UK cancer incidence by deprivation, 2019-2022

September 2026

Together we are beating cancer

CANCER RESEARCH UK

Contents

About this document

Reference

This report should be referred to as follows:

Cancer Research UK, 2026. UK Cancer Incidence by Deprivation, 2019-2022. Published September 2026.

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Acknowledgements

We are grateful to the many organisations across the UK which collect, analyse, and share the data which we use, and to the patients and public who consent for their data to be used. Find out more about the sources which are essential for our statistics here https://www.cancerresearchuk.org/health-professional/cancer-statistics/cancer-stats-explained/data-collection-implications.

About Cancer Research UK

We're the world's leading cancer charity dedicated to saving and improving lives through research. We fund research into the prevention, detection and treatment of more than 200 types of cancer through the work of over 4,000 scientists, doctors and nurses. In the last 50 years, we've helped double cancer survival in the UK and our research has played a role in more than half of the world's essential cancer drugs. Our vision is a world where everybody lives longer, better lives, free from the fear of cancer.

Abstract

Background
Health inequalities are unfair, avoidable and systemic differences in health between different groups of people. Inequalities by socioeconomic deprivation exist across the cancer pathway. Understanding and quantifying variation in cancer incidence by deprivation can inform public health initiatives aimed at reducing this inequality.

Methods
This analysis used national cancer incidence and population data for 2019-2022, to quantify the deprivation gap in cancer incidence in the UK. Analysis was completed separately for each UK nation, gender, and cancer site, to improve accuracy of the results.

Linear regression was used to identify combinations of nation, gender, and cancer site where the age-specific crude incidence rate was significantly associated with deprivation quintile ($p<0.05$). For those combinations, the age-specific incidence rates of the least-deprived quintile were applied to the population of all quintiles, to obtain the number of cases expected if all quintiles had the same rates as the least-deprived. The difference between this expected number, and the number of cases observed, is the number of cases linked with deprivation.

Results
In all UK nations, the age-standardised incidence rate for all cancers combined, and for most individual cancer sites, is statistically significantly associated with deprivation quintile. For example, in people in England, the incidence rate for all cancers combined is 17% higher in the most-deprived quintile of the population (694 cases per 100,000 people) versus the least (592 cases per 100,000 people).

Around 33,800 cancer cases each year in the UK are linked with deprivation. This equates to around 95 cases each day – almost 1 in 10 cancer cases.

Over half (54%) of these deprivation-associated cases are lung cancer. Almost 4 in 10 (37%) lung cancer cases are associated with deprivation. Other cancer sites with a high proportion of cases associated with deprivation are cervix (25% of all cases are associated with deprivation), liver (23%), cancer of unknown primary (22%), and head and neck cancers (21%).

Discussion

There is a clear and strong association between cancer incidence and deprivation. Tens of thousands of UK cancer cases each year could in theory be avoided if the whole population of each nation had the same incidence rates as the least-deprived group.

Much of this inequality is likely to be due to smoking. Smoking rates have long been higher in more deprived areas. Rates of overweight and obesity - another key risk factor for cancer – also vary by deprivation. Public health initiatives addressing inequality in cancer risk factors are vital for reducing the cancer incidence deprivation gap.

Introduction

Cancer is the UK's biggest killer [1]. It is estimated that almost 4 in 10 UK cancer deaths within 5 years of diagnosis are avoidable, mainly through preventing cancer developing in the first place [2].

More than 3 in 20 cancer deaths in the UK – around 28,400 each year - are linked to deprivation, analysis of 2017-2021 data suggests. This deprivation gap in mortality is the culmination of inequalities across the cancer pathway [3].

Cancer survival is lower in more deprived groups, largely because these groups are more likely to be diagnosed at a later stage, and less likely to receive the most effective treatments. These inequalities in cancer care compound the effect of higher cancer incidence rates in more deprived groups [4].

Higher cancer incidence rates in more deprived groups are mainly due to differences in risk factor prevalence. Many key cancer risk factors – including smoking, and overweight and obesity – are preventable.

Up-to-date evidence on inequalities in cancer incidence is important to galvanise and inform action on prevention, screening, and provision of cancer care. This analysis provides a UK-wide picture of cancer incidence by socioeconomic deprivation.

Aims and objectives

1. To assess the relationship between cancer incidence and deprivation within each UK nation.
2. To estimate the total number of cancer cases associated with deprivation, based on differences in age-specific crude incidence rates.

Methods

Data sources

For England, Scotland, and Northern Ireland, cancer case counts for 2019, 2021 and 2022 (excluding 2020 due to COVID impacts) were obtained on request from cancer registries. These were split by cancer site, deprivation quintile (English Indices of Deprivation [5], Northern Ireland Multiple Deprivation Measure [6], or Scottish Index of Multiple Deprivation [7], as appropriate), gender, and five-year age band. For Wales, cancer age-standardised rates for 2020-2022 were downloaded from the Public Health Wales website [8]. These were split by cancer site, deprivation quintile (Welsh Index of Multiple Deprivation [9]), and gender; five-year age bands were not available at this level of granularity.

Population counts by deprivation quintile, gender, and five-year age band were downloaded from the websites of the Office for National Statistics (England) [10], Northern Ireland Statistics and Research Agency [11], and National Records of Scotland [12]. Population data for Wales was obtained from the cancer data download described above. Where population data were provided by decile, these were aggregated into quintiles. For England and Scotland, population data for 2019, 2021 and 2022 were used. For Northern Ireland, only population data from 2021 was available at the level of granularity required, so was used as proxy for all three years in the analysis.

Deprivation indices comprise multiple metrics of deprivation including income, employment, education, health, housing, and crime. Each UK nation has its own deprivation index and these indices are not directly comparable either in composition (the metrics included, their operationalisation, or their geographical granularity) or values (e.g. the most deprived quintile in one nation may have similar values to the middle quintile in a different nation, on some or all metrics). To calculate UK figures for deprivation-associated cases, the 'matching' deprivation quintile from each nation was summed, e.g. the most deprived quintile in each nation. However, because of the diversity of deprivation metrics, no UK-level rates were calculated.

Calculation of age-specific incidence rates

For England, Scotland, and Northern Ireland, annual average age-specific crude incidence rates were calculated from the cancer data and population data for each combination of gender (females, males, persons), five-year age band, cancer site, and deprivation quintile.

Calculation of deprivation-associated cases

For England, Scotland, and Northern Ireland, deprivation-associated cases were calculated as the difference between the observed number of cases, and the number of expected cases if the entire population had the same age-specific crude incidence rate as the least deprived quintile, separately for each five-year age band, gender and cancer site. For Wales, a deprivation ratio was calculated for each quintile (dividing that quintile's age-standardised incidence rate by the rate in the least deprived quintile), and the observed number of cases in that quintile was divided by this ratio to estimate the expected number of cases; deprivation-associated cases were then calculated as the difference between the observed and expected numbers of cases. In these calculations, population size and structure was assumed to remain the same in the observed and expected scenarios. The total number of cases associated with deprivation for each cancer site in each nation is the sum of the deprivation-associated cases in each age group; for UK totals the national totals were summed.

Only combinations of nation, cancer site, and gender with a statistically significant association between higher deprivation and higher age-specific incidence rates in linear regression, were included in the figure for all cancers combined cases associated with deprivation.

Calculation of age-standardised incidence rates

Relative differences in age-standardised incidence rates between the most and the least deprived quintiles were calculated for all nations, by cancer site and gender. For England, Scotland, and Northern Ireland, cases and population data in five-year age bands were used to calculate European age-standardised rates and confidence intervals using standard methods. For Wales, age-standardised incidence rates with confidence intervals were in the data download.

Linear regression modelling

For England, Scotland, and Northern Ireland, linear regression was used to assess the association between deprivation quintile and age-specific crude incidence rate. Separate models were fitted for each combination of country, cancer site and gender, with age-specific crude incidence rate modelled against deprivation quintile while accounting for differences between age groups. Associations were considered statistically significant where $p<0.05$. For Wales, linear regression analysis was not conducted as age-specific incidence rates were not available.

Results

It is estimated that around 33,800 cancer cases each year in the UK – almost 1 in 10 of all cancer cases - are associated with deprivation (**Table 1**).

For most cancer sites, higher deprivation is associated with higher incidence. Lung cancer contributes around half (54%) of all UK deprivation-associated cancer cases (**Table 2**). The next-biggest contributors to the total are head and neck cancer (9% of the total), cancer of unknown primary (5%), and liver cancer (5%).

Deprivation-associated cases contribute the largest proportion of lung cancer cases, where 37% of all cases are associated with deprivation. This is followed by cervical cancer (25% of all cases are deprivation-associated), liver cancer (23%), and cancer of unknown primary (22%).

For a small number of cancer sites, lower deprivation is associated with higher incidence. These include melanoma skin cancer (around 5,500 cases associated with lower deprivation), prostate cancer (around 4,800 cases), and breast cancer (around 4,400 cases).

Bone was the only cancer site with no significant association between incidence and deprivation, for any UK nation.

Further cancer incidence by deprivation data is available on Cancer Research UK's Cancer Data Hub

GENDER	NATION	AGE-STANDARDISED INCIDENCE RATES PER 100,000 POPULATION			DEPRIVATION-ASSOCIATED CASES	
		MOST-DEPRIVED QUINTILE	LEAST-DEPRIVED QUINTILE	% DIFFERENCE	NUMBER	PERCENTAGE OF TOTAL FOR ALL CANCERS COMBINED
MALES	UK	a	a	a	18,200	9%
	ENGLAND	782	660	18%	14,900	9%
	WALES	733	613	19%	790	8%
	SCOTLAND	802	632	27%	2,200	12%
	NORTHERN IRELAND	749	655	14%	350	6%
FEMALES	UK	a	a	a	15,600	8%
	ENGLAND	629	537	17%	12,600	8%
	WALES	622	505	23%	760	8%
	SCOTLAND	704	537	31%	1,900	11%
	NORTHERN IRELAND	622	531	17%	290	6%
PERSONS	UK	a	a	a	33,800	8%
	ENGLAND	694	592	17%	27,500	8%
	WALES	677	559	21%	1,500	8%
	SCOTLAND	742	578	28%	4,100	12%
	NORTHERN IRELAND	678	584	16%	640	6%

a : UK rates cannot be calculated as each nation has its own metric for deprivation and these cannot be combined

Table 1. Age-standardised incidence rates for the most- and least-deprived quintiles, and number and proportion of cancer cases associated with deprivation (cancer sites where incidence is positively associated with deprivation, see Table 2 for details). Data are for 2019+2021+2022 in England, Scotland and Northern Ireland, 2020-2022 in Wales.

CANCER SITE	NUMBER OF DEPRIVATION-ASSOCIATED CASES	% OF ALL CASES AT THIS SITE WHICH ARE DEPRIVATION-ASSOCIATED	% OF TOTAL DEPRIVATION-ASSOCIATED CASES AT THIS SITE
LUNG	18,300	37%	54%
HEAD AND NECK	2,900	21%	9%
CANCER OF UNKNOWN PRIMARY	1,700	22%	5%
LIVER	1,600	23%	5%
OESOPHAGUS	1,500	15%	4%
STOMACH	1,300	20%	4%
KIDNEY	1,200	8%	4%
BLADDER	1,000	9%	3%
CERVIX	820	25%	2%
PANCREAS	780	7%	2%
UTERUS	730	7%	2%
BOWEL	570	1%	2%
ANUS	290	16%	1%
GALLBLADDER	250	19%	1%
VULVA	250	17%	1%
BRAIN, OTHER CNS AND INTRACRANIAL	180	2%	1%
PENIS[b]	120	15%	<1%
HODGKIN LYMPHOMA	100	5%	<1%
THYROID	90	2%	<1%
SMALL INTESTINE[b]	70	3%	<1%
NON-HODGKIN LYMPHOMA	55	<1%	<1%
VAGINA	50	16%	<1%
OVARY	45	1%	<1%
LEUKAEMIA	10	<1%	<1%
MESOTHELIOMA	-10	<1%	<1%
MYELOMA	-10	<1%	<1%
EYE[b]	-55	-6%	<1%
TESTIS	-190	-8%	-1%
BREAST	-4,400	-7%	-13%
PROSTATE	-4,800	-8%	-14%
MELANOMA SKIN CANCER	-5,500	-29%	-16%

b: Wales data does not include penis, small intestine, or eye cancers

Table 2. Number of cancer cases associated with deprivation, percentage of cases at each site which are deprivation-associated, and percentage of total deprivation-associated cases at each site, persons, UK. Data are for 2019+2021+2022 in England, Scotland and Northern Ireland, 2020-2022 in Wales.

Discussion

Summary of results

The analysis estimates that around 33,800 cancer cases each year in the UK are associated with deprivation. These cases could in theory be avoided if, within each UK nation, the entire population had the same age-specific cancer incidence rates as the least deprived quintile, and the population size and structure remained the same.

Lung cancer contributes over half of all deprivation-associated UK cancer cases. Head and neck cancers, cancer of unknown primary, liver cancer, and oesophageal cancer are the next-biggest contributors of deprivation-associated cases. Almost 4 in 10 lung cancer cases are associated with deprivation – the biggest proportion among cancer sites, followed by cervical and liver cancers.

For all these cancer sites, smoking is a key risk factor [13]. Previous analysis suggests that around 6 in 10 deprivation-associated cancer cases in England are attributable to smoking [14]. Smoking rates are persistently higher in more deprived areas, with the deprivation gap growing over time [15]. More deprived people who smoke typically start younger, and smoke more heavily [16, 17].

For many cancer sites associated with deprivation, overweight and obesity is also a risk factor [18]. Adult obesity prevalence is higher in more deprived areas, and the deprivation gap has widened over time [19]. 44% of children in the most deprived areas of England leave primary school with overweight or obesity, compared with 26% in the least deprived areas [20].

For cervical and bowel cancers, lower screening coverage in more deprived areas may partly explain the deprivation gap [21, 22]. Both these screening programmes can prevent cancer, by detecting precancerous cell changes which can be treated before they progress to invasive disease.

In the few cancer sites where lower deprivation is associated with higher incidence, possible explanations include lower risk factor exposure or symptom awareness in more deprived areas [23, 24], or differences in population composition by ethnicity (melanoma skin cancer) [25], and lower screening coverage (breast cancer) or use of other testing (prostate cancer) in more deprived areas [26, 27].

Differences between UK nations in the size of the cancer incidence deprivation gap may reflect differences in the magnitude of risk factor inequalities, and in the way deprivation data is captured. In Scotland, deprivation is mapped by data zones which have an average population of under 1,000 people [7], whereas in England, Northern Ireland, and Wales it is mapped by output areas with a population of 1,000-3,000 people [5, 6, 9]. Larger areas contain more deprivation diversity so the quintiles are less distinct from one another, which can obscure some of the

association between deprivation and risk factors, cancer incidence, and cancer outcomes [28].

Strengths and limitations

This analysis uses gold-standard, population-level, nation-specific data, and an established methodology, making the results robust and comprehensive.

Completing the analysis at nation level before aggregating to UK, means the analysis reflects relative inequality within areas which share health and social care systems.

The analysis largely omits cancer incidence data for 2020 - where there was a pronounced impact of COVID on cancer diagnosis - with the intention of providing estimates which are more representative of a 'normal' year. However, this may not reflect real-world differences that have occurred as the result of the pandemic. In places it was necessary to combine cancer data with population data from a slightly different period, and to use data with less granular age band or cancer site breakdowns than would usually be preferable.

The analysis is based on the deprivation quintile of cancer patients at the time of their diagnosis, however this may not reflect patients' level of deprivation (and associated patterns of exposure to cancer risk factors) throughout their lifetime.

The analysis is based on very small geographical areas, scattered across each UK nation. These areas are united not by where they sit on the map, but the characteristics of the people who live there - their income, employment status, education, health, housing, and risk of crime. This approach provides a more accurate picture of the association between deprivation and cancer incidence, but does not translate easily to identifying whole cities, local authorities, or regions where deprivation-associated cancer cases are clustered.

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