

# POPULATION DOSES FROM MEDICAL DIAGNOSTICAL X-RAY EXPOSURE IN BELGIUM

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An analysis was made by the Federal Agency for Nuclear Control of the annual population dose from medical diagnostic X-ray applications in Belgium. The analysis was based on data frequencies from the National Institute for Health and Disability Insurance, combined with contemporary data on effective doses typically received by patients. The annual per caput effective dose for Belgium was estimated more than 2 mSv. Although the individual doses to the patient are generally ALARA, the annual per caput effective dose is rather high and consistent with the statement that Belgium is a high consumer of medical imaging procedures.

## 1 Introduction

Like other Healthcare I countries, the largest artificial source of ionizing radiation to the population is medical radiology in Belgium. The use of ionizing radiation in medicine has offered tremendous advantages over the last decades. Potential detrimental effects on the use of ionizing radiation have increased awareness on the good use of it in medicine, to that extent that doses must be justified and kept as low as reasonably achievable (ALARA-principle).

A way to monitor the exposure of the population is to estimate the per caput and collective dose on a national scale. Although medical exposures are not distributed uniformly around the population, this allows identifying trends and comparison to other sources of exposure to ionizing radiation.

## 2 Methodology

The estimation of the Belgian population dose from all medical examinations was based on information on the frequency of examinations and the typical effective doses for each type of examination. The former was provided by the National Institute for Health and Disability Insurance (1), and represents data for the year of 2010 (diagnostic and interventional radiology, including dentomaxillofacial). The estimated size of the population in Belgium determined by Statistics Belgium was 10 839 226 (2). Because of its limitative nature, this evaluation does not include an estimation of the population dose to examinations in nuclear medicine and radiotherapy.

The effective doses per type of examination were derived from different sources, such as the UNSCEAR (3) reports. The Federal Agency for Nuclear Control has carried out national studies (4) in patient dosimetry from medical x-ray exposures, which allowed creating estimates that were representative for the current Belgian practice. The typical effective doses for dental radiological examinations were derived from the literature (5).

## 3 Results

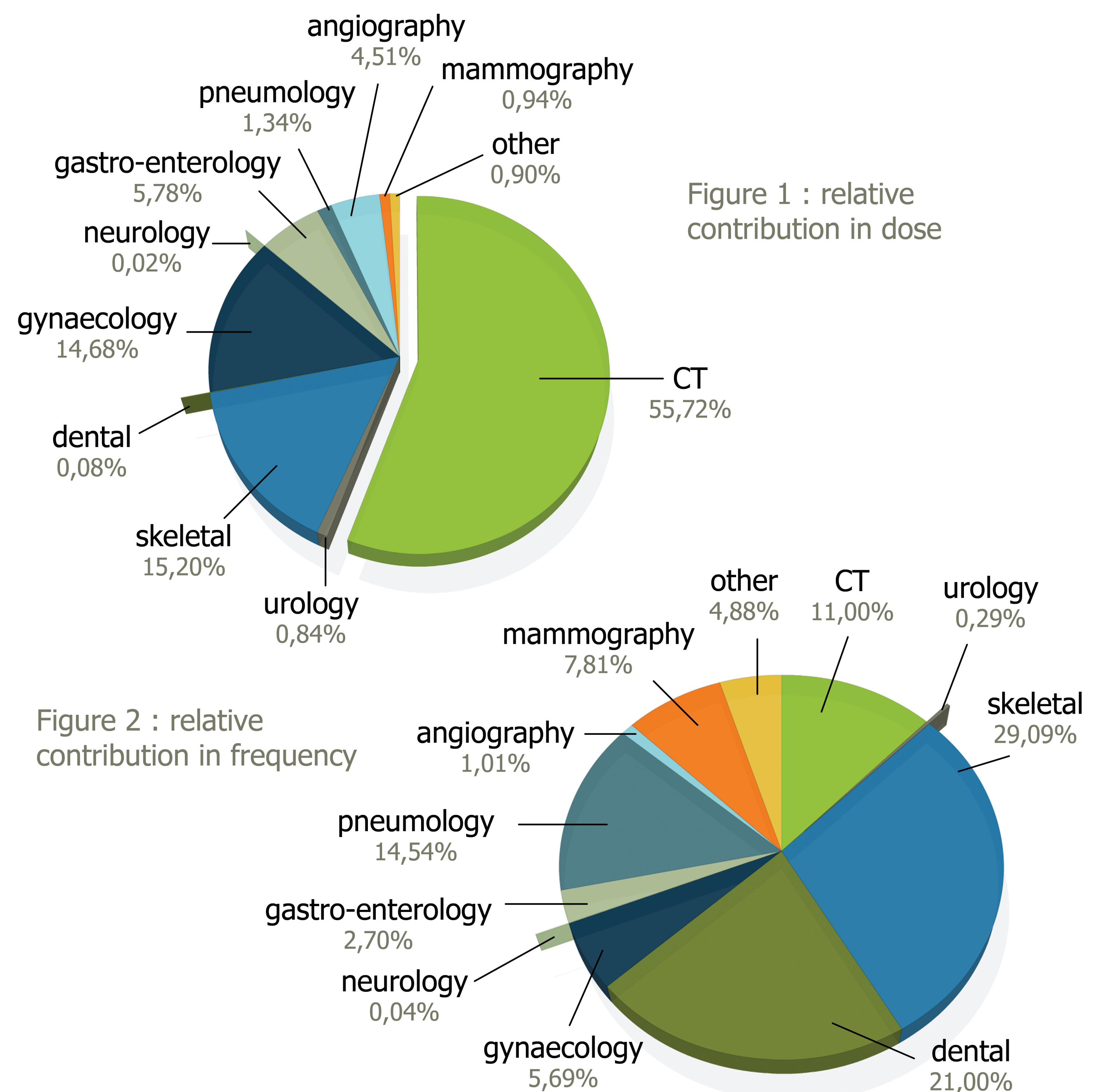
application	total number exams/1000 pop	% of total exames	dose per caput	% of total x-ray dose
CT	190	11	1,37	55
Other radiology	1163	69	1,09	44,9
Dental	329	20	0,002	0,1
Total radiology	1682	100	2,46	100

Table 1 : frequencies and contributions of medical diagnostic x-ray applications

The results on dose and frequencies, together with their relative contribution to the total dose are summarized in table 1 and figure 1 and 2.

Where CT only counts for 11 % of the total number of x-ray examinations, it is responsible for more than half of the total dose attributed to medical x-ray exposure. In opposite to CT, all dentomaxillofacial x-ray imaging is responsible for 20 % of all x-ray exams, resulting in a mere 0,1 % of the total dose.

The total exposure per caput for 2010 due to medical diagnostic x-ray exposure is estimated to be 2,46 mSv.



## 4 Discussion

In comparison with neighboring countries in Europe (6), and international data from UNSCEAR (3), Belgium is at the higher end of the total number of medical diagnostic x-ray procedures per 1000 inhabitants. As expected, CT counts for almost half the contribution in dose attributed to all radiological exams.

The current estimation on collective dose from all sources of ionizing radiation (including natural sources) is estimated about 5 mSv per year for Belgium.

As a conclusion, this assessment of exposure confirms the international trends and proves the necessity of a strict follow up of the ALARA principle in diagnostic imaging. Although currently a comparison against historical Belgian data is not possible, the need to further analyze the population exposure from medical applications on a periodical basis is recommended.

### LIMITATIONS

Although the data on frequencies assume to cover 100 % of the medical examinations, a number of examinations are not included into the health care reimbursement system in Belgium (e.g. medico-legal examinations). The national codes for health care reimbursement do not allow a specific estimation of effective dose per examination; some examinations are combined into one code, and each examination has a range of doses to the patient, depending on local practice (e.g. equipment, working procedures, medical preferences, ...) and patient characteristics (age, gender, size, ...).

### ACKNOWLEDGEMENTS

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### REFERENCES

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