

Cancer Risk from Paediatric CT Scanning: Implications for Radiation Protection in Medicine

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Abstract—The use of computed tomography (CT) imaging is clearly beneficial for millions of patients. However, the potential adverse health effects, particularly cancer, of ionizing radiation exposure from CT early in life are an issue of growing concern in the radiological protection, medical and public health communities. Although efforts to quantify these effects have been conducted, the precision and accuracy of reported risks needs confirmation. EPI-CT, a European collaborative epidemiological study, was set-up to quantify risks from paediatric computerised tomography to optimise paediatric diagnostic protocol. The study, coordinated by IARC, was designed as a multinational cohort study of children and young adults who underwent CT scanning for long-term follow-up. It combined data from existing and extended cohorts in France, the United Kingdom (UK) and Germany, and from new cohorts assembled in Belgium, Denmark, the Netherlands, Norway, Spain and Sweden using a common protocol. A flexible dose reconstruction approach that can accommodate collection of data from historical sources (prior to 2000) and automatically extracted data from the Digital Imaging and Communications in Medicine (DICOM) headers of recorded images available in the Picture Archiving Communication System (PACS) was developed. Individual organ doses estimates for each child were derived from Monte-Carlo-based radiation transport calculations using hybrid phantoms of different sex and ages. To account for uncertainties due to missing input data, a simulation method which maintains correlations of doses for persons within subgroups with similar exposure attributes and simulates uncertain dose-model parameters values, was used. Simulation studies were conducted to evaluate the potential impact of a range of potential confounders (e.g. underlying medical conditions, socio-economic status, missing medical procedures performed outside of participating hospitals) on risk estimates were conducted based on data from some EPI-CT countries and/or reasonable scenarios. A total of 1,170,186 patients (before censorship) were enrolled in the national cohorts. Most patients (75%) had had only one CT scan and 29% of all patients were younger than 5 years at the time of their first CT examination. The median duration of follow-up was 8.0 years for the entire cohort, though it varied across countries. Overall, the follow-up accounted for nearly 10 million person-years. The first estimates of risk of radiation related leukaemia will be presented and the impact of potential confounders on these estimates discussed. The study received partial funding from the EC 7th Framework Programme under grant agreement number 269912.