ICR The Institute of Cancer Research

PhD Project Proposal

Funder details

Studentship funded by:	CRUK CD3 Programme

Project details

Project title:	Modifiable Risk Factors and Cancer Burden in the UK: Trends, Impact, and Prevention Opportunities

Supervisory team

Primary Supervisor:	Montserrat Garcia-Closas, ICR
Associate Supervisor(s):	Bethan Davis, Imperial College London
Secondary Supervisor:	Amy Berrington, ICR

Divisional affiliation

Primary Division:	Division of Genetics & Epidemiology
Primary Team:	Integrative Cancer Epidemiology
Site:	Sutton

Project background

Cancer remains one of the leading causes of morbidity and mortality in the UK, and a substantial proportion of cases are attributable to modifiable behavioural, environmental, and metabolic risk factors. Over recent decades, the prevalence of known risk factors - such as obesity, alcohol intake, tobacco use, dietary patterns, reproductive factors, and air pollution- has shifted considerably and unevenly across demographic and geographic subgroups. These divergent trends contribute to widening inequalities in cancer incidence and outcomes. Yet, despite growing policy emphasis on prevention, there is limited contemporary, UK-specific evidence quantifying how these changing exposures translate into the current and future cancer burden, and what reductions in risk factors would yield the

This PhD project will use advanced analytical methods to generate high-quality epidemiological evidence to guide cancer prevention by analysing national health, administrative, survey and cancer registry data. It will estimate the current UK cancer burden and the proportion attributable to major modifiable risk factors across demographic and geographic subgroups. Using state-of-the-art modelling approaches, this project will quantify the potential reduction in cancer incidence under realistic and ambitious changes in risk factor prevalence. Finally, it will identify the interventions and policies most likely to reduce inequities in cancer outcomes and pinpoint the population groups and regions where targeted prevention would have the greatest impact.

This PhD project forms part of the Cancer Data Driven (CD3) Programme. CD3 is a new, multidisciplinary and multi-institutional strategic national research programme dedicated to using data to transform our understanding of cancer risk and enable early interception of cancers. It represents a major, multi-million-pound flagship investment funded through a strategic programme award by Cancer Research UK, the

National Institute for Health and Care Research (NIHR) and the Engineering and Physical Sciences Research Council (EPSRC); and the Peter Sowerby Foundation; in partnership with Health Data Research UK (HDR UK) and the Economic and Social Research Council's Administrative Data Research UK programme (ADR UK).

Project aims

- To estimate the current population cancer burden in the UK, overall and attributable to specific risk factors across population subgroups.
- To estimate the potential impact of reducing risk factors on cancer incidence across population groups and geographical locations.
- To identify potential interventions and policies to address inequities in cancer outcomes and improve overall public health.

Research proposal

Study design

Population-based modelling study in the whole UK population. The study uses aggregate population-level data on cancer incidence and risk factor distributions, combined with relative risk estimates from multi-cancer risk models.

Analyses

The project will focus initially on 12 major cancer types (breast, prostate, lung, liver, colorectal, kidney, head and neck, pancreatic, bladder, endometrial, oesophageal, and ovarian). These cancers were selected based on incidence, contribution to cancer mortality, associations with modifiable risk factors (particularly alcohol, smoking, obesity) and hormonal factors, and their potential for prevention and reduction in health inequalities.

Using national cancer registry and population health data, the student will estimate the current population burden of cancer in the UK, overall and attributable to key modifiable risk factors. Population impact measures -such as Population Attributable Fraction (PAF) and Population Attributable Risk (PAR) - will be used to quantify both relative and absolute burden, drawing on risk estimates from the CD3 programme and current distributions of risk factors from national health surveys, while accounting for latency between exposure and cancer development.

Analyses will examine how cancer burden varies across population subgroups defined by sex, ethnicity, socio-economic position and geography, with a particular focus on identifying health inequities. Advanced statistical, spatial and data visualisation approaches will be used to characterise regional patterns, quantify uncertainty, and explore complex or non-linear relationships between risk factors, location and cancer outcomes.

The project will also assess how cancer burden may change over time under current trends and under hypothetical scenarios in which risk factor levels are reduced. These projections will help identify population groups and regions where changes in risk factor prevalence could yield the greatest reductions in cancer incidence, and to estimate the scale of change required to meet specific public health or policy targets. Where appropriate, advanced modelling approaches may be used to explore the combined effects of multiple risk factors and uncertainty in future projections.

In collaboration with the CD3 programme, findings from the modelling work will be translated into evidence-based insights to inform interventions and policy actions aimed at reducing cancer burden and addressing inequities. Patient and public perspectives, alongside ethical and societal considerations

(including uptake of screening programmes), will be integral to this process, ensuring that recommendations are both impactful and implementable.

Data Sources

- Cancer incidence data from national cancer registries across England, Scotland, Wales and Northern Ireland, with linkage to socio-economic, geographic and (where available) ethnicity information, and historical data to support temporal analyses.
- Population risk factor data from national health surveys, supplemented by large prospective cohorts where needed, with appropriate population weighting using census and mid-year population estimates.
- Relative risk estimates from multicancer risk models developed within the CD3 programme.

Impact

The findings from this PhD project will provide evidence essential for shaping national prevention priorities, designing equitable public health interventions, and supporting strategic decision-making across the NHS, local authorities, and cancer research organisations.

Research setting

This PhD will be based in the Division of Genetics and Epidemiology within Prof. Montserrat García-Closas' Integrative Epidemiology Team, working closely with the secondary supervisor, Prof. Amy Berrington, who leads the Clinical Epidemiology Team. Together, these groups comprise a highly collaborative environment of pre- and post-doctoral fellows, statisticians, data scientists and students engaged in a broad portfolio of epidemiological and methodological research. Prof. García-Closas leads a multidisciplinary programme focused on integrative analyses to improve cancer risk prediction. She co-leads the Cancer Epidemiology and Prevention Unit across the Institute of Cancer Research and Imperial College London, where the Associate Supervisor, Prof. Bethan Davis, is based.

The PhD project forms part of the CD3 initiative, providing the student with direct access to a large, multi-institutional team of researchers, data scientists, and trainees working on national-scale cancer data resources. This setting offers exceptional opportunities for collaboration across institutions in the UK and internationally, fostering a rich and supportive training environment. The supervisory team and wider research network will ensure strong mentorship, interdisciplinary learning, and exposure to cutting-edge epidemiological methods and public-health applications.

The student will have the opportunity to attend the structured Early Detection Training Programme (run in partnership with the Alliance for Cancer Early Detection (ACED)), providing PhD students with a comprehensive foundation to cancer early detection.

Literature references

References

Brown, K.F., 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', British Journal of Cancer, 118, p. 1130.

Berrington de González, A., Brayley, M., Frost, R., Freedman, N., Gunter, M.J., Jackson, I., Lapitan, P., Shiels, M.S. and García-Closas, M. (2025) 'Trends in cancer incidence in younger and older adults: an international comparative analysis', Annals of Internal Medicine. doi: 10.7326/ANNALS-24-02718.

García-Closas, M., Richards, Z., Frost, R., Gunter, M.J. and Berrington de González, A. (2025) 'Temporal trends in behavioural risk factors for cancers with rising incidence in younger adults: an analysis of population-based data in England', medRxiv. doi: https://doi.org/10.1101/2025.08.21.25333984.

Rashid, T., Bennett, J.E., Muller, D.C., Cross, A.J., Pearson-Stuttard, J., Asaria, P., Daby, H.I., Fecht, D., Davies, B. and Ezzati, M. (2024) 'Mortality from leading cancers in districts of England from 2002 to 2019: a population-based, spatiotemporal study', The Lancet Oncology, 25(1), pp. 86–98. doi: 10.1016/S1470-2045(23)00530-2.

Candidate profile

Note: the ICR's standard minimum entry requirement is a relevant undergraduate Honours degree (First or 2:1).

Pre-requisite qualifications of applicants:

Master in Epidemiology, Public Health, Biostatistics, Data Science or related field; or equivalent experience in these areas

Intended learning outcomes:

- Understand the epidemiology of cancer.
- Critically read and analyse scientific literature.
- Develop hypotheses that build upon existing knowledge.
- Apply advanced epidemiology methods for data analyses and interpretation.
- Learn to work in a collaborative research environment, leveraging the support of internal teams and external collaborators to enhance research outcomes.
- Communicate research goals, methods, results and implications in both writing and orally.
- Understand and adhere to the ethical considerations and guidelines pivotal in research involving human samples and data.

Advertising details

Project suitable for a student with a background in:

- ☐ Biological Sciences
- ☐ Physics or Engineering
- ☐ Chemistry
- ☒ Maths, Statistics or Epidemiology
- ☐ Computer Science