UK Health Security Agency

## Exposure of Patients from the Medical Use of Radiation


Chest X-ray

CT scan of head



Nuclear medicine bone scan



## Estimated collective dose (man Sv) to UK population for common types of diagnostic procedures

| Procedure type | Estimated annual collective dose to UK population, man Sv $y^{-1}$ |
|---|---|
| **These estimations of collective dose data were published in 2016, using the most complete assessments of both frequency and dose in the UK at the time. In the absence of more recent data these are still the best estimates available. See text below on estimation of collective dose for more information. Total is shown to 2 significant figures, so does not equal the sum of the parts shown.** | |
| Conventional X-ray | 4,800 [1] |
| Angiography (non-CT) | 1,200 [1] |
| Interventional procedures (non-CT) | 2,000 [1] |
| Computed Tomography (CT) | 17,000 [1] |
| Diagnostic nuclear medicine (NM) | 1,700 [2] |
| **Total** | **27,000** |

1 Hart et al (2010)

2 Based on Hart and Wall (2005), with adjustment for change in frequency of procedures between 2003/2004 and 2009/2010

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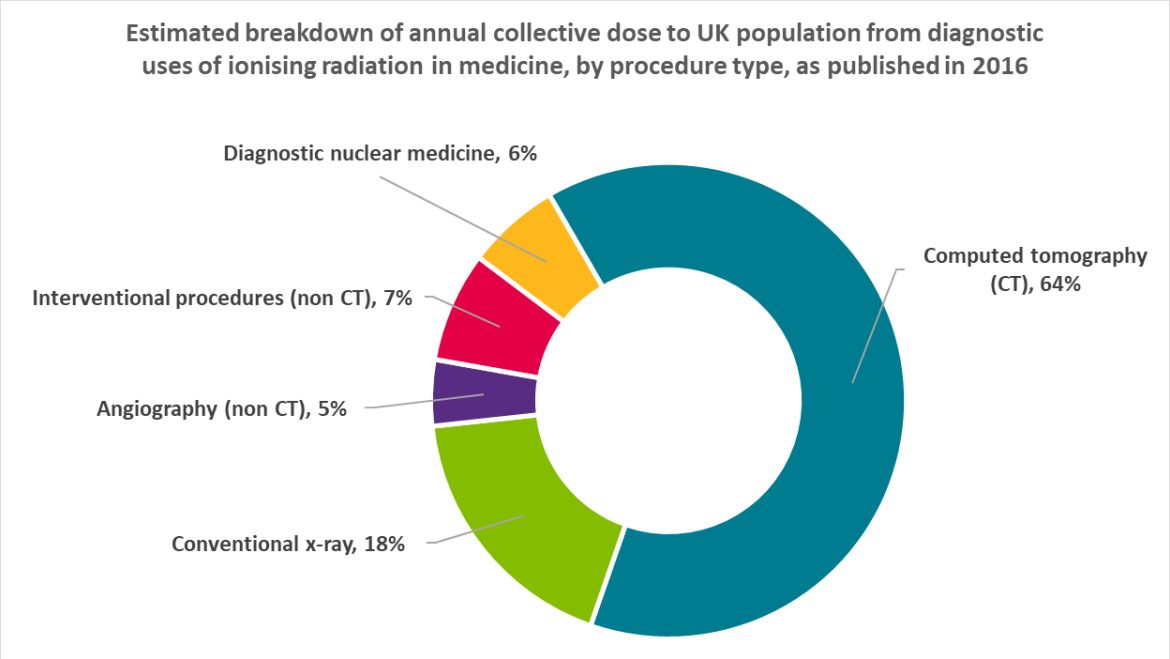


Ionising radiation has many uses in medicine today. It is used, in the form of X-rays, gamma rays, electrons and protons, to diagnose, monitor and to treat a wide range of medical conditions. Diagnosis and screening are the most frequent uses of ionising radiation in medicine. It is important to ensure that ionising radiation is used safely, wisely and appropriately. In the UK, The Ionising Radiation (Medical Exposure) Regulations 2017 (UK Parliament, 2017; UK Parliament, 2018; UK Parliament, 2024) are in place to protect the patient from the potential hazards of ionising radiation.

The purpose of this review is to estimate the overall exposure of the UK population from medical uses of ionising radiation for diagnostic purposes, not to provide information on individual doses to patients. There are different doses associated with each type of medical exposure. There are also variations in dose between patients undergoing the same procedure. There are many reasons for such variation, including the clinical reason for the procedure, the equipment and technique used, and individual patient factors.

**Estimation of collective dose from diagnostic medical exposures**

The table above shows the total contributions to the collective dose to the UK population from the principal diagnostic uses of ionising radiation in medicine, as published in 2016 (Oatway et al, 2016). This 2016 assessment of medical exposures was based on thorough assessments of both the number of procedures carried out in the UK each year (the frequency) and the typical doses from a range of diagnostic procedures in the fields of diagnostic radiology and nuclear medicine.

- For diagnostic radiology, data from Hart et al (2010), which presented data from 2008, was used

- For nuclear medicine, data from Hart and Wall (2005), which presented data from 2003/2004, was used with an adjustment applied to account for the change in frequency of procedures between 2003/2004 and 2009/2010.

Changes in collective dose will occur due to changes in the frequency of each procedure, and changes in doses per procedure. Overall, the total number of diagnostic procedures using ionising radiation has increased since the previous assessments. Patient doses per procedure have also changed, with technological advances and improved techniques sometimes resulting in lower levels of dose per procedure compared to the previous assessment. Until a full review of both the frequency of procedures and patient doses has been completed it is not possible to provide an accurate update on the collective dose from diagnostic medical procedures. Updated surveys on diagnostic X-ray and nuclear medicine procedures are anticipated for the late 2020s. Until then, the data used for diagnostic medical procedures in the previous review of population dose from all sources (Oatway et al, 2016) is presented in the table above.

**Therapeutic uses of radiation**

Ionising radiation is also used in medicine to treat diseases, where the cell killing effects of radiation are harnessed, with intentionally high doses delivered to specific target volumes or organs. It is not appropriate to include doses from therapeutic exposures in the collective dose from ionising radiation to the UK population as such high doses have a different effect on the body from the low to medium doses arising from diagnostic procedures (UNSCEAR, 2021). This also applies more broadly for comparison with the other sources of exposure to ionising radiation considered in this review.

**Further information on frequency of medical exposures and associated doses**

Information regarding UKHSA's work related to doses associated with medical exposures is available from the Medical Dosimetry Group.

External sources of information include a report from the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) looking at medical exposure to ionising radiation (UNSCEAR, 2021), which presents a comprehensive global estimate of the frequencies and doses from medical exposure, their distribution and trends in medical categories in the 2009–2018 period.

Frequency information from NHS England can be found in the Diagnostic Imaging Dataset https://www.england.nhs.uk/statistics/statistical-work-areas/diagnostic-imaging-dataset/ for diagnostic examinations and from https://digital.nhs.uk/ndrs/data/data-outputs/cancer-data-hub/radiotherapy-delivery-in-england for radiotherapy procedures.

**References**

Hart D and Wall BF (2005). *A Survey of Nuclear Medicine in the UK in 2003/04.* Chilton (UK), HPA-RPD-003.

Hart D, Wall BF, Hillier MC and Shrimpton PC (2010). *Frequency and Collective Dose for Medical and Dental X-Ray Examinations in the UK, 2008.* Health Protection Agency, Chilton (UK), HPA-CRCE-012.

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Oatway WB, Jones AL, Holmes S, Watson SJ and Cabianca T (2016). *Ionising radiation exposure of the UK population: 2010 review.* Public Health England, Chilton (UK), PHE-CRCE-026.

UK Parliament (2017). *The Ionising Radiation (Medical Exposure) Regulations 2017*. (SI 2017/1322)

UK Parliament (2018). *The Ionising Radiation (Medical Exposure) Regulations (Northern Ireland) 2018*. (SI 2018/17)

UK Parliament (2024) *The Ionising Radiation (Medical Exposure) Amendment Regulations 2024* (SI 2024/896)

UNSCEAR (2021). *UNSCEAR 2020/2021 Report. Volume I Annex A Evaluation of medical exposure to ionising radiation.*