



United Nations Scientific Committee
on the Effects of Atomic Radiation



International Conference on
RADIATION PROTECTION IN MEDICINE
Setting the Scene for the Next Decade

**UNSCEAR's medical exposure surveys:
Findings and the way forward**

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- Objectives of UNSCEAR's medical exposure surveys
- Historical review/milestones
- Medical exposure categories
- Population doses estimation
- Health Care Level classifications
- Levels and trends in medical exposures
- Conclusions
- Future perspectives



Historical milestones



- UNSCEAR 1958 Report:
 - Medical radiation **dose data** from 10 countries on genetically significant and bone marrow doses
- UNSCEAR 1962 Report:
 - Annual **frequency** data from 20 countries
- UNSCEAR 1982 Report:
 - First **survey** together with WHO including data on availability of diagnostic radiology equipment
- UNSCEAR 1988 Report:
 - First **global estimate** of medical exposures
- UNSCEAR 1993, 2000 and 2008 Reports:
 - **Collective effective dose**



Objectives of UNSCEAR's surveys



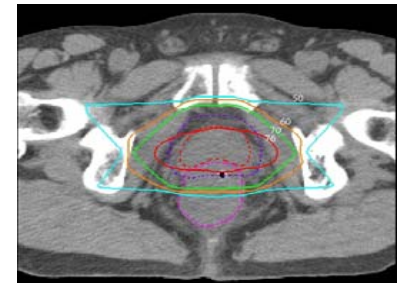
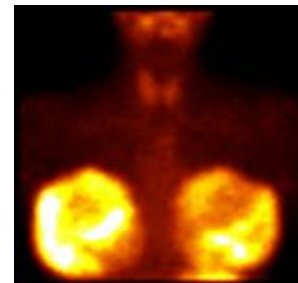
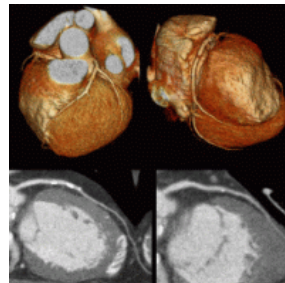
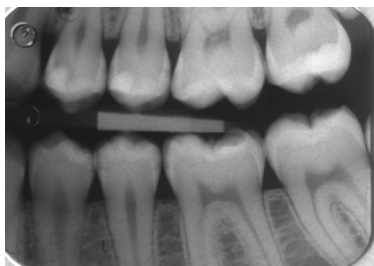
To facilitate evaluation of:

- global estimates of frequency and levels of exposures, with break-downs by medical procedure, age, sex, health care level, and country;
- trends in practice (including those relatively fast-changing);
- supporting contextual evidence on equipment and staffing levels.



Medical exposures categories

- Diagnostic radiology
 - Plain radiography, fluoroscopy, CT and DEXA
 - Image guided interventional procedures
- Nuclear medicine
 - Gamma camera, PET/CT and NM treatments
- Radiation therapy
 - External beam therapy and brachytherapy





Population dose estimation

- ***E (Effective dose)*** is used for expressing stochastic risk to radiation workers and to whole population
 - Given by: $E = \sum_T w_T H_T$
where equivalent dose to tissue or organ, H_T , is weighted by dimensionless tissue weighting factor w_T .
- Effective dose concept applies only to dose levels in radiology and nuclear medicine and is **NOT** appropriate to assess dose levels in radiation therapy.



Population dose estimation

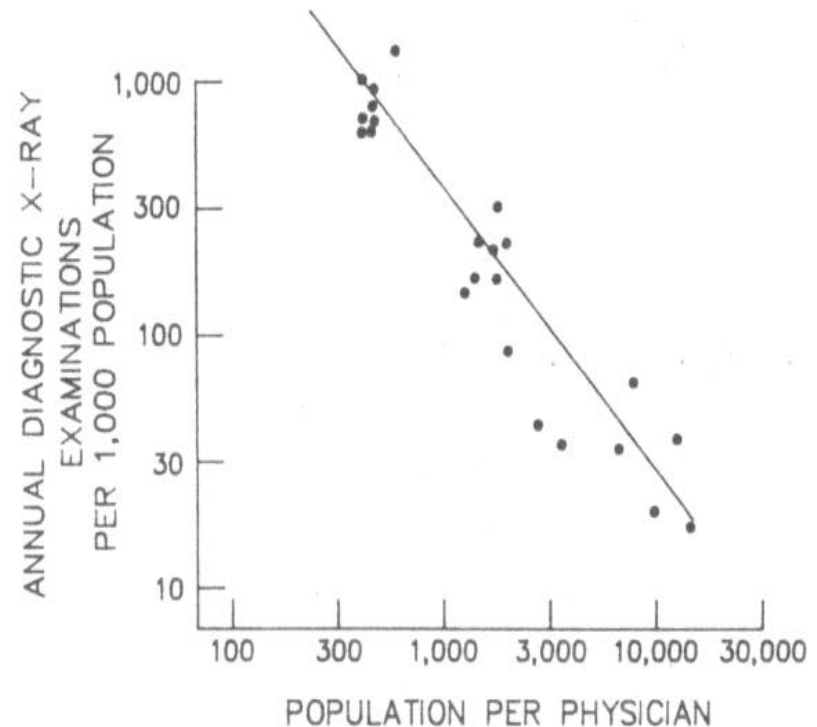
- ***S (Collective effective dose)*** is summation, over all types of examinations, of mean effective dose (E_e) for specific examination type multiplied by number of examinations (n_e)
 - Given by: $S = \sum E_e n_e$
 - n_e = number of annual frequencies (expressed as number of examinations per 1,000 population)
- "It is possible...to use effective dose and even collective dose for medical diagnostic exposure as long as this is done only for comparative purposes and for the same or similar patient populations, and it would require additional considerations or significant corrections if we try to use them to compare with other populations." [UNSCEAR 2000, page 297]



Health Care Levels (HCL) classification

Analytical model to extrapolate to a global level of medical radiological exposures

- To estimate the frequency of medical radiation usage on a worldwide basis
- Grouping of countries by health care systems / levels
- Number of **physicians per population** correlates with the number of medical radiological devices and procedures



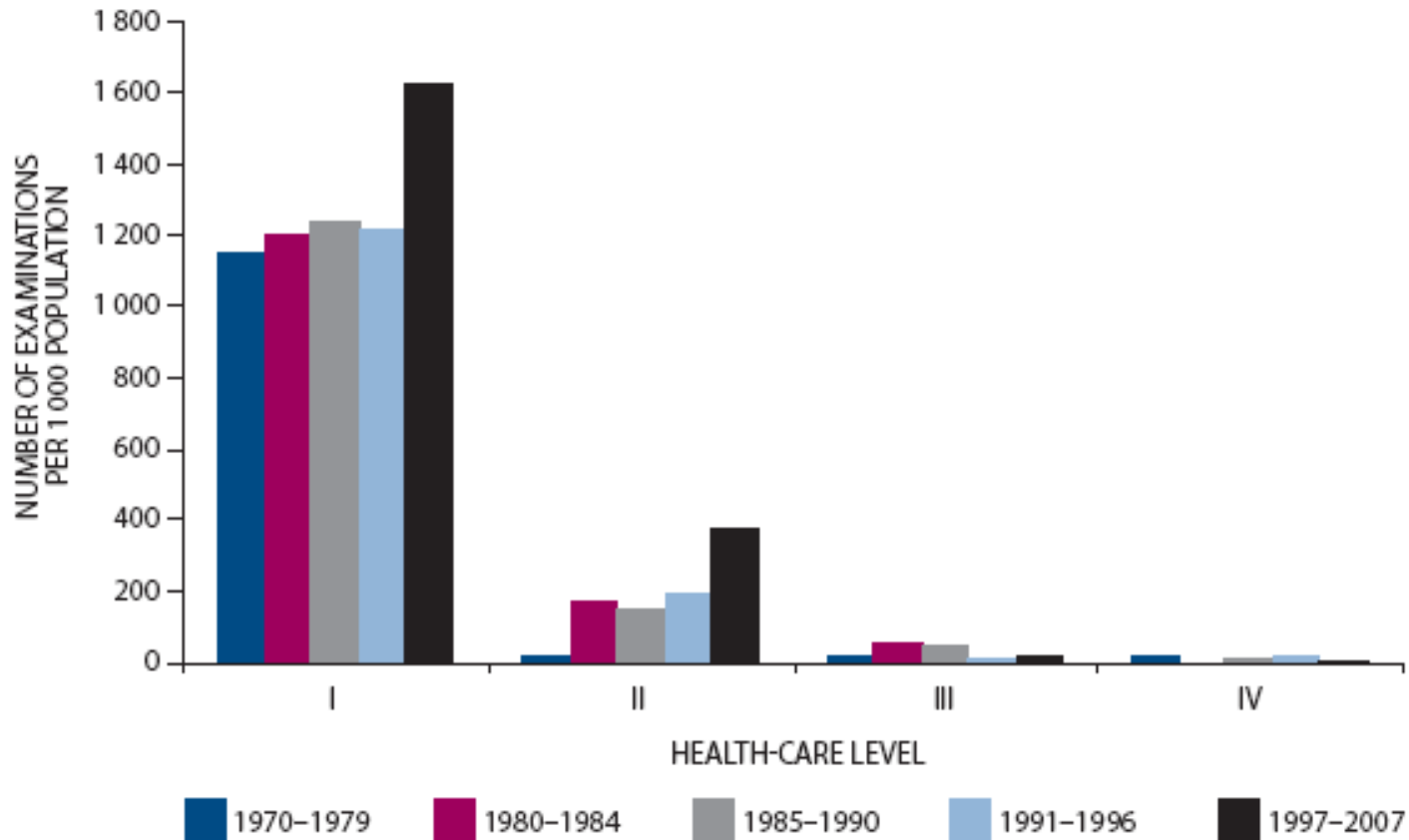
[Mettler et al.: Analytical Modelling of Worldwide Medical Radiation Use. Health Physics. 52(2):133-141, 1987]

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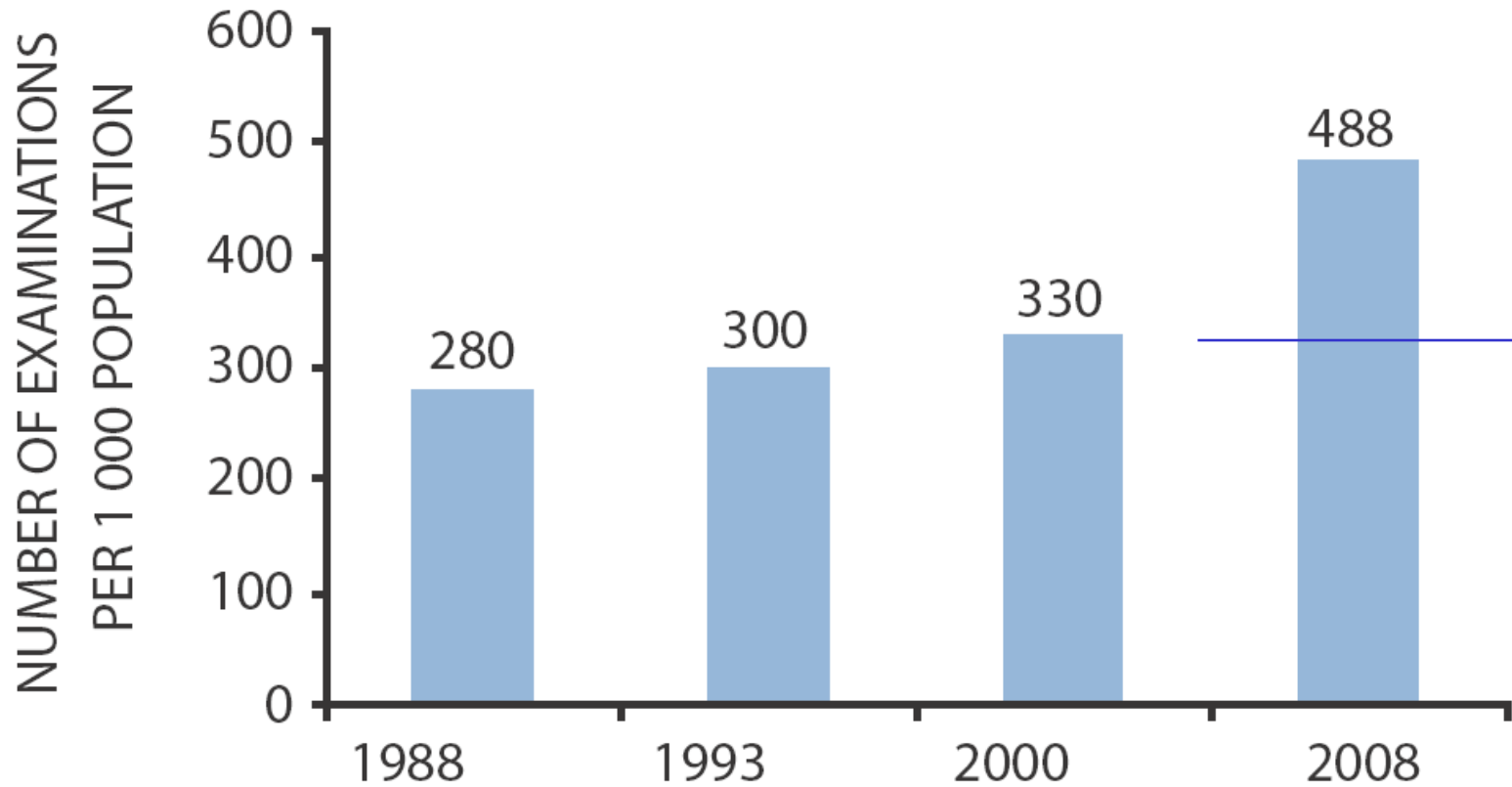
Diagnostic radiology: Trend in annual frequency by HCL



[UNSCEAR 2008 Report] (Evaluation period 1997-2007)



Diagnostic radiology: Trend in annual frequency



UNSCEAR SURVEY

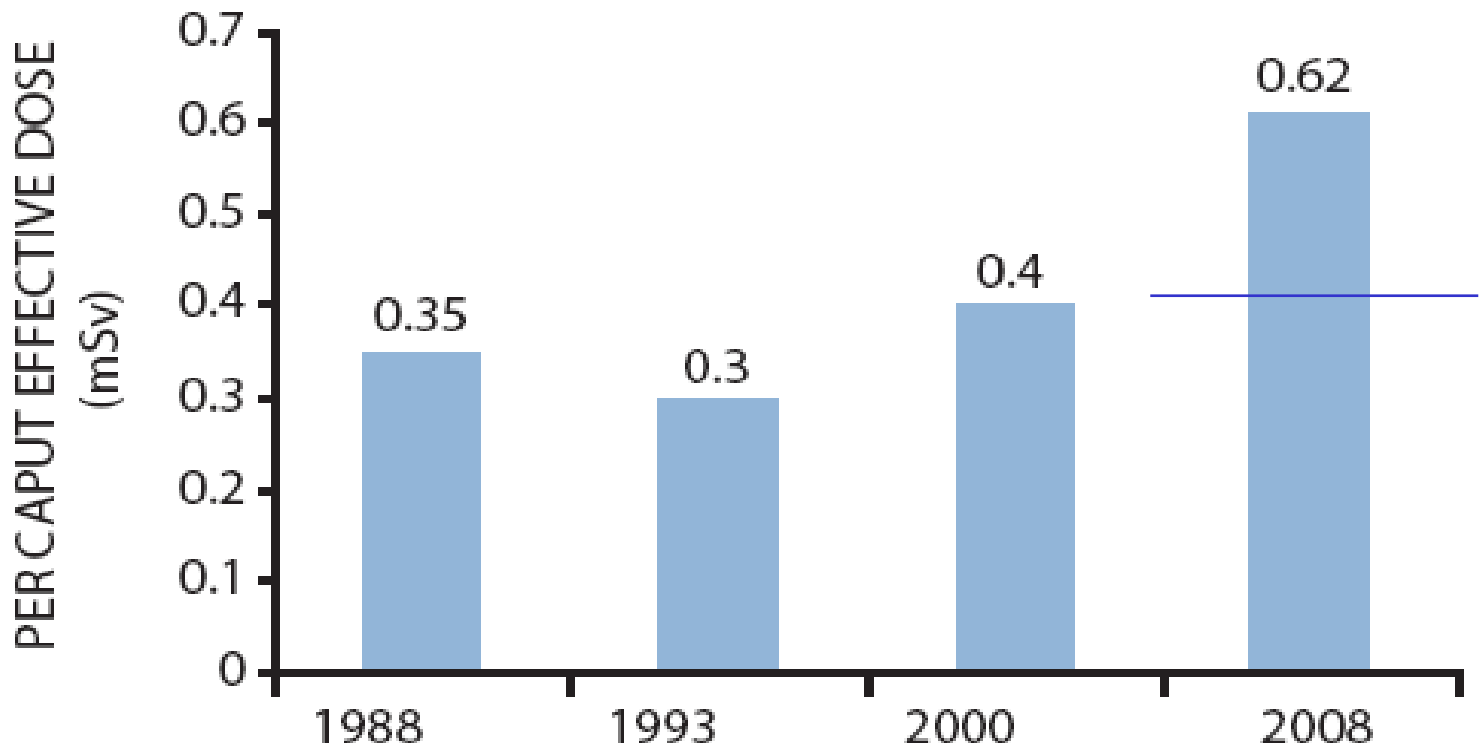
[UNSCEAR 1988, 1993, 2000, 2008 Reports]

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Diagnostic radiology: Trend in per caput effective dose

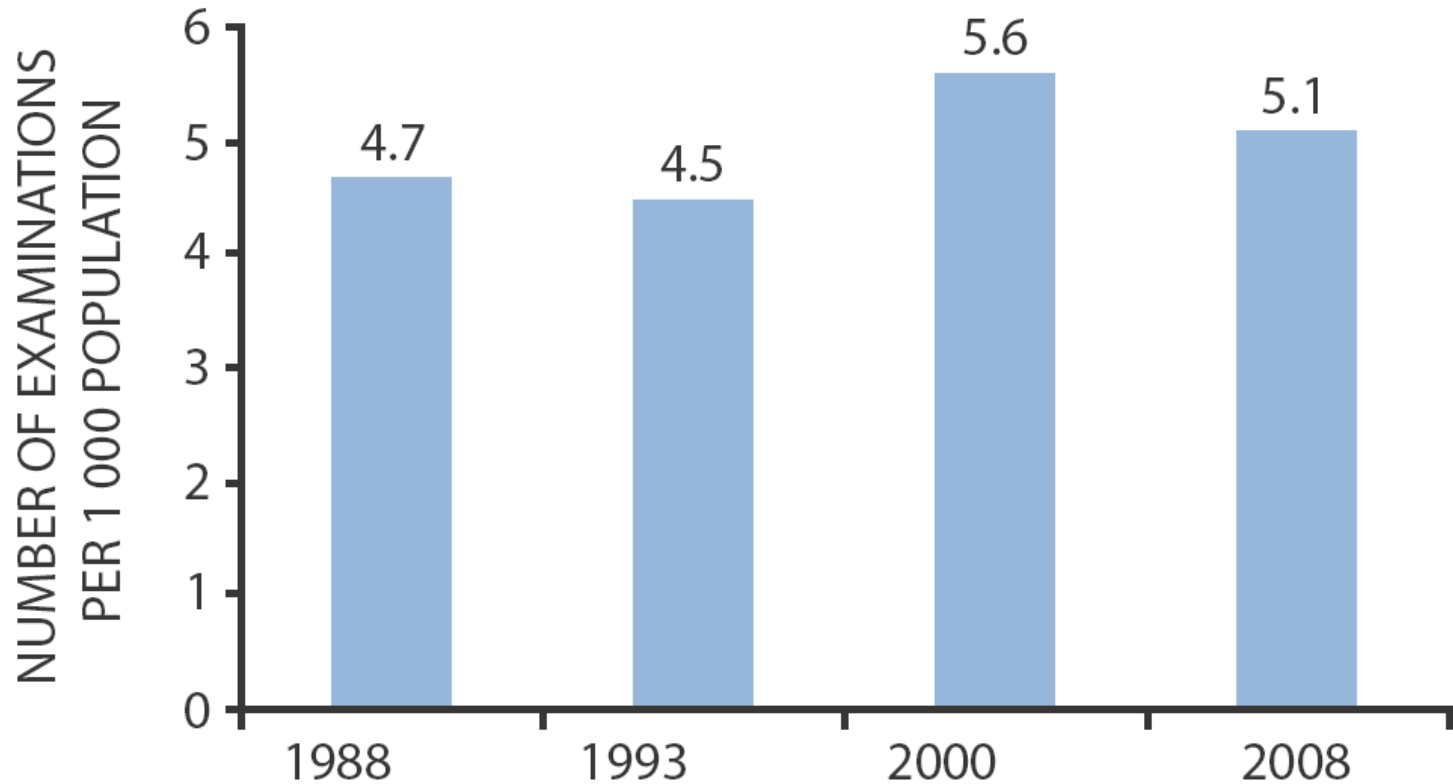


UNSCEAR SURVEY

[UNSCEAR 1988, 1993, 2000, 2008 Reports]



Nuclear medicine: Trend in annual frequency

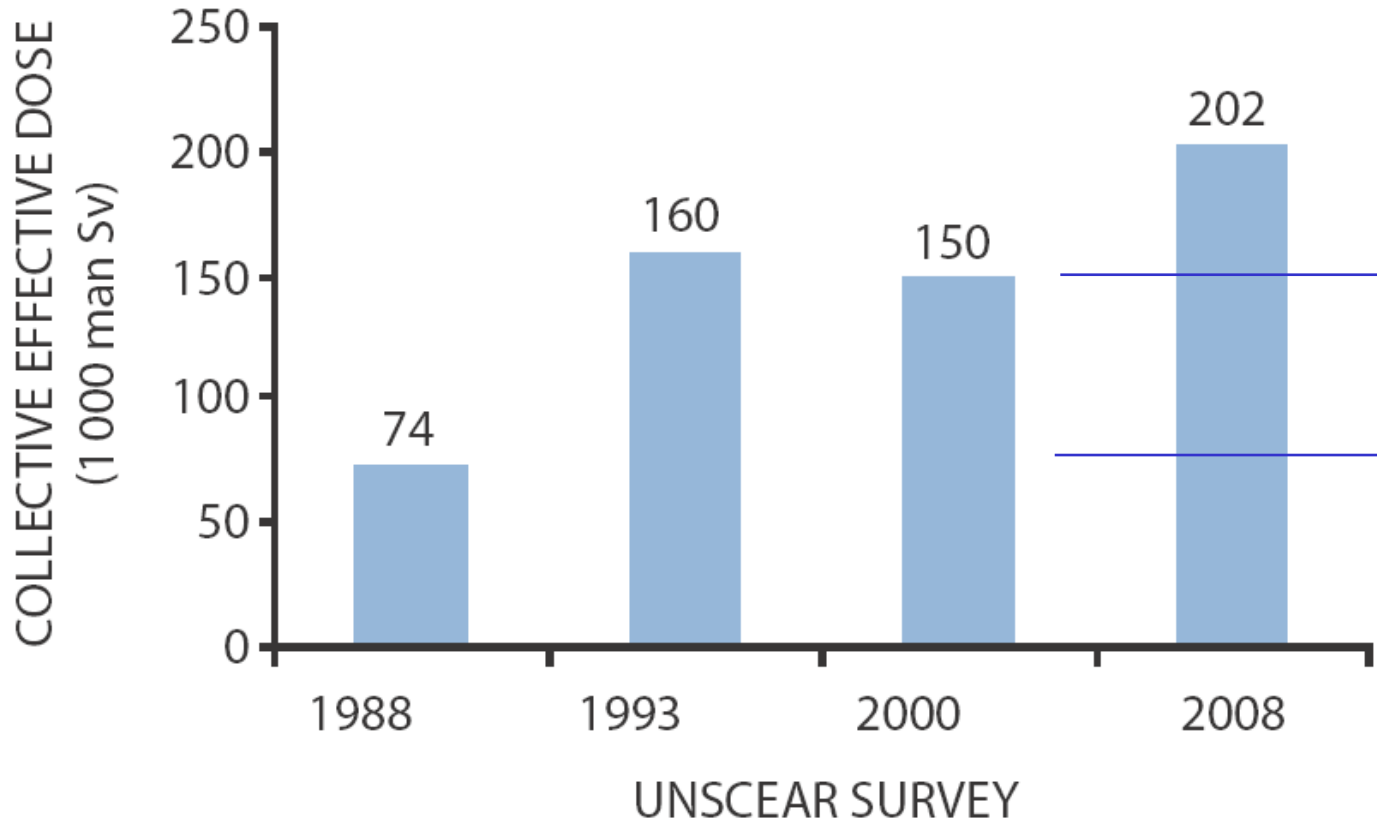


UNSCLEAR SURVEY

[UNSCLEAR 1988, 1993, 2000, 2008 Reports]



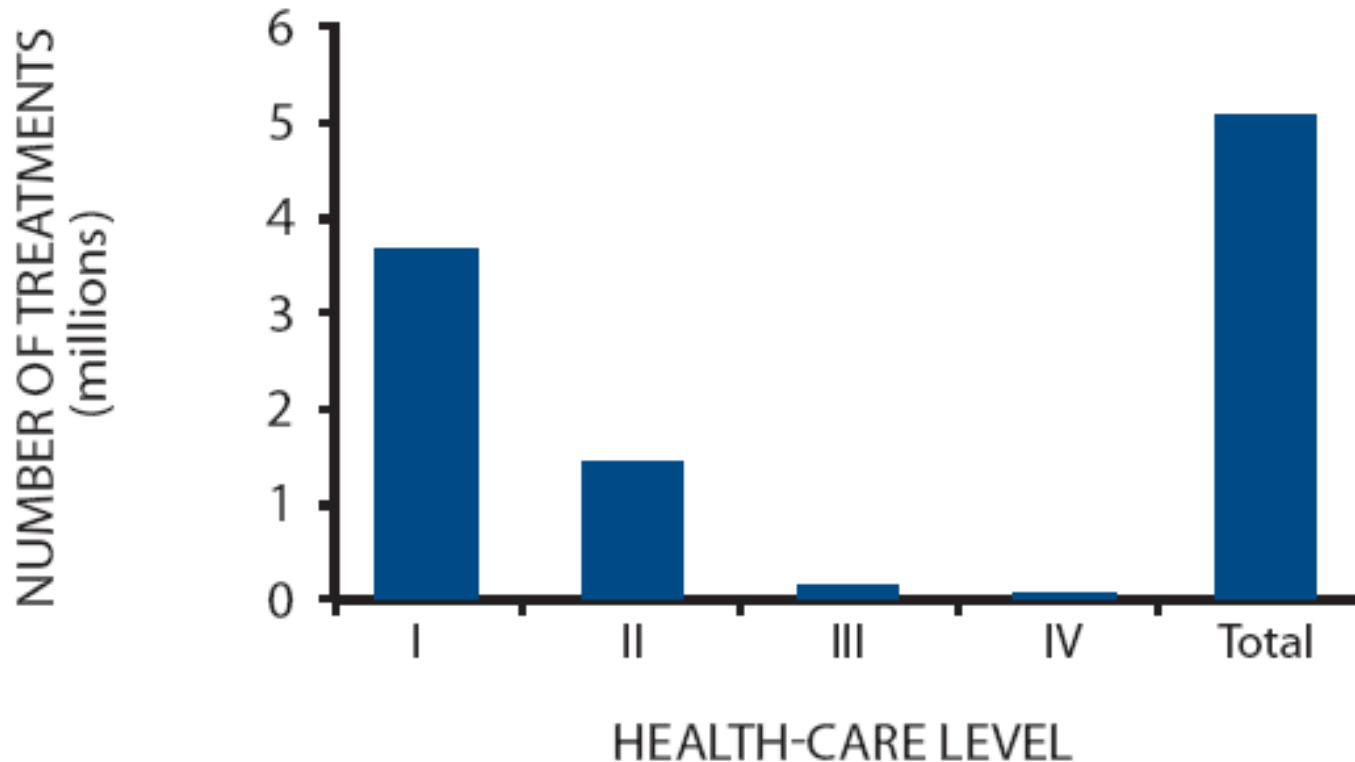
Nuclear medicine: Trend in annual collective dose



[UNSCEAR 1988, 1993, 2000, 2008 Reports]



Radiotherapy: Annual number of treatments per HCL



[UNSCEAR 2008 Report] (Evaluation period 1997-2007)



Conclusions



- Medical exposure remains by far largest artificial source of exposure and continues to grow significantly.
- Distribution of medical exposures is uneven among countries and regions:
24% of world population receive:
 - Two-thirds of all diagnostic examinations;
 - 90% of all nuclear medicine procedures;
 - 70% of total radiation therapy treatments.



Conclusions



- The overall collective effective dose from diagnostic radiology has doubled since 1988 because of greater use of CT scanning mainly in HCL I countries with a tendency for further increase in rest of the world.
- Even if annual frequency of diagnostic nuclear medicine procedures has remained fairly constant since 1988, its contribution to collective effective dose has tripled, due to introduction of high-dose cardiac studies as well as increase in ‘hybrid’ (PET/CT and SPECT/CT) imaging systems.



Future perspectives



UNSCEAR's new Global Medical Exposure Survey starts in 2013 based on a strategy to improve data collection elaborated with WHO and IAEA.

Some elements of the strategy:

- (i) standardize taxonomy and terminology of the survey;
- (ii) translate questionnaire into other official UN languages;
- (iii) develop electronic solution for data collection;
- (iv) focus on most significant examinations and procedures in terms of their contribution to population dose;
- (v) establish small standing expert group on medical exposure;
- (vi) review health care level methodology for better extrapolation.



Thank you for your attention



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