783	18.2	(16.9,19.6)
Yorkshire	782	15.5	(14.4,16.7)

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

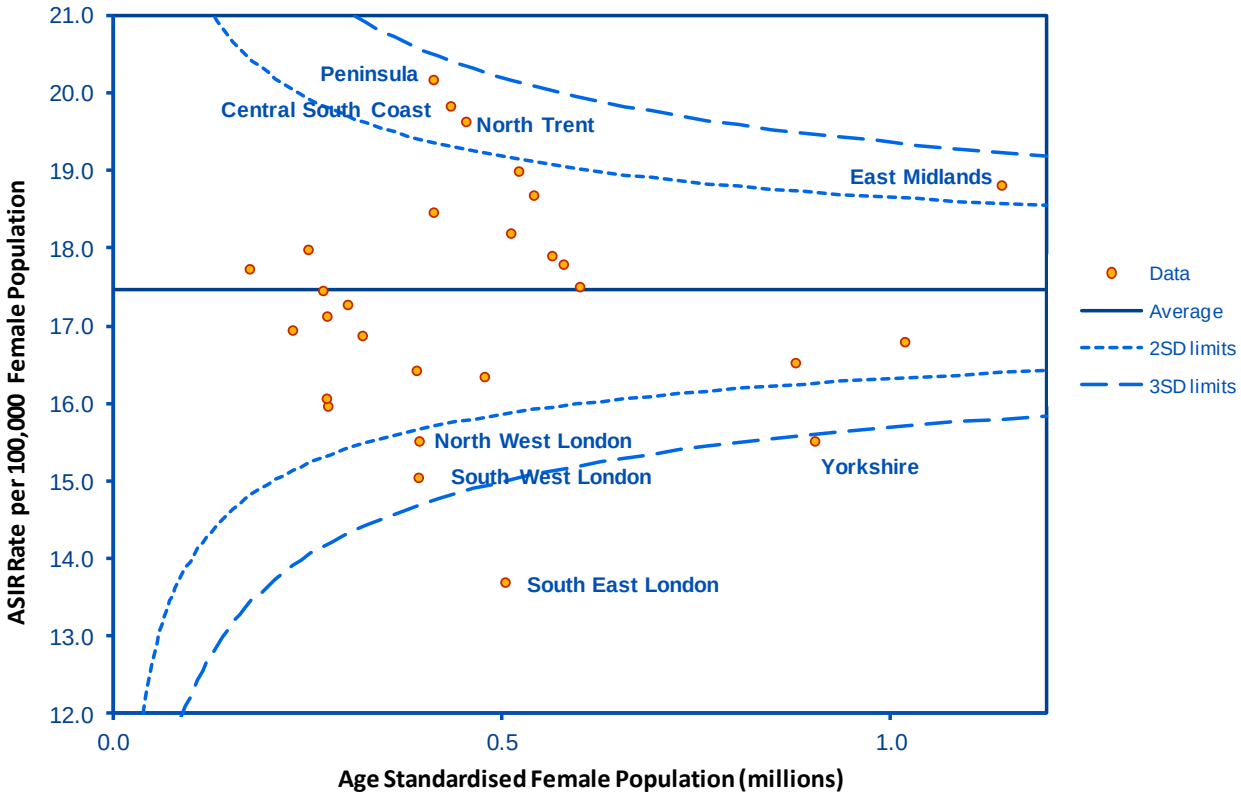


Figure 3 Funnel plot of incidence by Cancer Network, England, 2007-2009

Source: UK Cancer Information Service

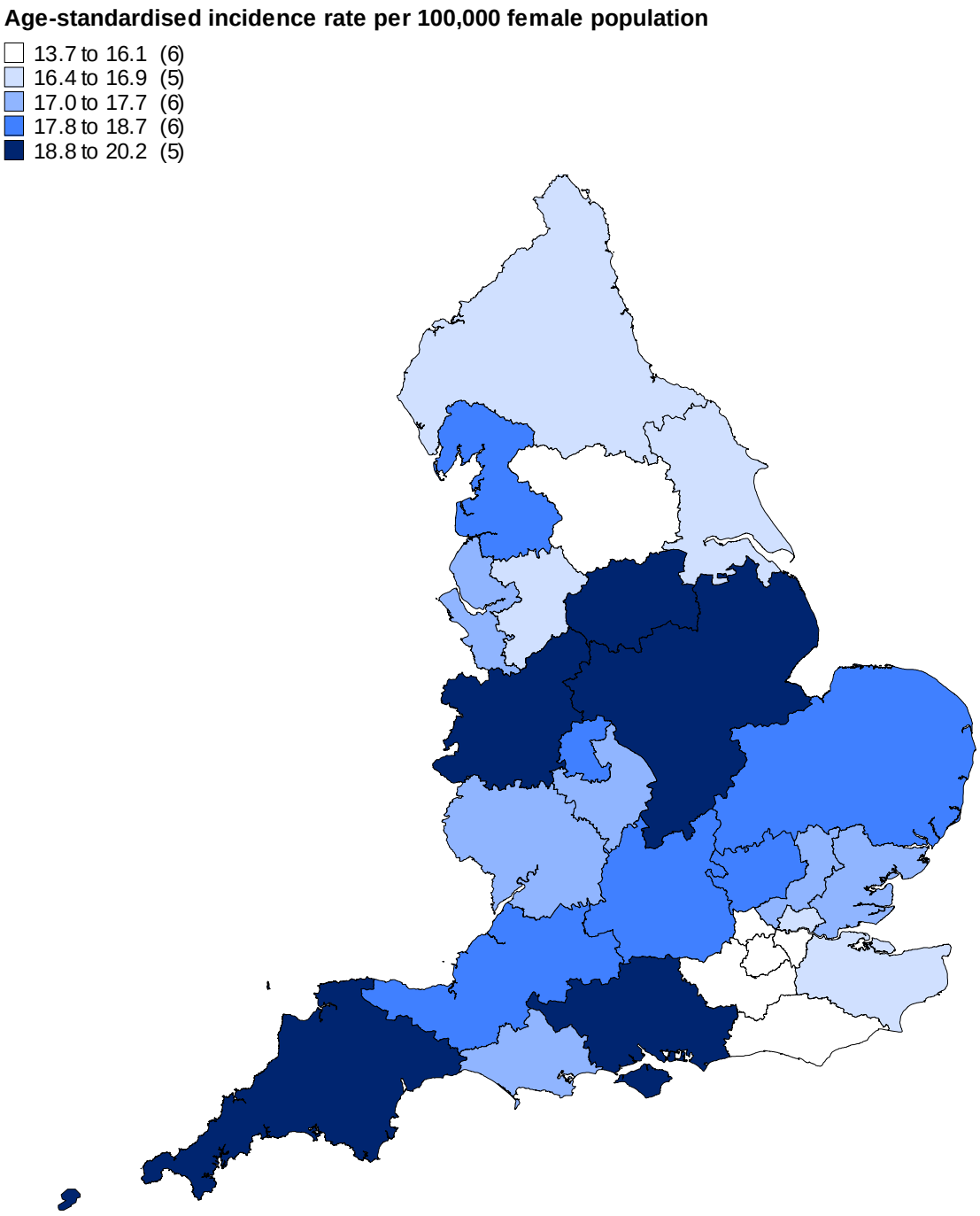


Figure 4 Map of incidence by CN, 2007-2009

The bracketed numbers in the key above are the number of CNs included in each quintile.

Produced by Trent Cancer Registry on behalf of the Department of Health. Based on Ordnance Survey Material.

Incidence by Age 2009

The age-specific incidence rates rise steadily with age, peaking among women in their 70s and 80s. The numbers of cases are highest among women in their 60s and 70s, accounting for almost half the diagnoses in 2009 (2,817 out of 5,849). This includes all morphological types of ovarian cancer.

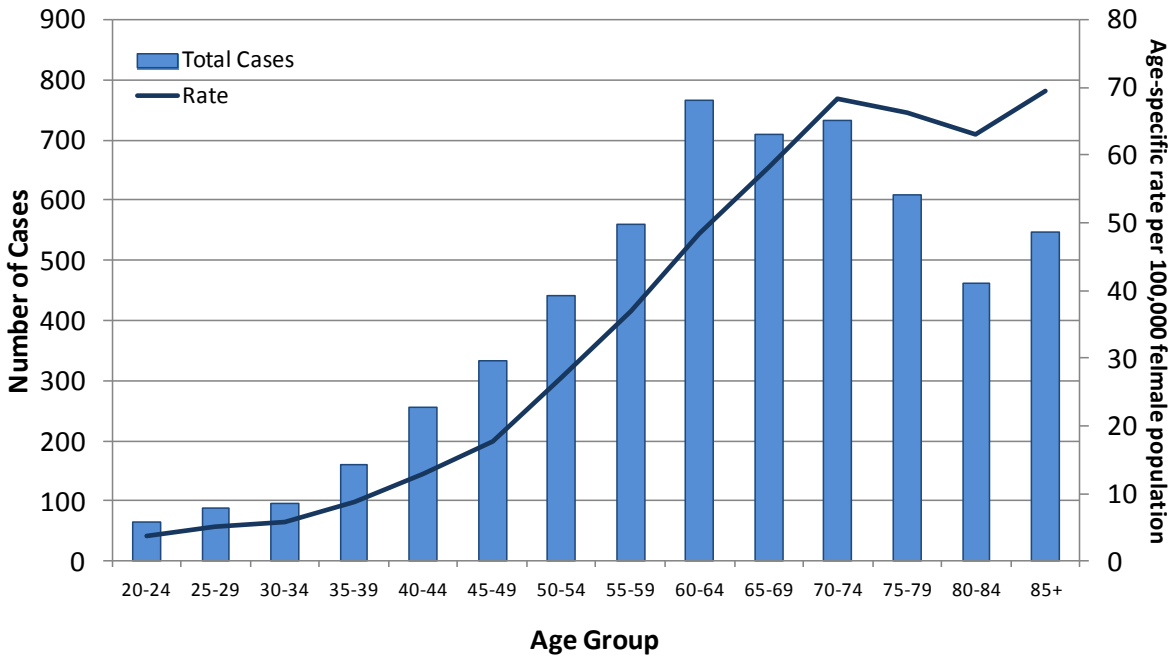


Figure 5 Age-specific incidence rates and numbers of cases diagnosed by five-year age group, England, 2009
Source: UK Cancer Information Service

Trends in incidence by age, England, 1989-2009

Incidence rates have remained stable, at around 9 per 100,000 female population for women aged 20-49. For women aged 50-69, rates have fallen over the last 10 years from 48 to 40 per 100,000 female population. For women aged 70 and over, the rate increased between 1989 and 2003 from 57 to 70 per 100,000 female population, after which rates began to fall.

The recent downward trend in the incidence of ovarian cancer among women aged 50 and over may reflect the protective benefit of the oral contraceptive pill. Women currently aged 70 and over were the first cohort of child-bearing age to have the oral contraceptive pill widely available during the 1960s.

Age bands have been grouped where trends were similar and are presented in figure 6 below.

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

	1989		1994		1999		2004		2009	
Age Band	Total Cases	Rate	Total Cases	Rate	Total Cases	Rate	Total Cases	Rate	Total Cases	Rate
15-19	20	1.2	9	0.7	25	1.7	28	1.8	26	1.6
20-24	26	1.4	33	2.0	36	2.5	42	2.7	64	3.7
25-29	46	2.4	54	2.8	68	3.9	65	4.2	89	5.2
30-34	61	3.7	79	4.2	98	5.0	88	4.9	95	5.9
35-39	138	8.7	120	7.2	161	8.5	151	7.6	161	8.8
40-44	215	12.6	211	13.3	193	11.6	205	10.8	255	12.9
45-49	295	21.6	358	21.1	346	21.9	314	19.0	332	17.6
50-54	469	36.6	440	32.6	546	32.5	469	30.2	441	27.1
55-59	571	45.8	532	42.4	634	47.9	667	40.7	560	36.9
60-64	641	51.0	627	52.4	661	54.4	676	52.8	767	48.3
65-69	723	53.9	666	56.6	735	64.8	675	58.3	709	58.2
70-74	589	59.1	754	62.7	690	64.7	711	68.0	732	68.2
75-79	551	57.2	501	59.8	727	71.5	637	69.2	609	66.2
80-84	391	56.7	460	64.1	412	65.0	553	70.7	462	63.1
85+	290	55.3	332	53.9	436	64.2	424	63.5	547	69.5

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

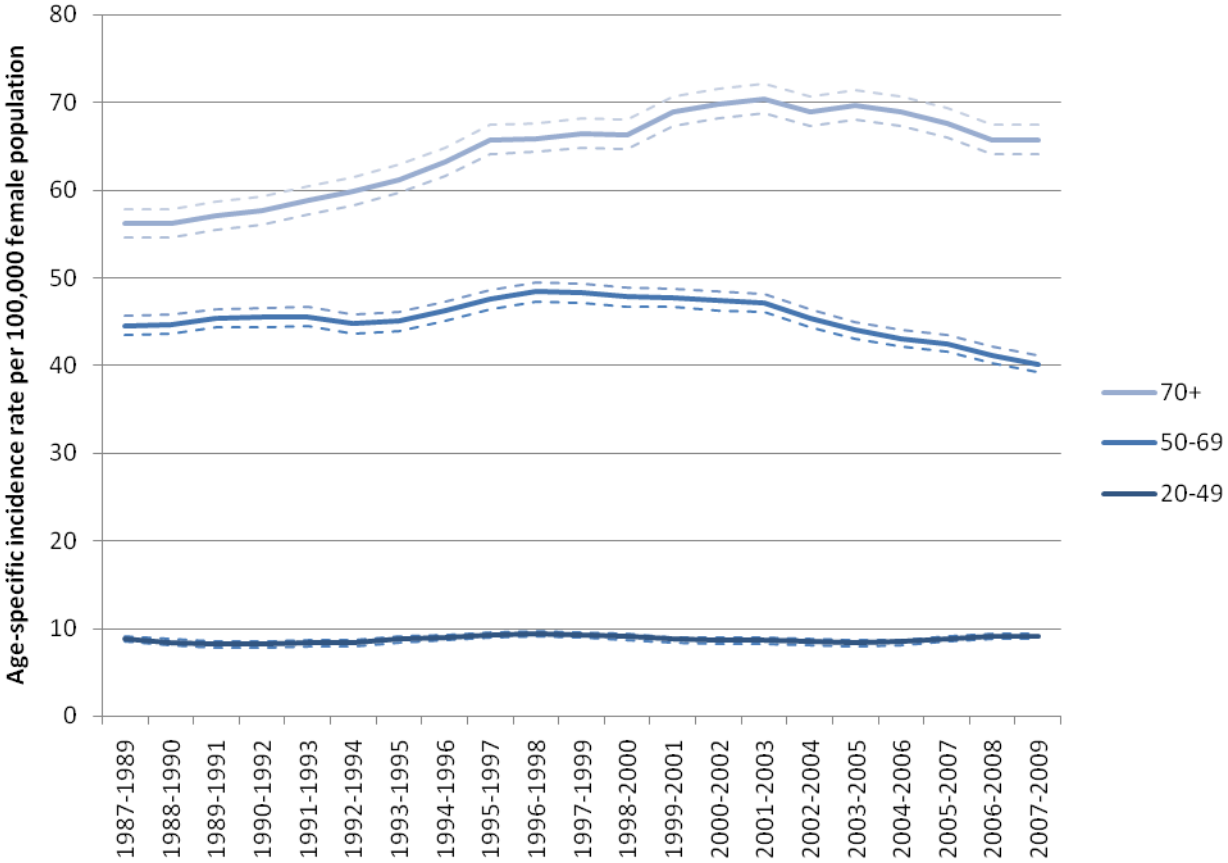


Figure 6 Trends in incidence by broad age band, England, 1987-1989 to 2007-2009

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

Comparing incidence and deprivation by Primary Care Trust 2007-2009

There is no 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 ovarian cancer among the 151 PCTs in England. The correlation co-efficient is -0.02.

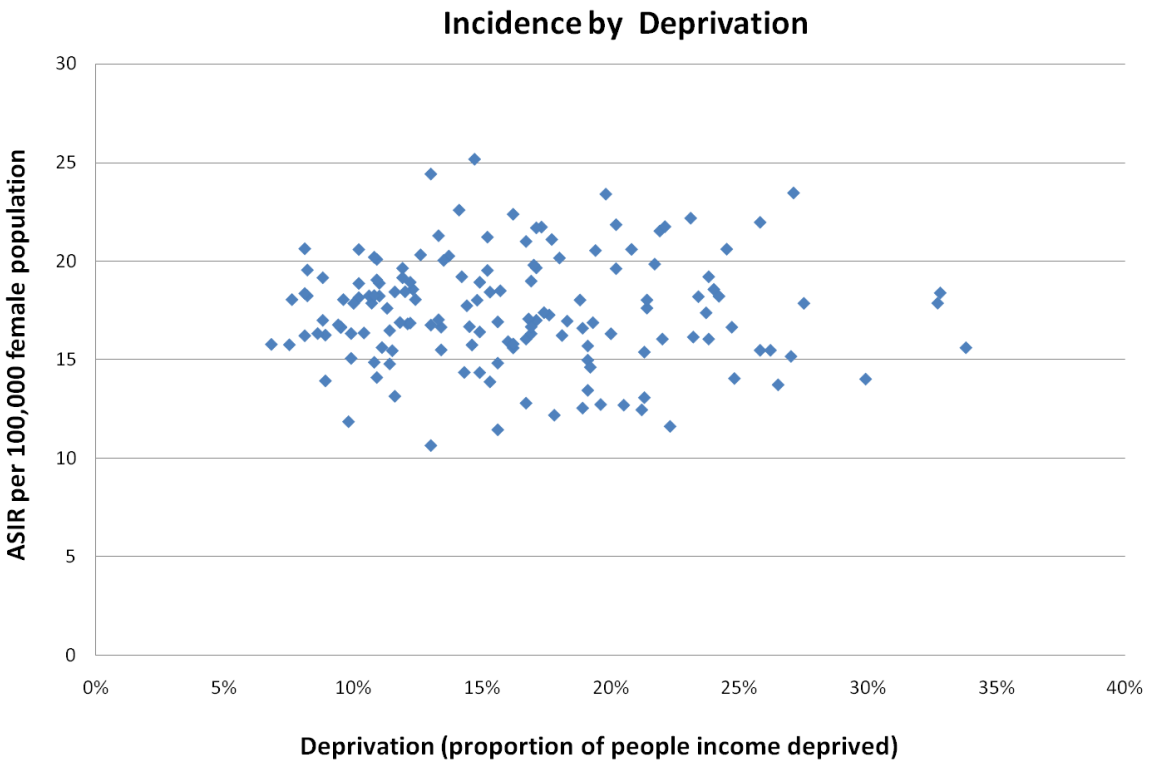


Figure 7 Scatter plot of incidence of ovarian cancer against measure of income deprivation by PCT, 2007-2009

Source: UK Cancer Information Service

Morphology

In this section ovarian cancer cases have been grouped by the morphological type of the tumour. For ovarian 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. Tumours included in the group 'unclassified epithelial' are surface epithelial stromal tumours/carcinomas morphology that have not been classified by a pathologist according to one of the recognised subtypes of epithelial ovarian carcinoma, as set out by the WHO. Tumours included in the 'miscellaneous and unspecified' group include rare or uncommon tumour subtypes and cases where a diagnosis of malignancy has been made without specifying a tumour subtype. Please see the 'morphology' section in Appendix 1 for further details on which tumour types are included in each morphological group.

Incidence Trends by Morphology Group

Over the last 10 years, the number of unclassified epithelial cases has fallen by 29%, perhaps indicating improvements in the coding and recording of ovarian cancer morphology. There has been a corresponding increase (38%) in the number of serous carcinoma cases; currently the most common morphological group for ovarian cancer (32%). Borderline cases have risen by 36%, while endometrioid carcinoma and mucinous carcinoma have fallen by 29% and 18% respectively. The other categories have remained fairly stable between 2000 and 2009. However, miscellaneous and unspecified tumour types have increased in the most recent years and in 2009 accounted for 8% of all cases.

An important consideration in the high proportion of cases that are unclassified or unspecified morphology concerns the information systems in pathology laboratories. The lack of modernisation of some hospital systems may impact on the quality of the pathology data that is received by registries.

Table 5 Incidence by morphology group by year, 2000-2009

	Year of Diagnosis									
	2000		2003		2005		2007		2009	
Morphology Group	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Serous carcinoma	1,352	**24.1%**	1,384	**23.8%**	1,465	**25.5%**	1,648	**28.9%**	1,865	**32.0%**
Endometrioid carcinoma	460	**8.2%**	404	**7.0%**	376	**6.5%**	364	**6.4%**	327	**5.6%**
Mucinous carcinoma	433	**7.7%**	366	**6.3%**	371	**6.4%**	339	**5.9%**	356	**6.1%**
Clear cell carcinoma	188	**3.3%**	236	**4.1%**	236	**4.1%**	241	**4.2%**	244	**4.2%**
Other classified epithelial-stromal tumours	175	**3.1%**	180	**3.1%**	203	**3.5%**	205	**3.6%**	201	**3.4%**
Unclassified epithelial	2,021	**36.0%**	2,123	**36.6%**	2,017	**35.0%**	1,698	**29.7%**	1,432	**24.5%**
Borderline	582	**10.4%**	658	**11.3%**	682	**11.9%**	791	**13.8%**	793	**13.6%**
Sex cord–stromal or germ cell tumours	108	**1.9%**	134	**2.3%**	106	**1.8%**	128	**2.2%**	148	**2.5%**
Miscellaneous & unspecified	301	**5.4%**	318	**5.5%**	299	**5.2%**	298	**5.2%**	467	**8.0%**
Total	**5,620**		**5,803**		**5,755**		**5,712**		**5,833**	

Source: National Cancer Data Repository (NCDR)

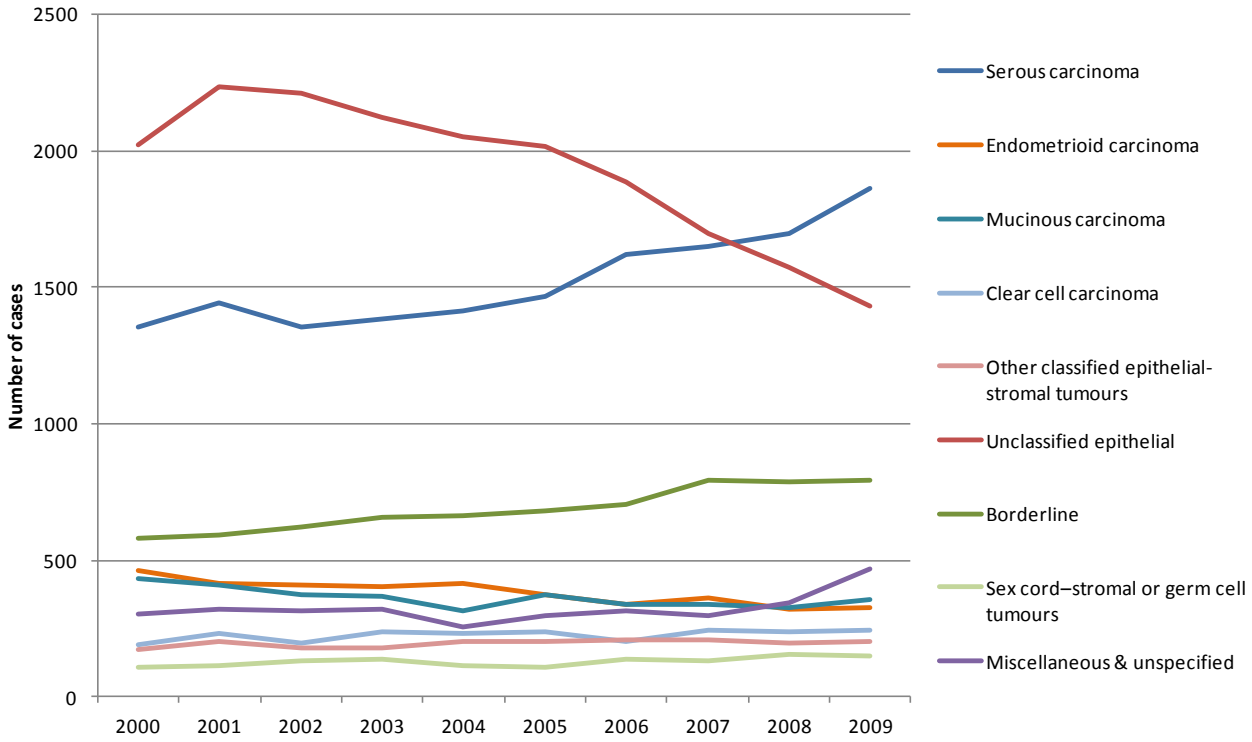


Figure 8 Trend chart of incidence by morphology group

Source: National Cancer Data Repository (NCDR)

Incidence by Age and Morphology Group 2007-2009

The highest proportions of serous carcinoma cases, over a third of all cases, are in women aged between 55 and 79. Endometrioid and clear cell carcinomas are most common in women aged 45-59.

The proportion of borderline cases, mucinous carcinomas and sex cord-stromal or germ cell tumours decreases with age, with the highest proportions (81% in total) in the under 35s. Malignant, germ cell tumours are most common in girls and young women in their 20s [4].

Patterns in the morphology groups by age show that unclassified epithelial and miscellaneous & unspecified cases increase with age; more than 50% of cases in those aged 80 and over are classified as such compared with fewer than 20% in women aged under 50. The higher proportion of unspecified or unclassified morphology in older women may reflect the higher likelihood of co-morbidities or more advanced stage of disease. 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 cancer registration is made from a death certificate only), accounting for 1.9% of all cases overall. The number of DCO cases increases with age with the highest proportion in the 85 and over age group; 10% of registrations in this age group are DCO. This may account for the higher proportion of unclassified epithelial or miscellaneous and unspecified morphologies.

Table 6 Proportions of cases by morphology group by age band for patients diagnosed 2007-2009

	Age Group										
Morphology Group	**<35**	**35-44**	**45-49**	**50-54**	**55-59**	**60-64**	**65-69**	**70-74**	**75-79**	**80-84**	**85+**
Serous carcinoma	9%	20%	28%	30%	37%	42%	39%	38%	32%	24%	13%
Endometrioid carcinoma	2%	8%	10%	11%	9%	6%	5%	5%	4%	3%	2%
Mucinous carcinoma	15%	12%	6%	8%	7%	5%	5%	4%	5%	4%	2%
Clear cell carcinoma	1%	5%	8%	7%	8%	5%	4%	3%	3%	2%	1%
Other classified epithelial-stromal tumours	1%	2%	2%	3%	4%	4%	5%	5%	4%	3%	2%
Unclassified epithelial	4%	8%	15%	17%	18%	22%	27%	32%	39%	47%	54%
Borderline	43%	37%	24%	19%	14%	11%	9%	7%	7%	5%	3%
Sex cord–stromal or germ cell tumours	23%	5%	4%	1%	1%	1%	1%	1%	1%	1%	1%
Miscellaneous & unspecified	2%	2%	3%	4%	3%	5%	5%	5%	6%	12%	22%

Source: National Cancer Data Repository (NCDR)

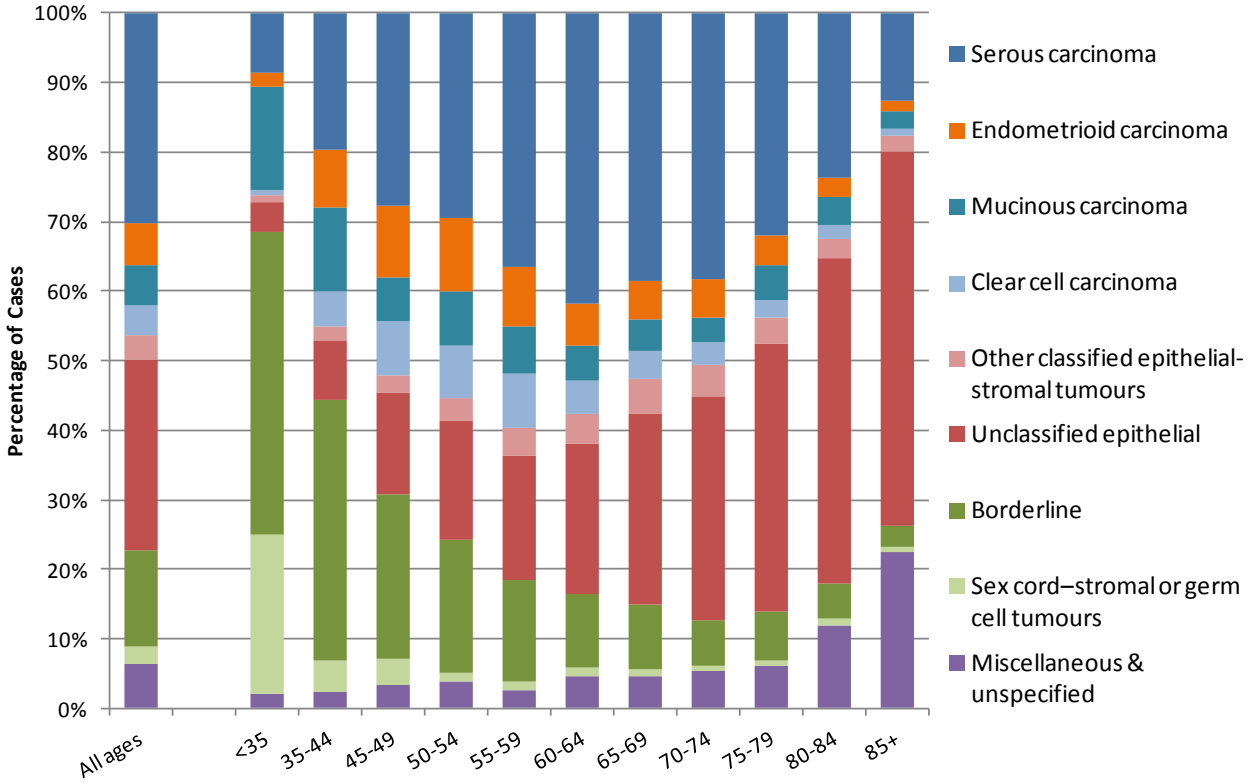


Figure 9 Proportions of cases by morphology group by age band for patients diagnosed 2007-2009

Source: National Cancer Data Repository (NCDR)

Incidence by Deprivation by Morphology Group 2007-2009

The proportion of cases that are other classified epithelial-stromal tumours, clear cell carcinomas, miscellaneous & unspecified or unclassified epithelial is similar across the deprivation quintiles.

However, there is strong evidence that women living in the most affluent fifth of areas have a higher proportion of serous carcinomas than women in the most deprived fifth of areas, 33% vs. 29%. There is also evidence that endometrioid carcinomas are more common in women living in the most affluent compared with women in the most deprived fifth of areas.

Conversely, there is strong evidence that women living in the most deprived fifth of areas nationally have a higher proportion of borderline tumours than women living in the least deprived areas. This is perhaps due to a higher proportion of ovarian cancers in younger women living in the most deprived areas compared to the least deprived, as it is younger women who are most likely to develop a borderline case of ovarian cancer. There is also evidence that mucinous carcinomas are more common in women living in the most deprived fifth of areas nationally than in the least deprived. This pattern may be linked to a higher prevalence of smoking among women living in more deprived areas, as it is thought to be a risk factor for mucinous carcinomas and to be protective against clear cell carcinomas [5]. There is also evidence that sex-cord-stromal and germ cell tumours are more common in women living in the most deprived fifth of areas.

Table 7 Proportions of cases by morphology group by deprivation quintile for patients diagnosed 2007-2009

Morphology Group	Level of deprivation					
	1 - Most Affluent	2	3	4	5 - Most Deprived	p-value
Serous carcinoma	32.7%	31.1%	30.8%	28.7%	27.8%	<0.001*
Endometrioid carcinoma	6.9%	6.2%	5.3%	5.7%	5.1%	0.001*
Mucinous carcinoma	5.1%	5.5%	6.1%	6.4%	6.8%	0.001*
Clear cell carcinoma	4.8%	4.3%	4.4%	3.7%	3.8%	0.02
Other classified epithelial-stromal tumours	3.4%	3.9%	3.3%	3.3%	3.6%	0.75
Unclassified epithelial	26.2%	28.0%	27.9%	27.9%	26.8%	0.58
Borderline	12.9%	12.7%	13.0%	14.8%	16.2%	<0.001*
Sex cord–stromal or germ cell tumours	2.2%	2.0%	2.6%	2.5%	3.3%	0.002*
Miscellaneous and unspecified	5.7%	6.3%	6.6%	7.0%	6.6%	0.05

'*' 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: National Cancer Data Repository (NCDR)

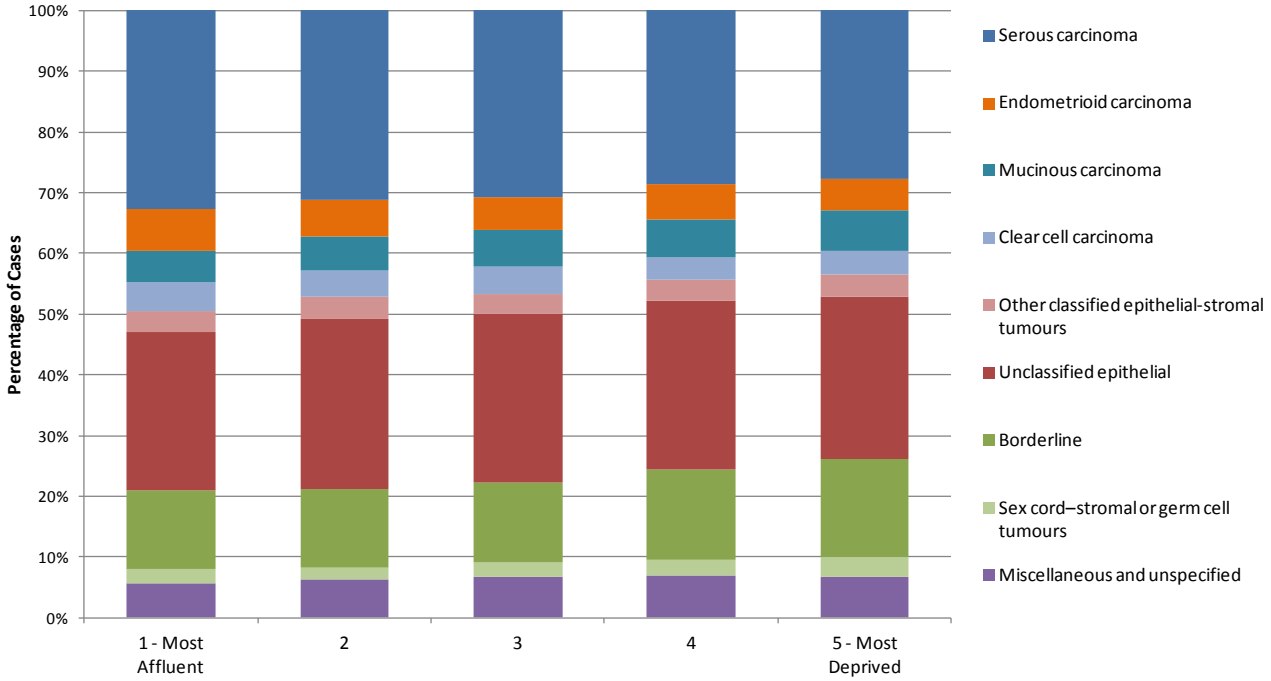


Figure 10 Proportions of cases by morphology group by deprivation quintile for patients diagnosed 2007-2009

Source: National Cancer Data Repository (NCDR)

Ovarian Cancer Mortality

Differences in the age profile of areas have been adjusted for through age-standardising the incidence rates; therefore, any differences in incidence rates between areas do not reflect differences in the age of the female populations.

Mortality by Strategic Health Authority 2008-2010

There is evidence that ovarian cancer mortality rates are lower than the national average for residents of London and Yorkshire & the Humber SHAs and evidence that rates are higher in the West Midlands and South Central SHAs, broadly reflecting the pattern in incidence rates.

Table 8 Mortality by SHA, 2008-2010

SHA	Total Deaths	ASMR	95% CI
England	10,481	9.1	(9.0,9.3)
North East	515	8.6	(7.8,9.4)
North West	1,478	9.6	(9.0,10.1)
Yorkshire & The Humber	935	8.1	(7.6,8.7)
East Midlands	926	9.6	(8.9,10.2)
West Midlands	1,223	10.0	(9.4,10.6)
East of England	1,264	9.5	(9.0,10.1)
London	1,028	8.0	(7.5,8.5)
South East Coast	1,009	9.2	(8.6,9.9)
South Central	877	9.9	(9.2,10.6)
South West	1,226	8.9	(8.4,9.5)

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

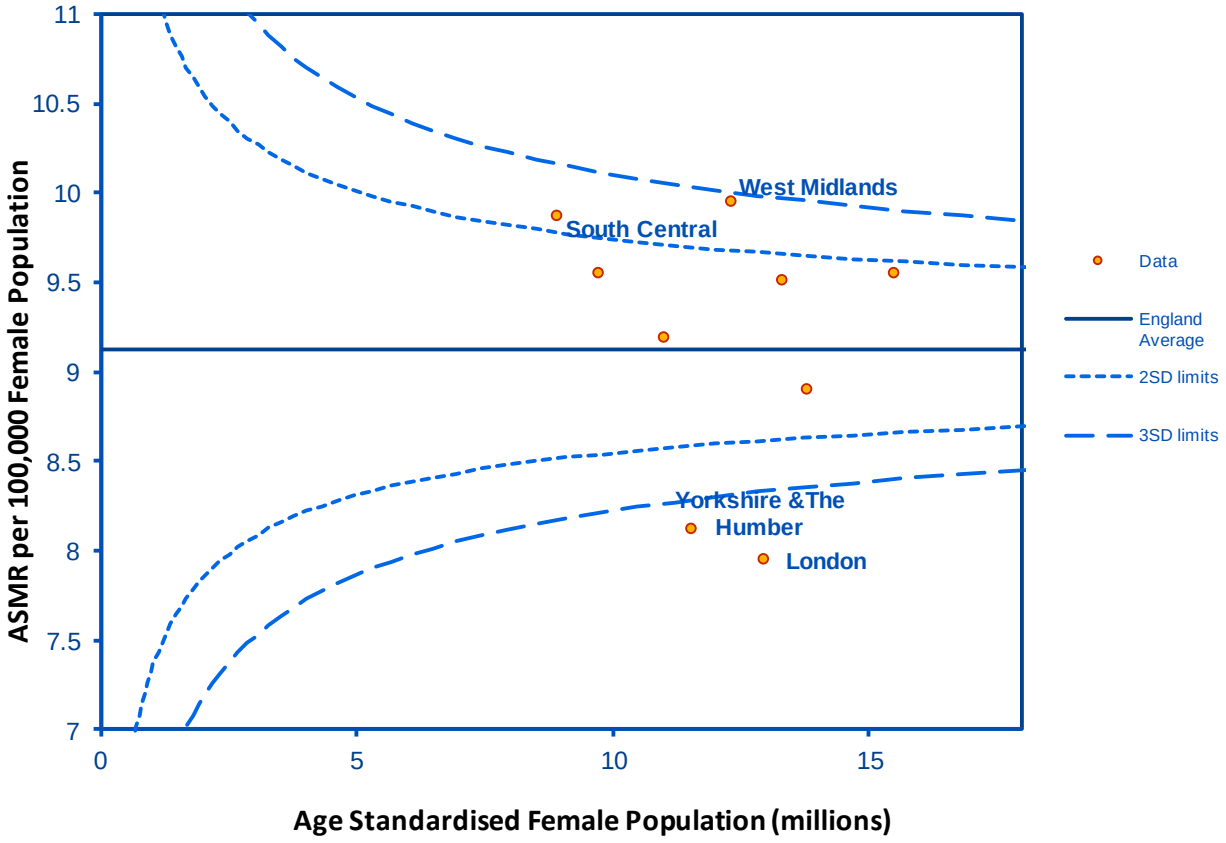


Figure 11 Funnel plot of mortality by SHA, England, 2008-2010

Source: UK Cancer Information Service

Mortality by Cancer Network, 2008-2010

Mortality rate patterns among CNs broadly reflect those seen for the SHAs. Similar to incidence, there is evidence that rates per 100,000 female population are lower than the national average for North East London and, most notably, South East London and Yorkshire CNs. There is evidence that rates are higher than nationally for Central South Coast, Lancashire & South Cumbria and, particularly for Greater Midlands CN (see figure 12).

Table 9 Mortality by Cancer Network, 2008-2010

Cancer Network	Total Deaths	ASMR	95% CI
England	10,481	9.1	(9,9.3)
3 Counties	234	8.4	(7.2,9.6)
Anglia	640	9.7	(8.9,10.6)
Arden	219	10.2	(8.8,11.7)
Avon, Somerset & Wiltshire	393	8.5	(7.6,9.4)
Central South Coast	507	10.2	(9.2,11.2)
Dorset	193	9.5	(8.1,11.2)
East Midlands	824	9.4	(8.7,10.1)
Essex	300	9.2	(8.1,10.4)
Greater Manchester & Cheshire	572	9.0	(8.2,9.8)
Greater Midlands	510	11.4	(10.3,12.5)
Humber & Yorkshire Coast	225	8.6	(7.4,9.9)
Kent and Medway	378	9.6	(8.6,10.7)
Lancashire & South Cumbria	372	10.3	(9.2,11.5)
Merseyside & Cheshire	459	9.8	(8.8,10.8)
Mount Vernon	265	9.6	(8.4,10.9)
North East London	198	7.9	(6.8,9.1)
North London	239	8.8	(7.6,10.1)
North of England	612	8.5	(7.8,9.3)
North Trent	380	9.7	(8.7,10.8)
North West London	269	8.2	(7.2,9.3)
Pan Birmingham	365	8.8	(7.8,9.8)
Peninsula	452	9.5	(8.5,10.5)
South East London	183	6.8	(5.8,7.9)
South West London	236	8.2	(7.1,9.4)
Surrey, West Sussex & Hampshire	264	9.1	(8,10.4)
Sussex	316	9.7	(8.6,11)
Thames Valley	442	9.1	(8.2,10)
Yorkshire	434	7.4	(6.7,8.2)

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

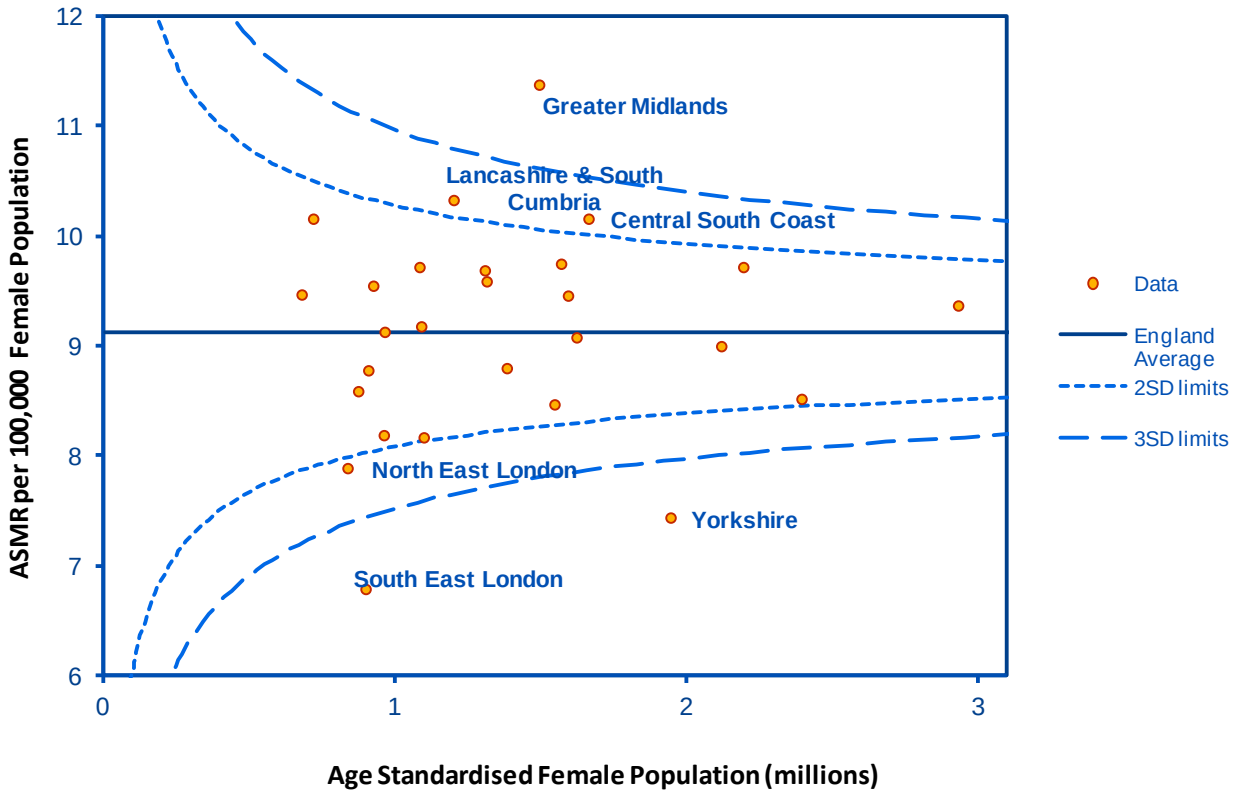


Figure 12 Funnel plot of mortality by Cancer Network, England, 2008-2010

Source: UK Cancer Information Service

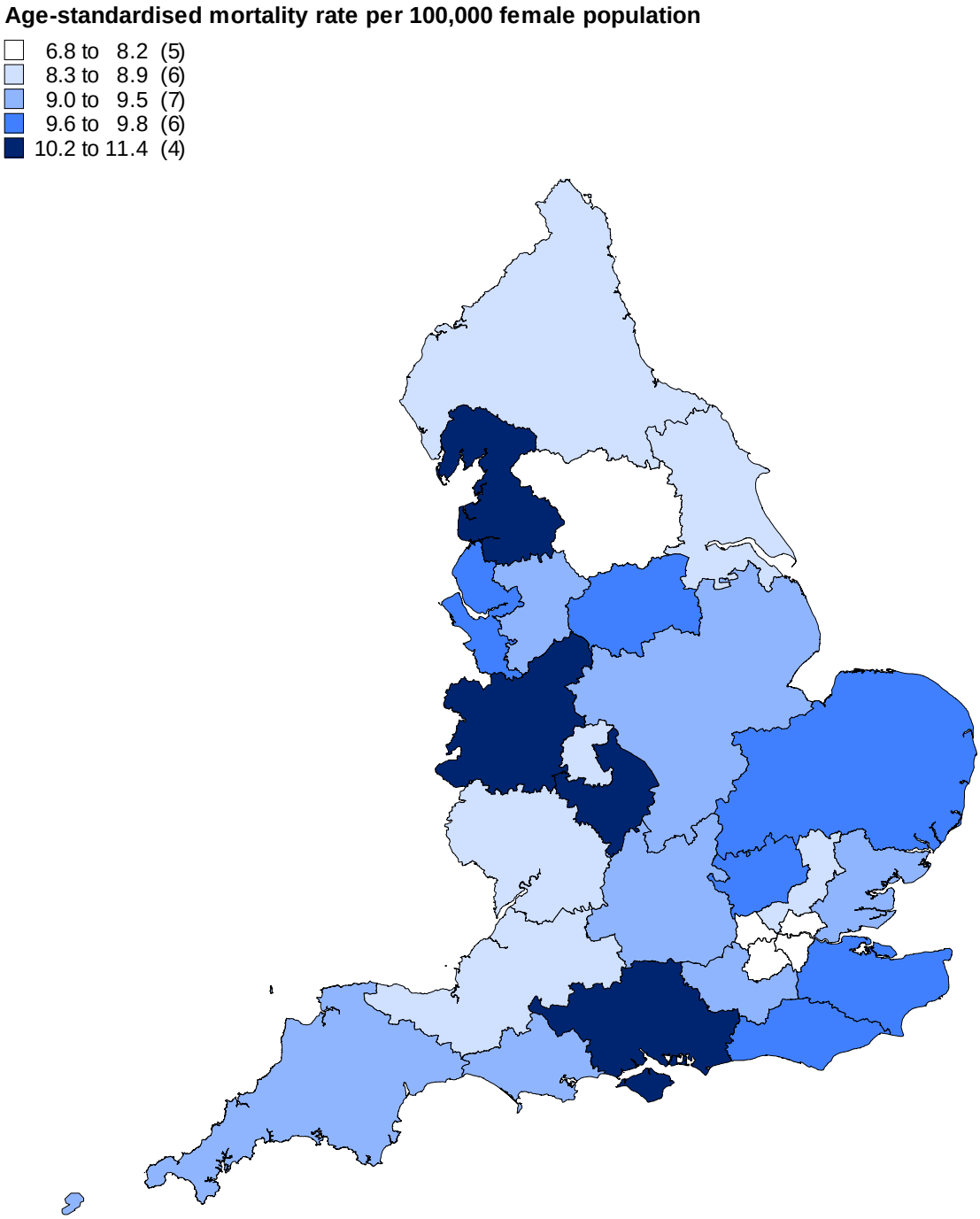


Figure 13 Map of mortality by CN, 2008-2010

The bracketed numbers in the key above are the number of CNs included in each quintile.

Mortality by age, England, 2008-2010

In 2008-2010, the age-specific mortality rate for ovarian cancer increases sharply with age from the 40-44 age group onwards. There is a correspondingly sharp rise in the numbers of deaths up to the 70-74 age group, after which the number of deaths levels off. Between 2008 and 2010, over 80% of deaths from ovarian cancer occurred in women aged 60 or over.

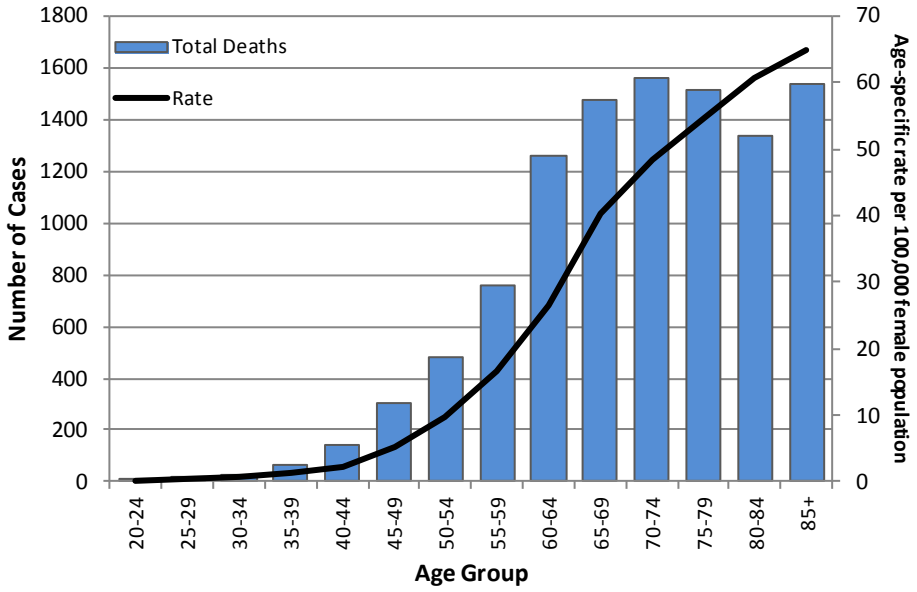


Figure 14 Age-specific mortality rates and numbers of deaths by five-year age group, England, 2008-2010

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

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

Over the 20 years from 1988-1990 to 2008-2010, the mortality rate for women in their 20s to 40s has remained low. The mortality rate for women in their 50s and 60s has fallen from 32 to 21 deaths per 100,000 female population (Figure 15) over this period. There has also been a fall in the rate for women in their 40s, most notably in the last 10 years. In contrast, the mortality rate for women aged 70 and over increased from 48 per 100,000 female population in 1988-1990 to 57 per 100,000 in 2002-2004, after which mortality has fallen to 54 per 100,000 in 2008-2010. The trends in mortality rates reflect the trends in incidence rates for each of the broad age groups.

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

	1988-1990		1993-1995		1998-2000		2003-2005		2008-2010	
Age Group	Total Deaths	Rate	Total Deaths	Rate	Total Deaths	Rate	Total Deaths	Rate	Total Deaths	Rate
20-24	12	0.2	13	0.3	10	0.2	13	0.3	11	0.2
25-29	24	0.4	24	0.4	25	0.5	18	0.4	21	0.4
30-34	46	0.9	49	0.9	42	0.7	42	0.8	29	0.6
35-39	108	2.3	92	1.8	84	1.5	81	1.4	65	1.2
40-44	265	5.2	225	4.7	188	3.8	149	2.6	139	2.3
45-49	493	12	519	10.2	408	8.6	315	6.3	300	5.3
50-54	846	22.1	739	18.2	798	15.9	611	13.1	483	9.9
55-59	1,090	29.2	1,091	29.1	996	25.1	1,075	21.9	760	16.7
60-64	1,437	38	1,311	36.5	1,350	37.1	1,299	33.8	1,260	26.6
65-69	1,750	44.5	1,551	43.8	1,478	43.4	1,511	43.6	1,472	40.2
70-74	1,445	46.8	1,754	49.7	1,657	51.7	1,623	51.7	1,557	48.5
75-79	1,397	48.4	1,304	50.3	1,680	56.1	1,514	54.7	1,510	54.6
80-84	1,014	49.2	1,179	54.8	1,169	59.8	1,453	62.7	1,337	60.7
85+	807	51.5	887	47.9	1,115	54.7	1,272	62.5	1,534	64.8

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

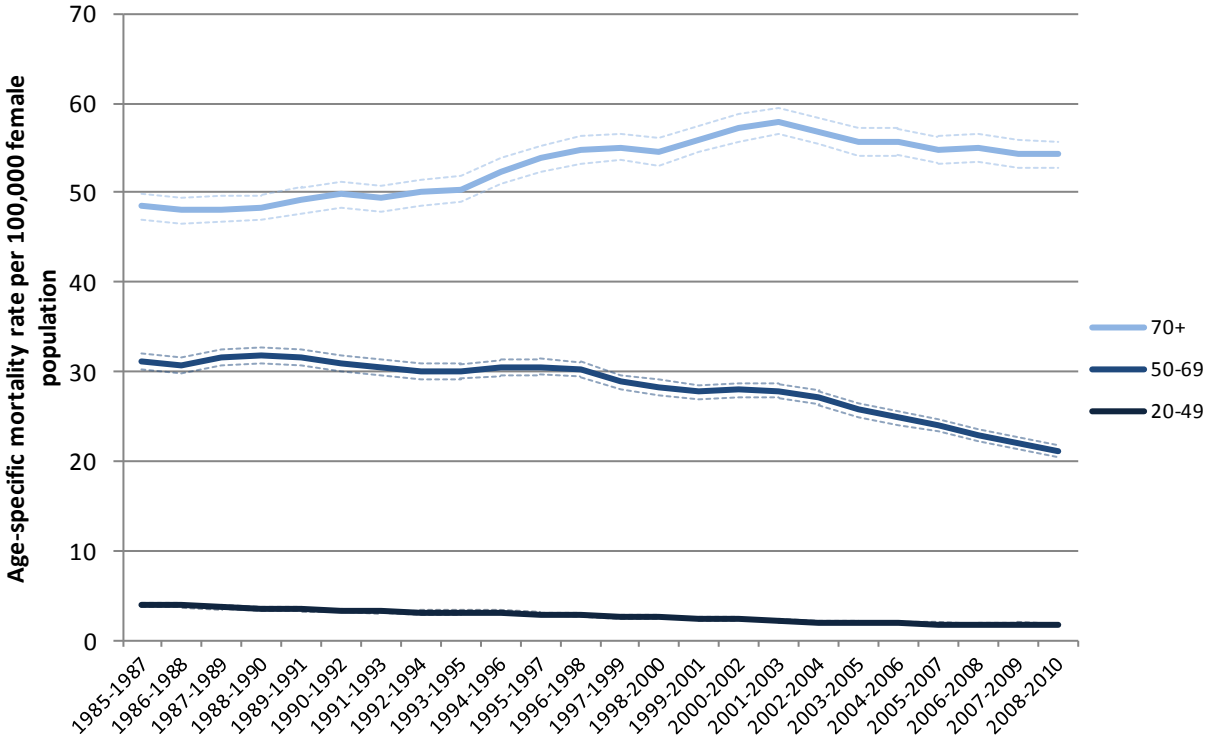


Figure 15 Trends in mortality by broad age bands, England, 1985-1987 to 2008-2010

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

Comparing mortality and deprivation by Primary Care Trust, 2008-2010

There is no 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 ovarian cancer among the 151 PCTs in England, with a correlation co-efficient of -0.13.

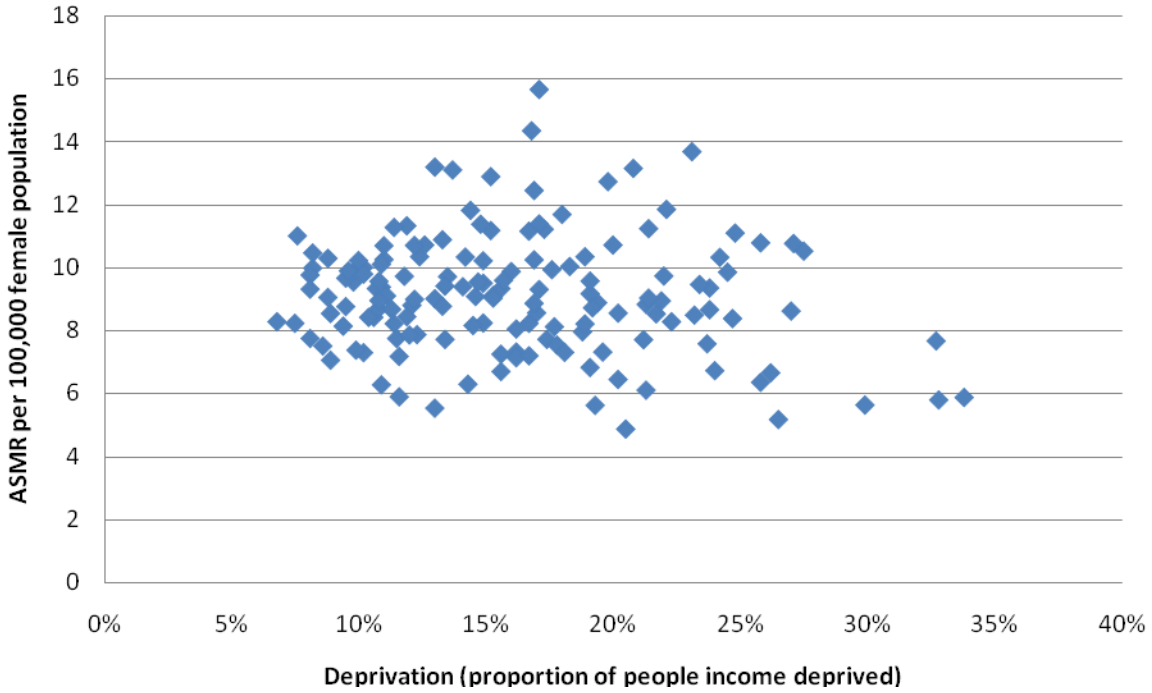


Figure 16 Scatter plot of mortality against measure of deprivation by PCT, 2008-2010

Source: UK Cancer Information Service

Ovarian Cancer Survival

Details of the definition of relative survival used here can be found in Appendix 1. There may be differences between the relative survival rates calculated here and those found in other sources. This may be due to differences in the methodology used, but may also reflect differences in the definition of ovarian cancer. For further details, please see the section 'Definition of Ovarian Cancer' in Appendix 1.

Trends in one- and five- year relative survival, England, 1985 to 2009 / 2005

In England, ovarian cancer survival has improved since the mid-1980s. One-year relative survival has improved steadily over the period, from 57% to 73% (for patients diagnosed in 2009). Five-year relative survival remained stable at just below 33% until 1994, after which survival improved to 44% for patients diagnosed in 2005.

This improvement in the survival of women diagnosed with ovarian cancer may be attributed to progress in diagnosis and treatment, including: the establishment of specialist gynaecological oncology multidisciplinary teams; centralisation of surgery for ovarian cancer by subspecialist gynaecological oncologists; and improvements in access to chemotherapy treatments. Chemotherapy regimens which combine taxanes with platinum agents are now considered to be the primary treatment for women with more advanced disease[3]. Improvements in the awareness of the symptoms of ovarian cancer and thereby earlier diagnosis, may also contribute to improved survival.

Whilst there has been improvement in recent years, ovarian cancer survival rates are still low when compared to other gynaecological cancers. Survival rates are also low when compared to ovarian cancer survival rates in other countries with similar health care systems [6]. Earlier presentation and diagnosis of ovarian cancer is vital in improving survival rates. In 2007, 29% of patients subsequently diagnosed with ovarian cancer entered the patient pathway through emergency presentation. Generally, cancer patients admitted through the emergency patient pathway were found to have poorer survival than patients diagnosed through other routes[7].

Table 11 Trends in one- and five- year relative survival, England, 1985 to 2009

		One-Year relative Survival			Five-Year relative Survival		
Year	Total Cases	Cumulative Deaths	%	95% CI	Cumulative Deaths	%	95% CI
1985	4,180	1,865	56.9	(55.3,58.4)	2,998	32.6	(31.0,34.2)
1986	4,344	1,964	56.3	(54.7,57.8)	3,151	31.6	(30.0,33.2)
1987	4,365	1,927	57.4	(55.8,58.9)	3,121	32.8	(31.3,34.4)
1988	4,344	1,946	56.7	(55.1,58.2)	3,135	32.0	(30.5,33.6)
1989	4,476	1,976	57.4	(55.8,58.9)	3,194	33.0	(31.4,34.6)
1990	4,403	1,970	56.7	(55.2,58.3)	3,195	31.6	(30.0,33.1)
1991	4,509	1,898	59.4	(57.9,60.9)	3,233	32.5	(31.0,34.1)
1992	4,524	1,928	58.9	(57.4,60.4)	3,229	32.9	(31.4,34.5)
1993	4,642	1,956	59.4	(57.9,60.9)	3,320	32.9	(31.3,34.4)
1994	4,492	1,803	61.4	(59.9,62.9)	3,170	33.8	(32.3,35.4)
1995	4,837	1,819	64.0	(62.6,65.4)	3,245	37.7	(36.1,39.2)
1996	4,871	1,847	63.7	(62.3,65.1)	3,255	38.0	(36.4,39.5)
1997	5,087	1,880	64.7	(63.3,66.1)	3,357	39.0	(37.5,40.6)
1998	5,120	1,759	67.3	(65.9,68.6)	3,338	39.7	(38.2,41.2)
1999	4,991	1,748	66.6	(65.2,68.0)	3,204	40.9	(39.3,42.4)
2000	5,063	1,715	67.9	(66.5,69.2)	3,194	42.3	(40.8,43.9)
2001	5,358	1,914	66.0	(64.6,67.3)	3,538	39.0	(37.5,40.5)
2002	5,186	1,831	66.5	(65.1,67.8)	3,360	40.6	(39.0,42.1)
2003	5,280	1,783	67.9	(66.6,69.2)	3,383	41.1	(39.6,42.6)
2004	4,997	1,683	68.0	(66.6,69.4)	3,108	43.3	(41.7,44.9)
2005	5,092	1,694	68.5	(67.1,69.8)	3,162	43.6	(42.1,45.2)
2006	5,157	1,582	71.1	(69.7,72.4)			
2007	5,121	1,492	72.7	(71.4,74.0)			
2008	4,946	1,493	71.6	(70.2,72.9)			
2009	5,162	1,477	73.3	(72.0,74.5)			

95% CI is 95% confidence interval for calculated rate.

Source: UK Cancer Information Service

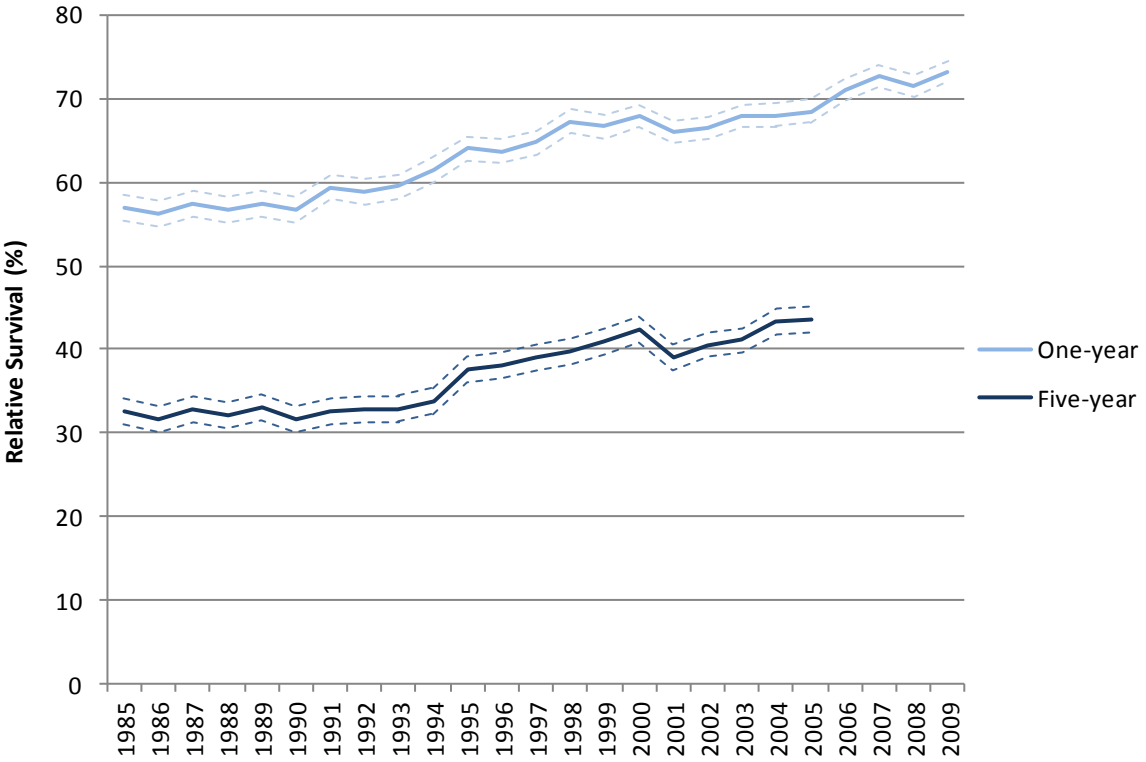


Figure 17 Trends in one- and five- year relative survival, England, 1985 to 2009/2005

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

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

For women diagnosed in the 20-year period from 1987-1989 to 2007-2009, one-year relative survival improved nationally and across all 28 CNs, particularly in 26 of the CNs.

Table 12 Trend in one-year survival by Cancer Network, 1987-1989 to 2007-2009

Cancer Network	1987-89	1997-99	2007-09	Change	
England	57.1	66.2	72.5	15.4	*
3 Counties	54.8	66.0	73.0	18.2	*
Anglia	52.3	64.3	71.0	18.8	*
Arden	55.0	66.3	68.3	13.4	*
Avon, Somerset and Wiltshire	49.8	68.8	74.3	24.5	*
Central South Coast	52.4	70.3	69.0	16.7	*
Dorset	57.6	68.3	74.9	17.3	*
East Midlands	56.7	64.2	72.1	15.4	*
Essex	63.7	66.1	74.3	10.6	*
Greater Manchester and Cheshire	56.4	65.8	71.5	15.1	*
Greater Midlands	57.9	62.3	71.5	13.7	*
Humber and Yorkshire Coast	56.7	68.8	76.0	19.4	*
Kent and Medway	57.5	66.3	69.2	11.7	*
Lancashire and South Cumbria	49.1	58.2	70.3	21.2	*
Merseyside and Cheshire	53.8	62.4	68.2	14.3	*
Mount Vernon	59.2	66.4	73.1	13.8	*
North East London	62.4	73.0	73.0	10.7	*
North London	67.4	70.5	73.4	5.9	
North of England	60.2	68.0	73.4	13.2	*
North Trent	55.2	63.1	73.1	17.9	*
North West London	62.4	71.0	77.0	14.6	*
Pan Birmingham	57.7	71.1	78.2	20.5	*
Peninsula CN	54.7	62.9	72.8	18.1	*
South East London	61.9	65.2	74.1	12.2	*
South West London	63.2	69.2	79.3	16.0	*
Surrey, West Sussex and Hampshire	51.8	64.2	75.5	23.7	*
Sussex	54.9	63.2	56.6	1.7	
Thames Valley	60.8	67.8	73.0	12.2	*
Yorkshire	58.7	67.5	77.8	19.1	*

'Change' is absolute change between 1987-1989 and 2007-2009.

* represents statistically significant difference over this time period

Source: UK Cancer Information Service

One-year relative survival by Cancer Network, 2007-2009

For patients diagnosed in 2007-2009, there is evidence that one-year relative survival is higher than the national average in South West London, Pan Birmingham, Yorkshire, and North West London CNs, but lower in Merseyside & Cheshire and much lower than the national average in Sussex CN.

The relative survival results presented here are not age-standardised; therefore, any differences across the CNs in the age of women diagnosed with ovarian cancer are not adjusted for. The markedly low survival rate for patients diagnosed in Sussex CN may reflect a population diagnosed with ovarian cancer that is older than other CNs. However, when age-standardised survival is calculated (results not presented), the rate for Sussex improves slightly, but remains much lower than the national average.

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, differences in 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.

The quality of the data is also dependent on the quality of data capture systems within multidisciplinary teams, cancer networks and cancer registries. At present, stage data for ovarian cancer are variably recorded by registries across England meaning that analysis by stage of disease cannot be carried out nationally. Registries have increased efforts to record stage for ovarian cancers over recent years and it is hoped that analysis based on stage of disease will be possible in the near future.

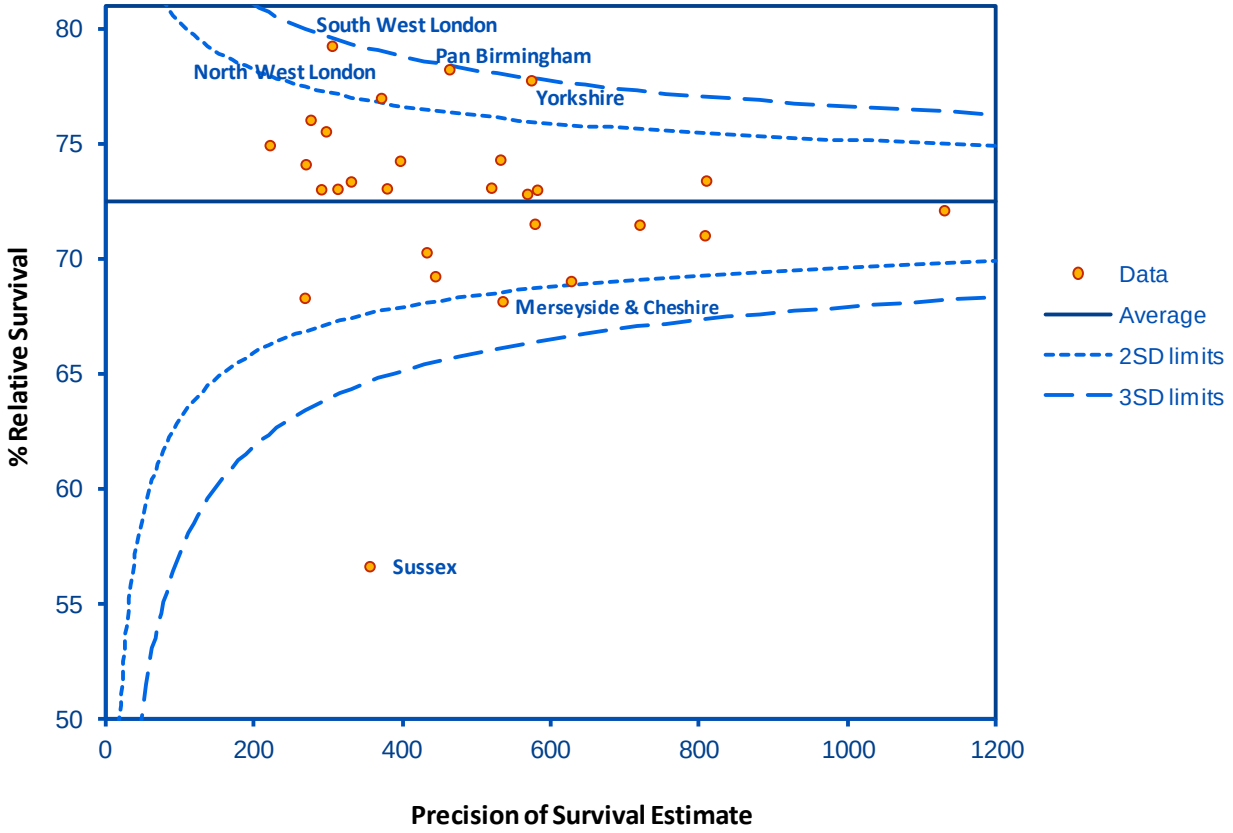


Figure 18 Funnel plot of one-year relative survival by Cancer Network, 2007-2009

Source: UK Cancer Information Service

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

For women diagnosed with ovarian cancer in the 15-year period from 1988-1990 to 2003-2005, five-year relative survival improved nationally and for the majority of CNs with survival particularly increasing in 15 CNs.

Table 13 Trend in five-year survival by Cancer Network, 1988-1990 to 2003-2005

Cancer Network	1988-90	2003-05	Change	
England	32.2	42.6	10.5	*
3 Counties	25.4	42.1	16.7	*
Anglia	30.0	40.3	10.3	*
Arden	29.8	41.6	11.7	
Avon, Somerset and Wiltshire	27.2	46.1	18.8	*
Central South Coast	30.6	44.0	13.4	*
Dorset	29.6	40.4	10.8	
East Midlands	30.7	43.4	12.7	*
Essex	29.3	40.7	11.4	*
Greater Manchester and Cheshire	27.3	43.4	16.1	*
Greater Midlands	33.9	44.5	10.6	*
Humber and Yorkshire Coast	30.1	40.9	10.8	
Kent and Medway	33.1	35.0	1.9	
Lancashire and South Cumbria	32.4	40.1	7.7	
Merseyside and Cheshire	30.5	37.1	6.6	
Mount Vernon	27.2	43.1	15.9	*
North East London	37.9	40.4	2.6	
North London	41.6	42.9	1.3	
North of England	34.8	46.3	11.5	*
North Trent	30.3	43.2	12.9	*
North West London	42.5	40.4	-2.1	
Pan Birmingham	37.6	48.8	11.2	*
Peninsula	25.5	43.0	17.6	*
South East London	40.1	46.5	6.3	
South West London	36.2	41.9	5.7	
Surrey, West Sussex & Hampshire	28.5	36.9	8.4	
Sussex	30.8	35.8	5.0	
Thames Valley	35.1	44.2	9.1	*
Yorkshire	33.6	45.7	12.1	*

'Change' is absolute change between 1988-1990 and 2003-2005

* represents 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 Pan Birmingham and North of England CNs, and lower in the Sussex, Merseyside & Cheshire and Kent & Medway 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.

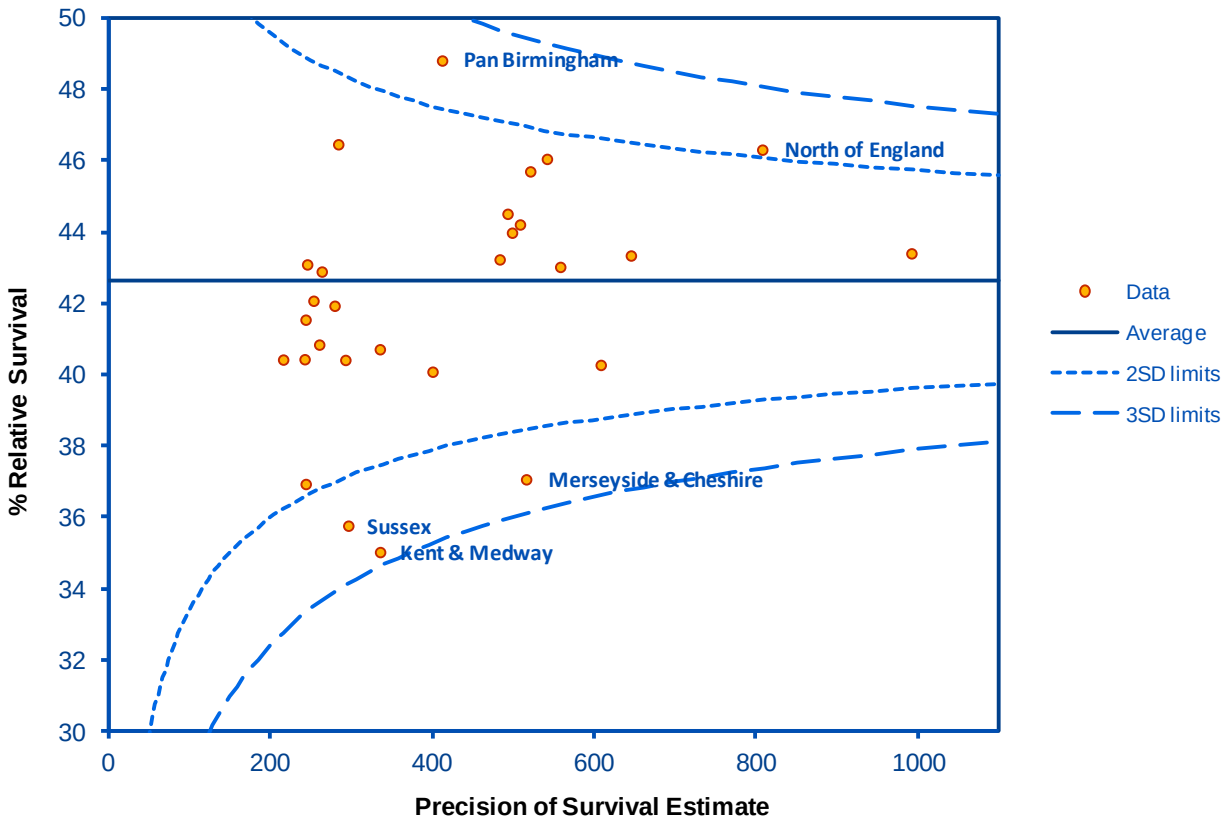


Figure 19 Funnel plot of five-year relative survival by Cancer Network, 2003-2005

Source: UK Cancer Information Service

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

There is strong evidence that ovarian cancer survival is worse in older women. For example, one-year survival in those aged 15-39 was 95.6% compared with 24.0% for those aged 85+. Similarly, five-year survival for those aged 15-39 was 84.2% compared with 13.7% for those aged 85+.

Differences in relative survival reflect differences in disease biology between age groups, including a higher proportion of borderline tumours in young women. As with many cancers, differences may, in part, also be due to difficulties in treating the disease in older women, relating to co-morbidities. However, there is also evidence that GPs may be less likely to recognise and refer older women presenting with ovarian cancer, which may contribute to the lower survival rates in older women[8].

Table 14 Age-specific relative survival, England, 2007-2009 (one-year) and 2003-2005 (five-year)

	One-Year Survival				Five-Year Survival			
Age Group	**Cases**	**Deaths**	**%**	**95% CI**	**Cases**	**Deaths**	**%**	**95% CI**
All ages	15,229	4462	72.5	(71.7,73.3)	15,369	9,653	42.6	(41.8,43.5)
15-39	1,250	56	95.6	(94.4,96.7)	1,080	173	84.2	(82.0,86.5)
40-44	704	55	92.3	(90.3,94.3)	610	159	74.5	(70.9,78.1)
45-49	963	88	91.0	(89.2,92.9)	884	347	61.5	(58.2,64.8)
50-54	1,166	159	86.6	(84.6,88.6)	1,238	590	53.3	(50.4,56.2)
55-59	1,533	222	85.9	(84.1,87.7)	1,799	977	47.0	(44.6,49.4)
60-64	1,947	382	81.0	(79.1,82.8)	1,849	1,158	39.1	(36.7,41.4)
65-69	1,799	467	74.9	(72.8,77.0)	1,863	1,269	34.4	(32.0,36.7)
70-74	1,791	599	67.9	(65.7,70.2)	1,843	1,378	28.8	(26.5,31.1)
75-79	1,534	696	56.6	(54.0,59.3)	1,746	1,407	24.5	(22.1,26.9)
80-84	1,276	773	42.0	(39.1,44.9)	1,384	1,216	18.3	(15.7,21.0)
85+	1,220	965	24.0	(21.4,26.7)	1,037	978	13.7	(10.2,17.1)

95% CI is 95% confidence interval for calculated rate

Source: UK Cancer Information Service

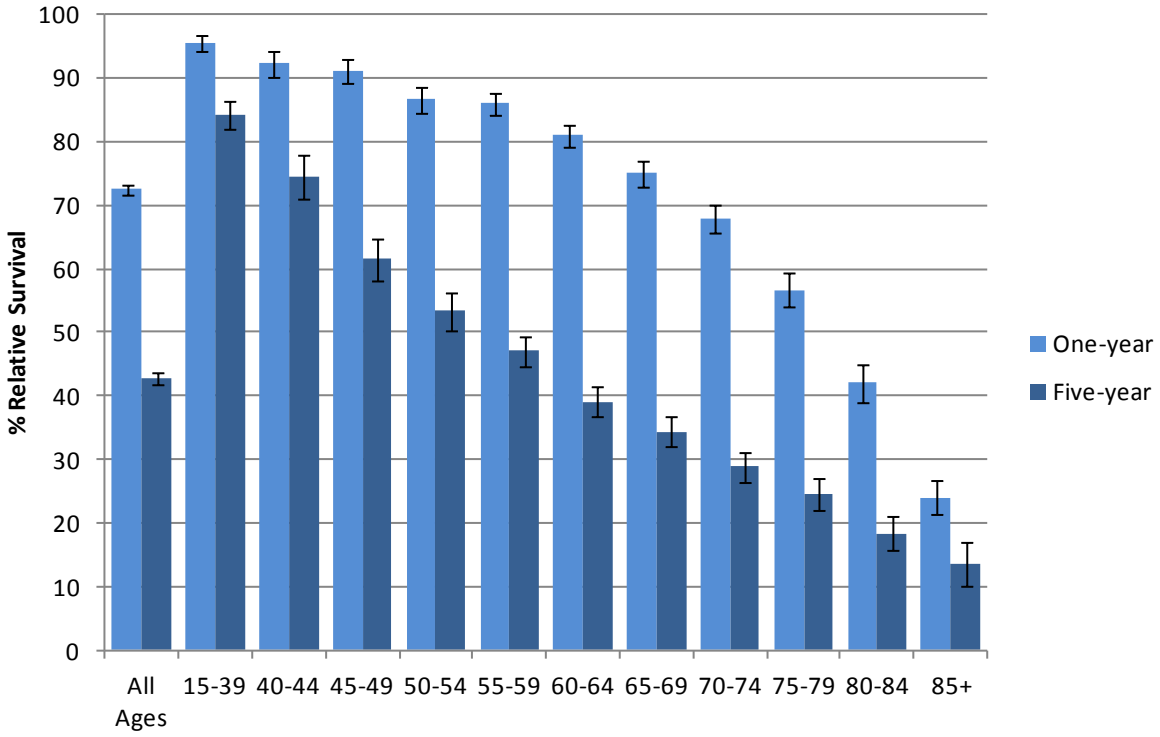


Figure 20 Age-specific relative survival, England, 2007-2009 (one- year) and 2003-2005 (five- year)

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

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

Over the 20 years since 1987-1989, there is evidence that one-year relative survival improved across all age groups, with the exception of women aged 85+. The greatest improvements in survival are in women aged 55-79.

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

Age	1987-1989	1997-1999	2007-2009	Change	
All Females	57.1	66.2	72.5	15.4	*
15-39	87.2	93.5	95.6	8.4	*
40-44	83.6	87.7	92.3	8.7	*
45-49	76.5	84.5	91.0	14.6	*
50-54	74.0	81.7	86.6	12.7	*
55-59	67.0	78.5	85.9	18.9	*
60-64	58.3	71.2	81.0	22.7	*
65-69	53.2	65.9	74.9	21.8	*
70-74	42.2	55.1	67.9	25.7	*
75-79	36.6	45.4	56.6	20.0	*
80-84	31.2	37.0	42.0	10.8	*
85+	23.0	28.8	24.0	1.0	

'Change' is absolute change between 1987-1989 and 2007-2009

* represents statistically significant difference over this time period

Source: UK Cancer Information Service

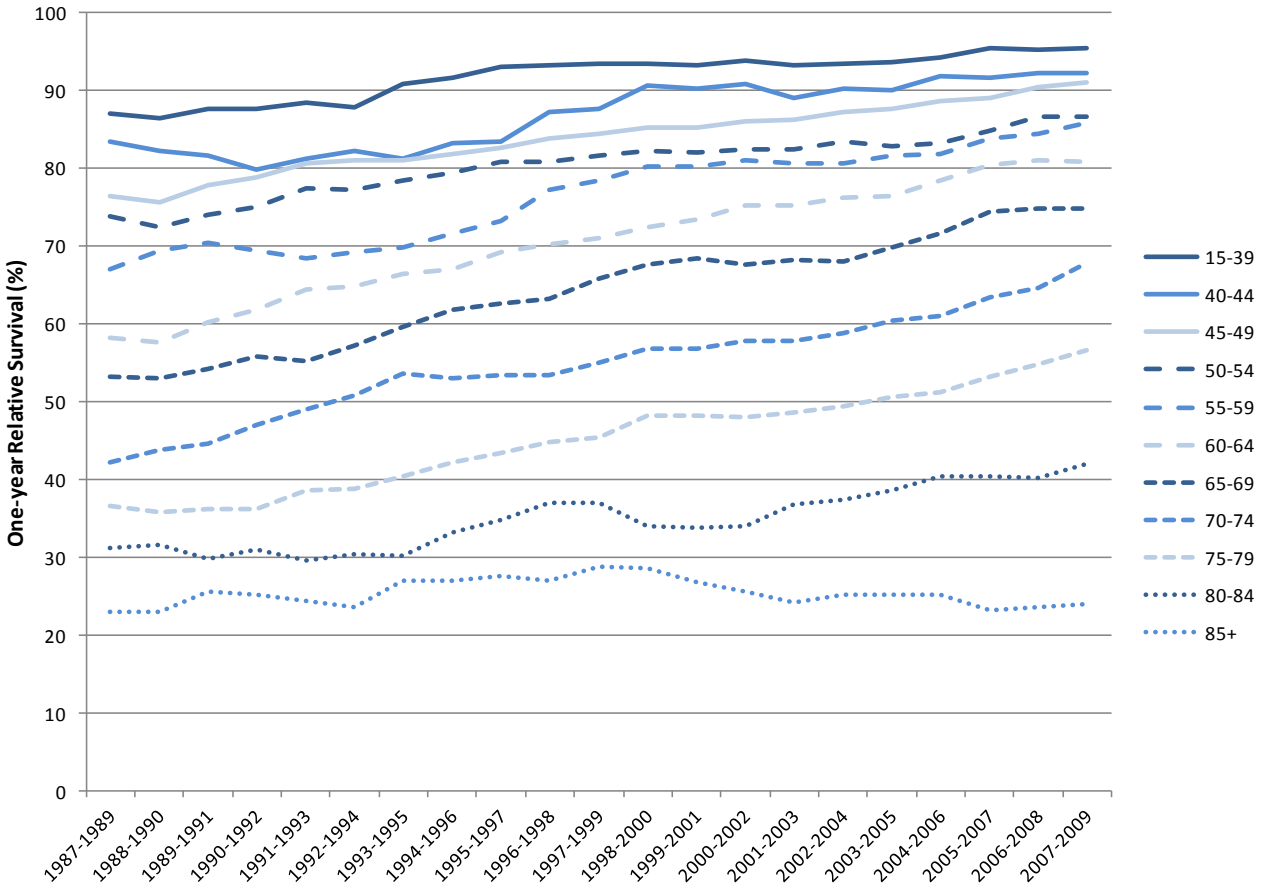


Figure 21 Trends in age-specific one-year relative survival, England, 1987-1989 to 2007-2009

Source: UK Cancer Information Service

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

Over the 15 years since 1988-1990, there is evidence that five-year relative survival improved in women of all ages, apart from those aged 80 and over. The greatest improvements are for women aged 40-49.

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

	1988-1990	2003-2005	Change	
All Females	32.2	42.6	10.5	*
15-39	72.2	84.2	12.0	*
40-44	51.6	74.5	22.9	*
45-49	41.8	61.5	19.7	*
50-54	39.9	53.3	13.5	*
55-59	33.7	47.0	13.3	*
60-64	28.5	39.1	10.6	*
65-69	24.3	34.4	10.0	*
70-74	19.7	28.8	9.1	*
75-79	17.2	24.5	7.3	*
80-84	17.3	18.3	1.0	
85+	13.8	13.7	-0.2	

'Change' is absolute change between 1988-1990 and 2003-2005.

* represents statistically significant difference over this time period

Source: UK Cancer Information Service

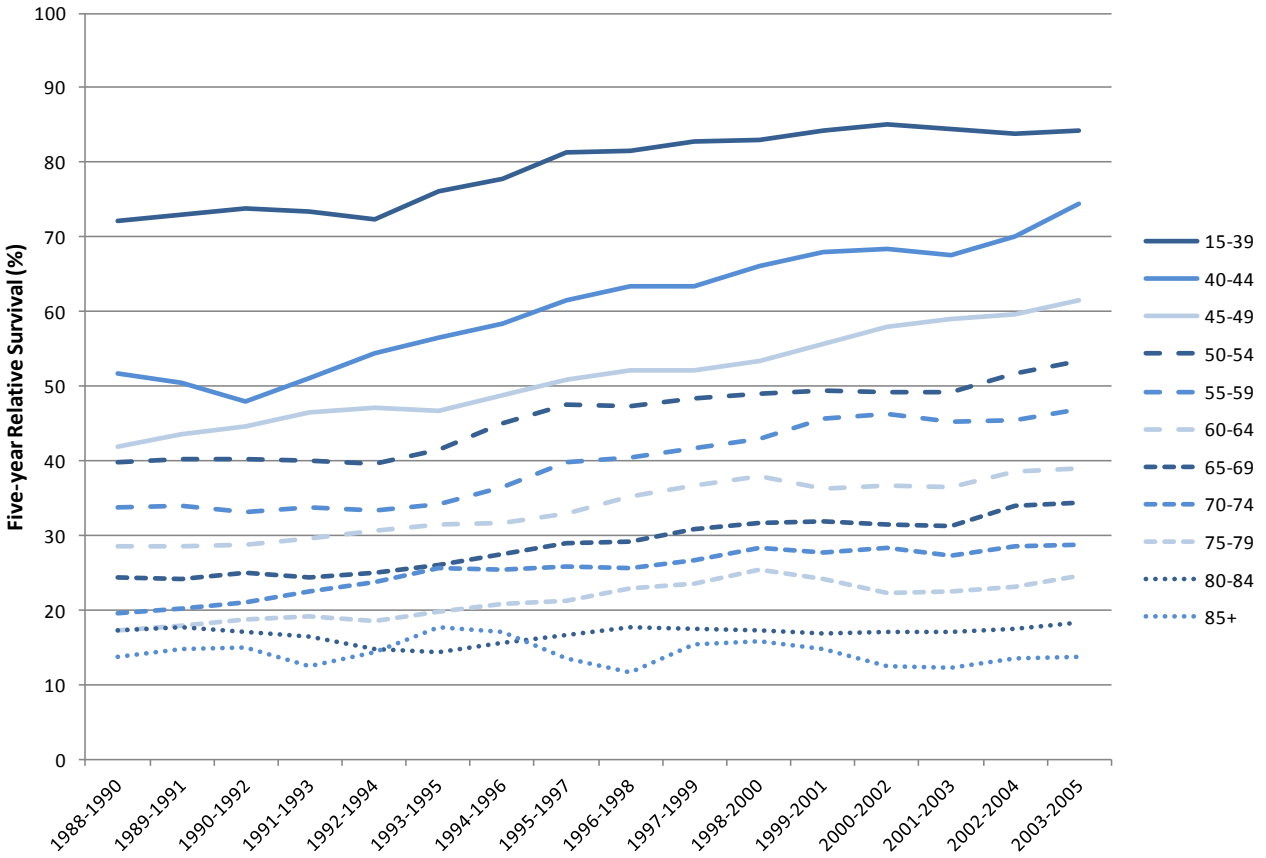


Figure 22 Trends in age-specific five-year relative survival, England, 1988-1990 to 2003-2005

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 for women living in the most affluent fifth of areas compared to women living in all other deprivation groups. There is a 4% gap in survival between the most affluent and most deprived areas. This may reflect earlier presentation and diagnosis of women with ovarian cancer in the more affluent areas. There is no evidence that five-year relative survival rates are different across the deprivation groups.

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

	One-year relative survival				Five-year relative survival			
Deprivation group	**Cases**	**Deaths**	**%**	**95% CI**	**Cases**	**Deaths**	**%**	**95% CI**
All Females	15,229	4,462	72.5	(71.7, 73.3)	15,369	9,653	42.6	(41.8, 43.5)
1 - Most Affluent	2,993	781	75.7	(74.0, 77.3)	3,043	1,878	43.6	(41.6, 45.6)
2	3,324	982	72.3	(70.7, 73.9)	3,349	2,106	42.5	(40.6, 44.4)
3	3,349	997	72.2	(70.5, 73.8)	3,344	2,160	40.9	(39.0, 42.8)
4	3,023	939	70.8	(69.0, 72.5)	3,087	1,942	42.9	(40.9, 45.0)
5 - Most Deprived	2,540	763	71.5	(69.7, 73.4)	2,546	1,567	43.5	(41.3, 45.7)

95% CI is 95% confidence interval for calculated rate

Source: UK Cancer Information Service

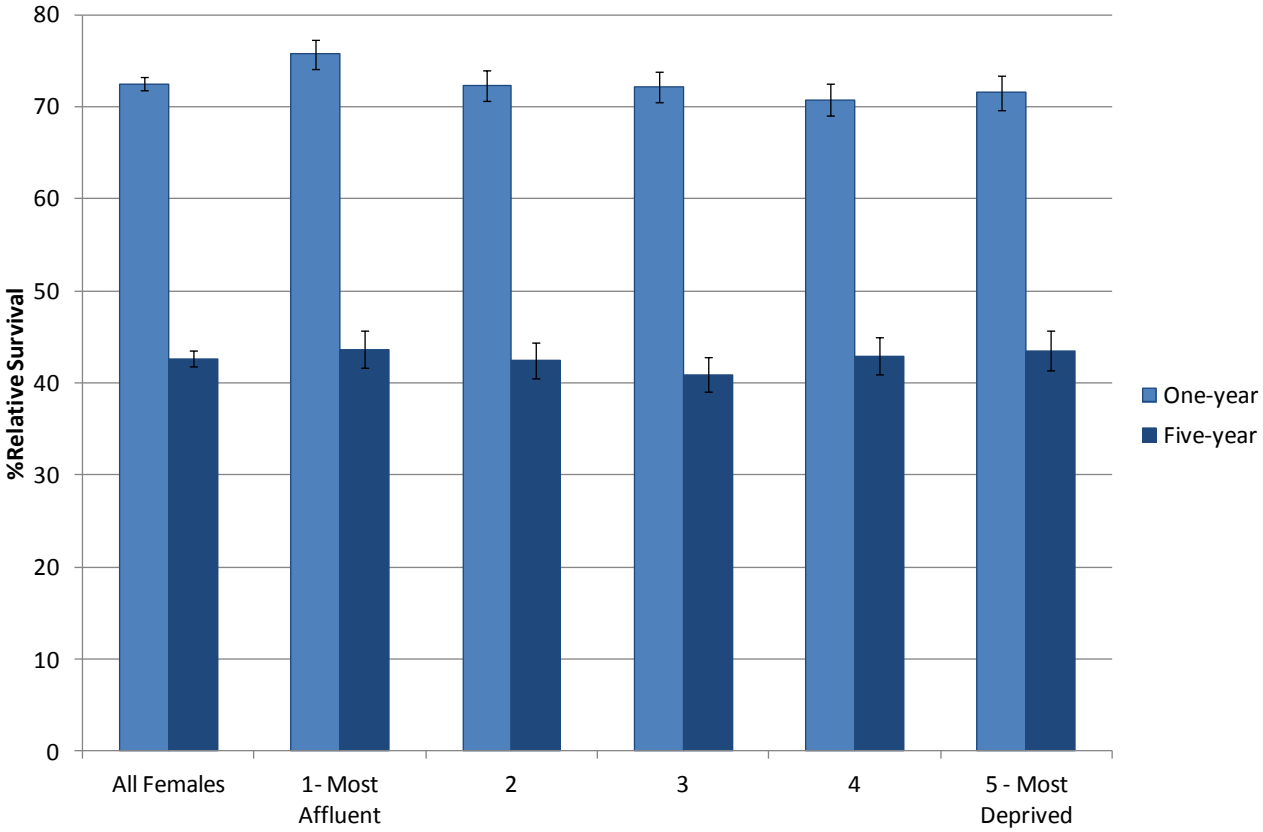


Figure 23 Relative survival by deprivation, England, 2007-2009 (one-year) and 2003-2005 (five-year)

Error bars are 95% confidence intervals for survival estimates

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). This data set holds merged data from the eight cancer registries in England.

Definition of ovarian cancer

The results presented in this report are based on invasive ovarian cancer, defined using the International Classification of Diseases version 10 (ICD10) codes. Incidence, mortality and survival data taken from the UK Cancer Information Service (UKCIS) is based on ICD10 codes C56-C57.4. C56 is "malignant neoplasm of ovary"; C57.0 to C57.4 includes malignant neoplasms of the fallopian tube, broad ligament, round ligament, parametrium and uterine adnexa, unspecified.

The definition of ovarian cancer in the morphology section is also based on these ICD 10 codes. However, ovarian cancer has been further defined by the behaviour of the tumour, by including only those cases with a behaviour code of malignant or malignant, uncertain whether primary or metastatic site. 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.

The definition of ovarian cancer used in the incidence and survival section of this report is based on the second edition of the *International Classification of Diseases for Oncology* (ICD-O-2) promulgated by the World Health Organisation (WHO) [9]. This definition includes all malignant ovarian neoplasms. Historically, there has been variation across English cancer registries in the recording of borderline cases as either tumours of uncertain behaviour or malignant ovarian tumours [10]. In the latest version of the oncology classification, ICD-O-3, ovarian cystadenoma of borderline malignancy has been re-coded as a tumour of uncertain behaviour. However, there are differences between registries in how and when ICD-O-3 coding was implemented. Therefore, all data have been back-converted to ICD-O-2 so that ovarian cystadenoma of borderline malignancy are included in the definition of malignant ovarian cancer.

The incidence rates presented in this report may be higher than rates presented in other sources where no back conversion to ICD-O-2 has been carried out. Other sources may also have converted all ovarian cancers to ICD-O-3, thus removing all borderline cases.

The International Cancer Benchmarking Partnership (ICBP) has produced analysis of ovarian cancer survival using the ICD-O-3 version[6]. Due to this difference in the ICD-O version used, the survival estimates in the ICBP report appear lower than the survival estimates presented in this profile report. Patients with a borderline malignancy of the ovary usually have better outcomes than patients with a malignant tumour type; therefore, removing borderline malignancies from the cohort of patients results in lower survival rates.

Morphology groups

The cancer morphology data are 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 tumours with behaviour code of malignant or malignant, uncertain whether primary or metastatic site, have been included. The coding is based on (ICD-O-2) [9]. The groupings for morphology codes presented in this report were derived by Lynn Hirschowitz (Consultant Pathologist, Birmingham Women's NHS Trust), Carolynn Gildea and Jason Poole (Trent Cancer Registry). The morphology groups include the morphology codes as follows:

Table A1 Morphology groupings used in the report

Morphology Group in Report	Morpholgy Code	Description
Serous Carcioma	8441	Serous cystadenocarcinoma, NOS
	8460	Papillary serous cystadenocarcinoma
	8461	Serous surface papillary carcinoma
Mucinous	8470	Mucinous cystadenocarcinoma, NOS
	8471	Papillary mucinous cystadenocarcinoma
	8480	Mucinous adenocarcinoma
	8481	Mucin-producing adenocarcinoma
	8482	Mucinous adenocarcinoma, endocervical type
	8490	Signet ring cell carcinoma
Endometrioid	8380	Endometrioid adenocarcinoma, NOS
	8382	Endometrioid adenocarcinoma, secretory variant
	8383	Endometrioid adenocarcinoma, ciliated cell variant
	8560	Adenosquamous carcinoma
	8570	Adenocarcinoma with squamous metaplasia
Clear Cell	8310	Clear cell adenocarcinoma, NOS
	9110	Mesonephroma, malignant
Other classified epithelial-stromal tumours	8020 & 8021	Undifferentiated carcinoma
	8050-8084	Squamous Carcinoma
	8120-8131, 9000	Transitional or Brenner carcinoma
	8313, 8323, 8381, 8930-8991, 9010-9030	Mixed epithelial & stromal carcinoma
Unclassified Epithelial	8010-8015, 8022-8046, 8090-8110, 8140-8231, 8246-8300, 8311-8312, 8314-8322, 8324-8325, 8336-8337, 8341-8375, 8384-8440, 8443, 8450, 8452-8454, 8500-8551, 8561-8562, 8571-8589	Various unclassified epithelial
Borderline	8442	Serous cystadenoma, borderline malignancy
	8444	Clear cell cystic tumour of borderline malignancy
	8451	Papillary cystadenoma, borderline malignancy
	8462	Serous papillary cystic tumour of borderline malignancy
	8463	Serous surface papillary tumour of borderline malignancy
	8472	Mucinous cystic tumour of borderline malignancy
	8473	Papillary mucinous cystadenoma, borderline malignancy
Sex cord–stromal or germ cell tumours	8240-8245, 8330-8335, 8340, 9060-9105, 9380-9523	Germ cell
	8590-8671, 8810	Sex cord-stromal
Miscellanous and unspecified	8000-8005, 8680-8806, 8811-8921, 9040-9055, 9120-9373, 9530-9989	Various miscellanous and unspecified tumour types

Age standardisation

Ovarian 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 Table A1.

Table A2 European standard population weights

Age group	Population	Age group	Population	Age group	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 [11]; 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 [12] 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 both/either ± 2 standard deviations (SDs), equivalent to 95% confidence intervals, and/or ± 3 SDs, equivalent to 99.8% confidence intervals. Those areas that fall outside of these control limits are deemed to be statistically significantly different from the group average. More information on funnel plot methodology can be found in the APHO technical briefing no.2 [13]

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.

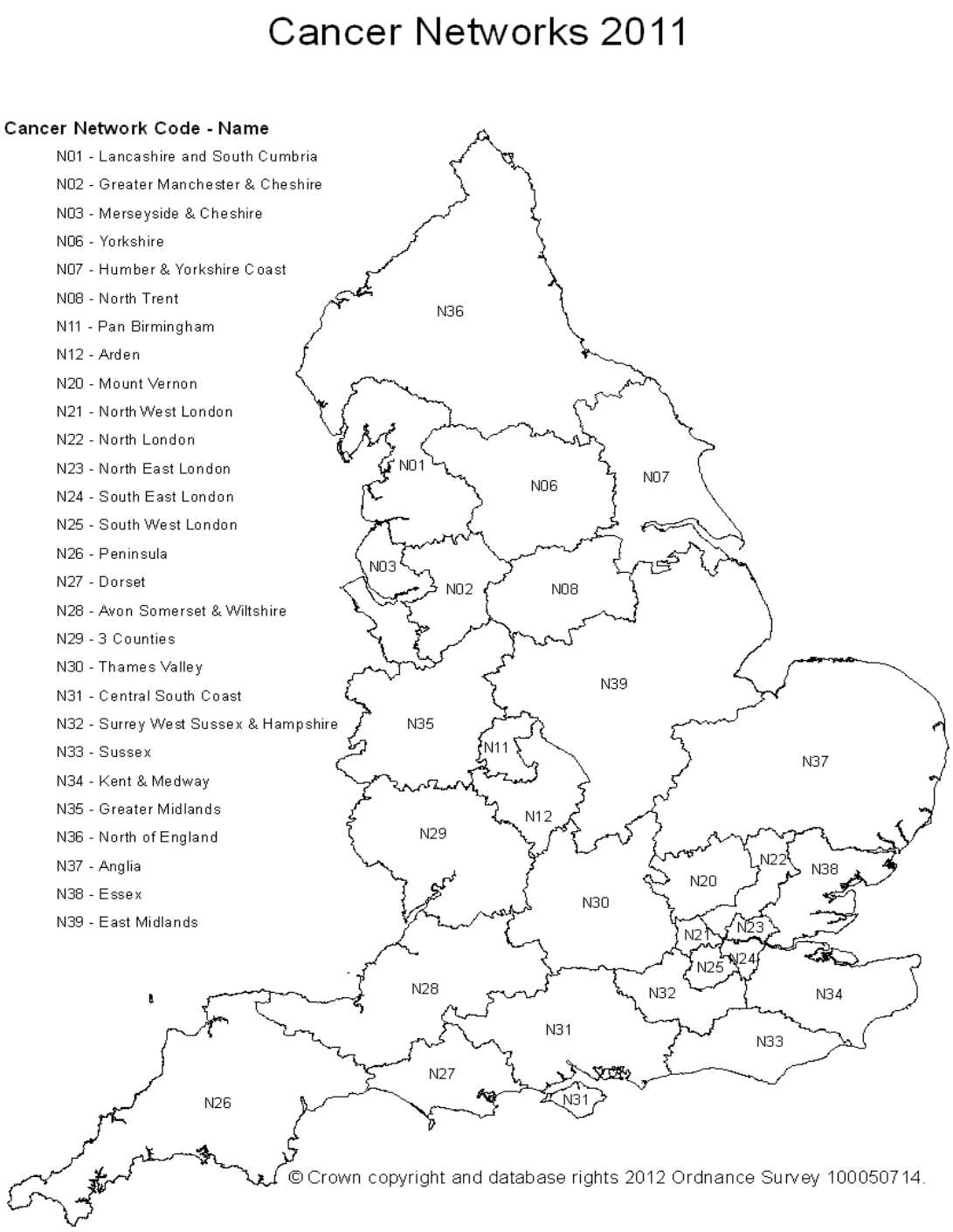
Deprivation was analysed at the smallest population level available, Lower SOA, with an average population of 1500 in England. National LSOAs were split into five equally sized quintile groups according to ranked Income Domain scores. At PCT level the score of the Income Domain was used as published by the Association of Public Health Observatories [14]. 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. So, 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.

Appendix 2: Guide to Cancer Networks & Strategic Health Authorities



SHA Boundaries 2009

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