DIAGNOSTIC REFERENCE LEVELS IN X-RAY AND NUCLEAR MEDICINE PROCEDURES IN FRANCE: EVOLUTION OF COLLECTED DATA AND COLLECTION TOOLS.

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Introduction

The French Diagnostic Reference Levels in France:

Definition of the first DRLs in 2004 (12th February order):
• Based on European DRLs (EUR 16260, 16261, 16262) after validation of measurements in representative radiology and CT departments,
• Based on marketing authorizations (« AMM ») for nuclear medicine,

Radiology: DRL in ESD and DAP (single view, numerical values only for ESD) for 9 adult and 8 pediatric examinations

CT: DRL in CTDI\textsubscript{w} and DLP (single sequence) for 4 adult examinations

NM: DRL in total administered activities for 10 adult examinations

Professionals must evaluate the “doses” delivered to 30 patients each year for 2 examinations chosen in the “DRL” order list and compare the results to national DRL values
IRSN and DRLs

Who is the IRSN?

- The Institute for radiation protection and nuclear safety is a public organization in charge of research and expertise in the field of RP and NS, separated from control and regulatory functions.

What is the role of IRSN in DRLs?

- Data collection
- Advice and assistance to professionals
  - Hotline and mail: +33.(0)1.58.35.98.62 / nrd@irsn.fr
  - DRL dedicated web-site: http://nrd.irsn.fr/
  - Dose calculation tool for radiology: MICADO (V2 in 2012)
- Periodical reports
Analyses and recommendations

Aims of the periodical reports

- Assessment of the implementation of the regulation by the professionals
- Assessment of the distribution and frequency of the types of examinations
- Analyses of the “doses” values: 75\textsuperscript{th} percentile or average, min, max,…
- Recommendations in order to update the DRL regulation, concerning:
  - Examinations list
  - Dosimetric quantities
  - Numerical values of the DRLs

Anteriority and issue of reports

- Two reports were published since 2004 (available at http://nrd.irsn.fr/, in French). The 2009-2010 data analyze is in progress
Results

Regulation implementation

- Important increase from 2004 to 2008
- Slight increase between 2008 and 2010 for CT and NM
- Decrease in diagnostic radiology since 2008
Results

Examinations distribution

Diagnostic radiology

- Chest (PA): 27.5%
- Pelvis (AP): 18.1%
- Lumbar spine (PA/AP): 14.9%
- Abdomen (AP): 11.9%
- Lumbar spine (LAT): 8.4%
- Chest (LAT): 7.7%
- Breast: 6.2%
- Skull (AP): 1.5%
- Skull (LAT): 1.2%
- Chest (PA) 5y: 0.9%
- Skull (LAT) 5y: 0.5%
- Pelvis (AP) 0-1y: 0.5%
- Others adult: 0.2%
- Abdomen 5y: 0.2%
- Chest (AP) 0-1y: 0.1%
- Others: 0.03%
Results

Examinations distribution

- **CT**
  - Chest: 29%
  - Brain: 36%
  - Abdomen: 4%
  - Abdomen-Pelvis: 5%
  - Chest-Abdomen-Pelvis: 5%
  - Pelvis: 1%
  - Others: 0%
Results

Examinations distribution

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>99mTc Bone</td>
<td>24%</td>
</tr>
<tr>
<td>99mTc Lung perfusion</td>
<td>11.8%</td>
</tr>
<tr>
<td>99mTc Myocardial perfusion (rest and tress)</td>
<td>11.2%</td>
</tr>
<tr>
<td>18F Positron emission tomography</td>
<td>10.5%</td>
</tr>
<tr>
<td>99mTc Thyroid</td>
<td>5.4%</td>
</tr>
<tr>
<td>99mTc Left ventricular ejection fraction</td>
<td>4.8%</td>
</tr>
<tr>
<td>201Tl Myocardial perfusion (rest and stress)</td>
<td>4.3%</td>
</tr>
<tr>
<td>99mTc Brain perfusion</td>
<td>4.3%</td>
</tr>
<tr>
<td>123I Thyroid</td>
<td>4.3%</td>
</tr>
<tr>
<td>99mTc Kidney (DTPA/MAG3)</td>
<td>0.6%</td>
</tr>
<tr>
<td>99mTc Kidney (DMSA)</td>
<td>0.4%</td>
</tr>
<tr>
<td>111In Somatostatin analogs</td>
<td>4.1%</td>
</tr>
</tbody>
</table>
Results

Examinations distribution

- The distributions are comparable with examinations frequency in France
- Some examinations are frequently performed but not represented in the DRL regulation
- Some examinations of the DRL order list are no longer performed
Results

Examples of dosimetric analyses

Diagnostic radiology & CT

- Distributions of DRL data are plotted for each examination
- The relevant quantities are calculated (75th percentile, average, min/max, percentage above the DRL)
- The evolution of these quantities is reviewed
Practical consequences

24th October 2011: the first regulation update

Examinations list

- Some examinations were removed (skull in RD, single pelvis or abdomen in CT) and others added (hip, cervical and dorsal spine in RD; lumbar spine, AP and CAP in CT)
- Pediatric examinations were introduced in CT and NM

DRL dosimetric quantities

- Introduction of DAP values in radiology
- \( \text{CTDI}_w \) has been replaced by \( \text{CTDI}_{\text{vol}} \) in CT

DRL numerical values

- Numerical values of DRL has been decreased for 14 examinations
- When the results of analyses were not statistically significant or above the DRL value, the initial DRL was maintained
How do we collect the data?

From 2004 to 2011

- Forms (MS word® sheets) designed by IRSN:
  - Professionals filled the forms with a pen or a computer and send it by postal mail, fax or e-mail
  - IRSN captured the data in MS excel® sheets for posterior analyze

- Consequently:
  - No control during the capture by the professionals: many field were not filled or filled with wrong values
  - A lot of time lost to contact professionals and capture the data a second time

Since 1st March 2011

- A web access software and database is used for data transmission: https://basenrd.irsn.fr

- 3 parts in the software:
  - Users front-office
  - Administrator front office
  - Administrator back-office
Why and how a web-access tool?

Why?

- Enhancement of data's quality
  - No more re-capture at IRSN
  - Automatic controls of sufficiency and coherence of the data
- Reducing the time dedicated to capture by IRSN in order to increase:
  - Data analyses
  - Communication and exchange with professionals
- Availability of automatic tools for:
  - Help in data analyses
  - Feedback of information to users

How?

- A long time project:

  Specifications: Sept. 2008
  Choice of the software developer: Jun. 2009
  Acceptance & Commissioning: Jul. 2010

  1st March, 2011

- Updates:
  - Periodical evolutions of the tool taking into account the feedback
Conclusions and perspectives

**DRLs definition**
- Based on analyses of IRSN, the regulation was updated taking into account the national practice
- This first update is a starting point and the future objective is to periodically update the DRLs with a shortest frequency (about every two years)

**DRL data collection**
- The web-access database will allow IRSN to:
  - Cope with the expected increase of data transmission in the future
  - Strengthen support to users in order to encourage them to transmit data every year
- A progressive accommodation of the users:
  - More than 1300 departments have already transmitted data during the first year
Many thanks for your attention

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