CRUK analysis brief

UK Cancer Mortality by Deprivation

February 2025

Together we are beating cancer

CANCER RESEARCH UK

Contents

About this document

Reference

This report should be referred to as follows:

Cancer Research UK, 2025. CRUK analysis brief: UK Cancer Mortality by Deprivation.

Authors

Rosie Hinchliffe, Sam Finnegan, Eszter Jardan, Katrina Brown for the Cancer Intelligence Team at Cancer Research UK.

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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 around 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

Cancer is the UK's biggest killer. It is also associated with socioeconomic deprivation, with higher incidence and mortality rates in more deprived areas for most cancer types. Around 2 in 20 cancer diagnoses in the UK – around 35,700 each year - are linked to deprivation, analysis of 2013-17 data suggests.

This analysis found that around 28,400 cancer deaths each year in the UK are linked with deprivation, based on data for 2017-2021. This equates to around 78 deaths each day – more than 3 in 20 of all deaths from cancer.

Understanding and quantifying variance by deprivation can inform public health initiatives aimed at reducing and ultimately eliminating health inequalities. Providing this sense of scale is important to galvanise action.

Introduction

Health inequalities are markers of unfair, avoidable and systemic differences in society. The drivers of this acknowledged disparity in health are complex, multi-faceted, and intersectional, but it is clear that people living in areas of higher deprivation are at higher risk of experiencing poorer health. As such, initiatives to address and ultimately reduce and eliminate these disparities are a key part of health strategies across the UK.[1,2,3]

Cancer is the leading cause of death overall in the UK, accounting for a quarter of all deaths each year.[4] Inequalities exist across the cancer pathway.[5] Cancer incidence rates are 16% higher in the most deprived compared to the least deprived areas in England, and this disparity is also evident across Scotland, Wales and Northern Ireland.[6] Socioeconomic inequalities in cancer mortality are seen across Europe.[7]

Cancer is therefore a key area for government and health agencies to consider when designing strategies to reduce inequalities. This analysis brief presents the number and proportion of UK cancer deaths that are linked to deprivation.

Aims and objectives

1. To compare cancer mortality rates in the most deprived versus least deprived areas within each UK nation, and to aggregate this to UK-level.
2. To estimate the total number of cancer deaths associated with deprivation, based on differences in age-specific cancer mortality rates.

Methods

Data sources

Cause of death data by deprivation quintile (English Indices of Deprivation or Welsh Index of Multiple Deprivation (WIMD) as appropriate), gender, and age group for England and Wales were downloaded from the Office for National Statistics (ONS) and filtered to include only deaths from cancer.[8] Cancer mortality data by Scottish Index of Multiple Deprivation (SIMD) and Northern Ireland Multiple Deprivation Measure (NIMDM) for Scotland and Northern Ireland respectively were obtained from the relevant cancer registries by request. Population data by IMD quintile, gender, and age group were obtained for England and Wales from ONS,[8] for Scotland from the National Records of Scotland (NRS),[9] and for Northern Ireland from the Northern Ireland Statistics and Research Agency (NISRA).[10] Where source data were presented by decile, the data were aggregated into quintiles.

Each UK nation has its own deprivation index and these indices are not directly comparable either in composition (the metrics included and their operationalisation) 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, the 'matching' deprivation quintile from each nation was summed, e.g. the most deprived quintile in each nation.

Calculation of age-specific mortality rates

Three-year average age-specific mortality rates were calculated by gender (females, males, persons), five-year age band, cancer site, and deprivation quintile. Rates were calculated for 2018+2019+2021 in England, Scotland and Wales and for 2017-2019 in Northern Ireland. Population data were not available for 2021 in England and Wales, instead 2021 deaths were applied to 2020 population data. This analysis did not include 2020 data due to the pronounced impact of COVID on cancer mortality; including 2020 would have made the results less representative. UK-level age-specific mortality rates were calculated by five-year age band, cancer site, and gender, using summed deaths and populations for the 'matching' deprivation quintile in each of the four UK nations.

Calculation of deprivation-associated deaths

Deprivation-associated deaths were calculated by subtracting from the observed number of deaths, the number of expected deaths if the entire population had the same age-specific crude mortality rate as the least deprived quintile, separately for each five-year age band, gender and cancer site. In this calculation, population size and structure was assumed to remain the same in the observed and expected

scenarios. The total number of deaths associated with deprivation for each cancer site is the sum of the deprivation associated deaths in each age group. Source data for England and Wales used broader cancer site groupings than in Scotland and Northern Ireland, so deprivation associated deaths in the latter two countries were further aggregated into groups that most closely matched those used in England and Wales.

Calculation of age-standardised mortality rates

Mortality data for Wales were provided for ages 0-49 and then in five-year age bands from 50-90+. Deaths and population data for England, Scotland, and Northern Ireland were aggregated into the same age groups as those used in the Wales data. UK-wide European age-standardised rates and their confidence intervals were then calculated using standard methods. Age-standardised rates were considered statistically significantly different if their confidence intervals did not overlap.

Results

It is estimated that around 28,400 cancer deaths each year in the UK – more than 3 in 20 of all cancer deaths - are linked with deprivation. Age-standardised cancer mortality rates are nearly 60% higher in the most compared with the least deprived quintile in the UK.

Almost half (47%) of deprivation-associated cancer deaths are from lung cancer. In the UK, age-standardised mortality rates for all broad cancer types are significantly higher in the most versus least deprived quintile.

COUNTRY	NUMBER OF DEPRIVATION-ASSOCIATED DEATHS			
	ALL CANCERS COMBINED		LUNG CANCER	
	PER YEAR	PER DAY	PER YEAR	PER DAY
UK	28,355	78	13,356	37
ENGLAND	22,069	60	10,393	28
NORTHERN IRELAND	625	2	370	1
SCOTLAND	4,270	12	1,959	5
WALES	1,391	4	635	2

Table 1. The total number of cancer deaths (ICD10 C00-C97 all cancers combined, and C33-C34 lung cancer) estimated to be attributable to deprivation Data are for 2018+2019+2021 in England, Scotland and Wales, 2017-2019 in Northern Ireland.

COUNTRY	AGE-STANDARDISED MORTALITY RATE (95% CONFIDENCE INTERVAL)	
	LEAST DEPRIVED	MOST DEPRIVED
UK	216.6 (215.2-218.0)	337.0 (334.9-339.1)
ENGLAND	214.3 (212.8-215.7)	328.1 (325.8-330.4)
NORTHERN IRELAND	239.0 (229.6-248.3)	347.0 (334.0-359.9)
SCOTLAND	227.1 (222.1-232.2)	410.7 (403.1-418.3)
WALES	230.1 (223.9-236.4)	340.9 (331.7-350.1)

Table 2. Age-standardised mortality rates for all cancers combined (ICD10 C00-C97) for the least deprived and most deprived quintiles in the UK and constituent nations. Data are for 2018+2019+2021 in England, Scotland and Wales, 2017-2019 in Northern Ireland.

Further cancer mortality by deprivation data, including by cancer type, are available on Cancer Research UK's Cancer Data Hub

Discussion

Summary of results

The analysis estimates that around 28,400 cancer deaths each year in the UK are associated with deprivation. These deaths could in theory be avoided if the entire population had the same age-specific cancer mortality rates as the least deprived quintile, and the population size and structure remained the same. .

Age-standardised cancer mortality rates are almost 60% higher in the most deprived areas in the UK, compared with the least deprived (337 vs 217 per 100,000). The reasons for this are likely to be complex and multifaceted, and run across the entire cancer pathway. They may include higher prevalence of key risk factors including smoking and obesity,[11,12,13,14,15,16] which cause higher cancer incidence.[17,18] They may also include an increased likelihood of being diagnosed later,[19,20,21] and with more comorbidities,[22,23] both of which can reduce treatment options and therefore may be associated with poorer survival.[2425, 26, 27,28,29,30]

Lung cancer accounts for almost half of these additional deaths (around 13,400) and also has the biggest difference in mortality rates between the most and least deprived areas in the UK (94 vs 32 per 100,000).

Strengths and limitations

This analysis uses gold-standard, population-level, nation-specific data, and an established methodology, making the results robust and comprehensive. Grouping together 'matching' deprivation quintiles for each nation rather than attempting to map all nations to the same index, means the analysis better reflects relative inequality within areas which share health and social care systems.

Analysis of cancer mortality by deprivation for the UK overall has not, to our knowledge, been completed previously.

The analysis omits cancer mortality data for 2020 - where there was such a pronounced impact of COVID - 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.

References

[1] NHS England, National Healthcare Inequalities Improvement Programme. Last accessed February 2025.
[2] NHS England, Core20PLUS5 (adults) – an approach to reducing healthcare inequalities. Last accessed February 2025.
[3]HSC Public Health Agency, Health inequalities project locations announced. Last accessed February 2025.
[4] Data are for UK, at ICD-10 chapter-level for ICD-10 A00-R99, V01-Y98, and U00-U85 except for ICD-10 C00-D48 (neoplasms) which is split into C00-C97 (malignant neoplasms) and D00-D48 (in situ and benign neoplasms, and neoplasms of uncertain or unknown behaviour). More information is available here.
[5] Cancer Research UK (2025). Cancer in the UK 2025: Socioeconomic deprivation. Published
[6] Calculated by the Cancer Intelligence Team at Cancer Research UK, April 2020. Based on method reported in National Cancer Intelligence Network Cancer by Deprivation in England Incidence, 1996-2010 Mortality, 1997-2011(link is external). Using cancer incidence data 2013-2017 (Public Health England) and population data 2013-2017 (Office for National Statistics) by Indices of Multiple Deprivation 2015 income domain quintile, cancer type, sex, and five-year age band. More information is available here.
[7] Vaccarella, S. et al. Socioeconomic inequalities in cancer mortality between and within countries in Europe: a population-based study. The Lancet Regional Health – Europe, Vol.25. February 2023. https://doi.org/10.1016/j.lanepe.2022.100551
[8] Office for National Statistics (ONS), Death registrations by cause and IMD, England and Wales, 2001 to 2021 and populations by IMD England and Wales, 2001 to 2020
[9] National Records of Scotland (NRS), Population estimates by Scottish Index of Multiple Deprivation (SIMD). Last accessed February 2025.
[10] Northern Ireland Statistics and Research Agency (NISRA), 2020 Mid Year Population Estimates for Northern Ireland. Last accessed February 2025.
[11] Office for National Statistics (2024). Adult smoking habits in the UK: 2023.
[12] Scottish Government (2024). Scottish Health Survey 2023.
[13] Welsh Government (2024). Adult lifestyle (National Survey for Wales): April 2022 to March 2023.
[14] Department of Health Northern Ireland (2024). Health Survey Northern Ireland 2023/24.
[15] Office for National Statistics (2018). Smoking inequalities in England, 2016.
[16] NHS England (2024). Health Survey for England 2022.
[17] Brown KF, Rumgay H, Dunlop C, et al. (2018). The fraction of cancer attributable to modifiable risk factors in England, Wales, Scotland, Northern Ireland, and the United Kingdom in 2015. Br J Cancer 118: 1130–1141
[18] Cancer Research UK (2024). CRUK analysis brief: Smoking-attributable cancer cases in

the UK, 2003-2023.

[19] Barclay ME, Abel GA, Greenberg DC, Rous B, Lyratzopoulos G (2021). Socio-demographic variation in stage at diagnosis of breast, bladder, colon, endometrial, lung, melanoma, prostate, rectal, renal and ovarian cancer in England and its population impact. Br J Cancer 124: 1320– 1329.

[20] NHS England (2024). Stage at diagnosis.

[21] Public Health Scotland (2021). Cancer incidence in Scotland to December 2019.

[22] Fowler, H. et al (2020). Comorbidity prevalence among cancer patients: a population-based cohort study of four cancers. *BMC Cancer* **20**, 2 (2020). https://doi.org/10.1186/s12885-019-6472-9

[23] Knies, G. and Kumari, M (2022). Multimorbidity is associated with the income, education, employment, and health domains of area-level deprivation in adult residents in the UK. Scientific Reports 12, 7280 (2022). https://doi.org/10.1038/s41598-022-11310-9

[24] National Disease Registration Service (NDRS), as part of the Cancer Research UK – NHS England Partnership (2024). Treatment Breakdown by Demographics, 2013-2021.

[25] Søgaard, M., et al. (2013). The impact of comorbidity on cancer survival: a review. *Clinical Epidemiology*, *5*(sup1), 3–29. https://doi.org/10.2147/CLEP.S47150

[26] J. Stairmand, et al. (2015). Consideration of comorbidity in treatment decision making in multidisciplinary cancer team meetings: a systematic review. Annals of Oncology, Volume 26, Issue 7, Pages 1325-1332, https://doi.org/10.1093/annonc/mdv025.

[27] Belot, A. et al, (2019). Association between age, deprivation and specific comorbid conditions and the receipt of major surgery in patients with non-small cell lung cancer in England: A population-based study. *Thorax* 2019;**74:**51-59.

[28] NHS England (2023). Cancer survival in England, cancers diagnosed 2016 to 2020, followed up to 2021.

[29] Welsh Cancer Intelligence and Surveillance Unit (2023). Cancer Survival in Wales, 2002–2020.

[30] Northern Ireland Cancer Registry (2024). Official statistics.