Radiation Epidemiology at Newcastle University

Diagnostic medical x-ray examinations, including CT scans, play a vital role in modern healthcare. X-rays, as a form of ionising radiation, are associated with an increased risk of developing cancer. Information on the cancer risks from low doses of ionising radiation, including diagnostic x-rays, is limited, however.

At Newcastle University, we are investigating the long-term health risks of low dose medical radiation exposure. Currently we are focusing on computed tomography (CT) scans and cardiac catheterizations (x-ray guided procedures used to diagnose and treat heart disease).

We have assembled two cohorts of patients exposed to medical radiation in order to improve knowledge of the cancer risks at low doses.

- A cohort of around 410,000 individuals who received a CT scan while aged under 22 years, and:
- A smaller cohort of around 14,000 individuals who underwent a cardiac catheterization while aged under 22 years.

Both cohorts were assembled from records of each examination type recorded at participating hospitals. Radiation doses for each examination were estimated using a type of computer modelling called Monte Carlo simulation. Cohort members were matched to the NHS Digital cancer registry to determine who has developed cancer, the cancer site and the date of diagnosis.

These cohorts are pooled with cohorts from other European countries to increase statistical power, providing unprecedented ability to determine the excess cancer risks at low doses.

This research will aid clinicians, radiographers and physicists in the effective use of diagnostic x-ray imaging, including the processes of justification (weighing up the advantages of an x-ray exposure with the risks) and optimisation (reducing doses to as a low as reasonably achievable).

What have we found, so far?

We have found evidence of an increased risk of brain tumours and leukaemia from CT scans, but not Hodgkin's lymphoma. Our findings suggest the cancer risks from medical x-ray exposures are reasonably small, and compatible with previous risk estimates. We have also found that the radiation doses from medical x-ray procedures have fallen

markedly over the last decade. Typical doses for chest and abdomen CT scans are now comparable with the yearly dose from natural background sources (radon gas, cosmic rays etc.).

Am I included in the Study?

If you have had a CT scan or cardiac catheterization in the UK, while aged under 22 years, before 2021, there is a possibility you may a member of one of our cohorts. Here is information about the data held, how they are used and your rights.

How we collect and use information:

The data used in our radiation research program were obtained from hospital records of examinations performed in x-ray departments at participating hospitals. Most, but not all hospitals in the UK provided data for this study. The period of data collection varied between hospitals, with start dates ranging from 1985 to 2000 and end dates ranging from 2001 to 2021. Data were obtained electronically, as a download from the Radiology Information System (RIS).

The types of data collected include:

- Name, date of birth
- Postcode
- Details of CT scans and cardiac catheterizations, including specific procedure type (e.g. CT head scan). For a sample of procedures, we gathered more detailed examination information, including exact region scanned and scanner type.
- Details of cancer diagnosis, including type and date of diagnosis, obtained form NHS Digital (https://digital.nhs.uk).

These data are used to improve information on the radiation doses and associated cancer risks from low dose x-ray exposures in young people. This information will be used to guide radiation protection practice and to ensure the benefits of x-ray procedures outweigh the risks. The study does not make use of automatic decision making. Postcode is used to profile socioeconomic status (which can influence cancer risks). The lawful basis for carrying out our research under the General Data Protection Regulation (GDPR) is that the task is carried out in the public interest, (Article 6, 1e) as the research is cited as part of the University's duties. Regarding Article 9, paragraph 1 does not apply as processing is necessary for scientific research purposes (Article 9, 2j).

The potential carcinogenic effects of radiation exposure persist throughout lifetime, meaning studies investigating these risks must necessarily be long term. For this reason, personal data will be stored for a period of 15 years beyond the study end date.

How data are stored:

All data are treated as confidential. We store data electronically on university computers accessed from the Sir James Spence Building, which is part of the Royal Victoria Infirmary. All files are securely stored and data are pseudo-anonymized. This means each patient is given a unique ID number that can, if needed, be linked back to the original patient identifiable data using information stored on the central database. Wherever possible, analysis is only performed on pseudo-anonymized data as opposed to directly identifiable patient data. Our offices have a key card access system and are alarmed at nights and weekends. All paper files are stored in locked filing cabinets within our office.

How we share information:

Data are shared with other study partners in the EPI-CT, MEDIRAD and HARMONIC projects and with study partners at the National Cancer Institute (NCI). All shared data are in pseudo-anonymized form. It is not possible for any study partners outside our office facility to directly identify patients. Data are not shared with any other third parties. We will never attempt to contact you regarding our study, without your explicit consent.

Your rights to the information held about you:

The Data Controller for this study is Newcastle University. The University is registered with the Information Commissioner's Office (ICO) to process personal and special categories of information under the General Data Protection Regulation (GDPR) and Data Protection Act 2018. Our registration number is Z5470161. The Data Protection Officer for Newcastle University is Maureen Wilkinson, who can be contacted on rec-man@ncl.ac.uk or by post: Data Protection Officer, Newcastle University, Blackhorse House, 91 Sandyford Road, Newcastle Upon Tyne, NE1 8HQ, United Kingdom.

Obtaining individual consent for each of the study participants would be impractical, given our research involves several hundred thousand participants, a small proportion of whom are deceased. The study has Confidentiality Advisory Group (CAG) support for obtaining patient data without needing to apply for individual consent under Section 251 of the National Health Service Act 2006.

You have the right to be informed about the study and how you or your child's data are used. You have the right to access information held about you or your child, correct data if they are inaccurate, request restricted use of data or reuse your own data for other purposes. You may object to the uses of automatic processing and profiling (not currently used, except for postcode-based socioeconomic status analysis). You may also request to be removed from the study by submitting a patient opt-out form. If you have any questions or concerns about the study design or findings, please contact a member of the study team. Concerns about data protection and privacy should be directed to our Data Protection Officer at rec-man@newcastle.ac.uk.

Contact Details

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