EPI-CT: design and epidemiological methods of an international study on cancer risks after paediatric CT

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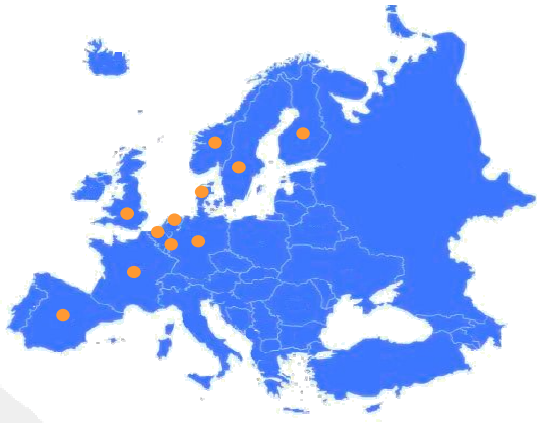
BACKGROUND & AIMS

The increasing use of CT scans in children and adolescents has become a matter of concern both from the point of view of radiation protection and public health because this specific age group:
- is more sensitive to the carcinogenic effects of ionizing radiation than adults
- has a higher life expectancy to show any detrimental health effect
- due to their smaller body mass tends to receive higher doses of radiation to specific organs than adults, when undertaking a CT scan.

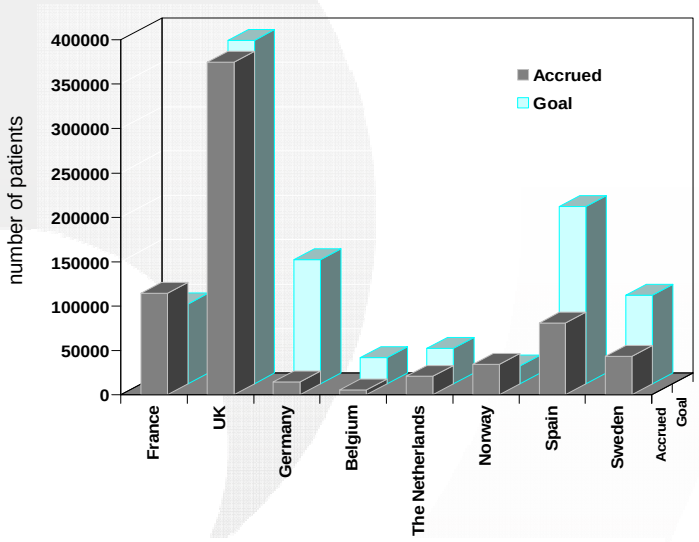
This international cohort study is aimed to quantify the risk associated with exposure to ionizing radiation due to CT scans in children and obtain guidelines on pediatric dose optimization for CT scans.



EPI-CT national cohorts are running in Belgium, France, Denmark, Germany, The Netherlands, Norway, Sweden, UK and Spain

METHODS

An international cohort of over a million paediatric and adolescent CT patients is being defined based on radiology department records of the participating hospitals. All retrospective CT scan data is retrieved for each patient to reconstruct the cumulative dose received by each patient to a number of different organs in the body. Participants will be followed passively through the cancer, mortality and hospital discharge registries to identify any incident outcome (death, cancer or other diseases) during the study period and estimate the risk of radiation-induced cancer (including childhood leukemia and brain tumors) and of non-cancer outcomes.



National contribution to the European EPI-CT cohort

POTENTIAL BIASES AND UNCERTAINTIES

Factors which may bias the association between ionising radiation exposure through CT scans and the risk of childhood leukaemia and solid tumours include:

- **Social class:** measures of socio-economic status will be based on parents' job title, parents' education level or the subjects' address associated to deprivation indexes depending on the country.

- **Congenital disorders:** Identification of patients with an increased risk of radiation induced cancer is being conducted where possible so they can be excluded from the main risk analyses.

- **Confounding by indication:** reason for CT scan are being reviewed to identify scans related to the diagnoses of cancer. In addition, analyses will be conducted excluding a period of 2 years for leukaemia and 5 years for any solid tumour to rule out CT scans which may be related to the diagnosis of an eligible cancer.

Additionally, given that a CT scan will not immediately contribute to cancer risk, exposures will be lagged by 2 and 5 years for leukaemia and solid tumours, respectively.

Characterisation of uncertainties include:

- **Missing doses from CT scans taken in non-participating hospitals and other radiological procedures**: Substudies in areas with full coverage both in the UK, Belgium and France will provide information about missed doses from non-CT procedures and from missed CTs that will be used to assess the potential impact of missed doses on study results.

- **Dose estimation variability** due to quality differences on data: data collected from RIS, or from PACS, including images, or including projections may lead to different dose estimations. Results obtained in the different dose reconstruction approaches will be compared to estimate the impact of each of them and sensitivity analyses will be performed taking into account this.

- **Mortality follow-up** will not be available in Germany and partially available in France. Given that CT patients tend to have higher mortality rates than the general paediatric populations, the impact of missing mortality data on person time at risk calculations will be evaluated using data form other countries.

Two recent studies of paediatric CT patients have observed and increased risk of leukaemia and other tumours related to the number of scans or dose. The findings of this much larger and careful study will be critical to confirm or inform these finding and to evaluate the adequacy of current radiation risk estimates derived from studies of children with moderate to high doses received at high dose-rates from atomic bombings or radiotherapy to the generally lower doses received by patients undergoing CT.

CREAL centre de recerca en epidemiologia ambiental EPI-CT