Occupational doses in Interventional Cardiology – experiences in obtaining worldwide data as part of the ISEMIR project

International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry

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The ISEMIR project

• Information System on Occupational Exposure in Medicine, Industry and Research
  • Based on the experience of a network of Nuclear Power Plant operators
  • A database containing operational occupational doses at a detailed level is very helpful for:
    • Comparing doses for specific occupations and functions
    • Assessing the impact of specific radiation protection actions
    • Following dose trends

A tool for the implementation of ALARA
The ISEMIR project

- Set up in January 2009 for a 3 year period, to help improve occupational radiation protection in targeted areas

- First targeted area is Interventional Cardiology
  - Working Group on Interventional Cardiology (WGIC), Feb 2009
WG on Interventional Cardiology

• Aims include:
  • Worldwide overview of occupational exposures in Interventional Cardiology
  • Establish a system for regular collection of occupational doses in IC
    • Improve implementation of optimization of occupational radiation protection in IC
WGIC activities – 2009

• Worldwide overview
  • Included a Questionnaire sent to Regulatory Bodies
    • Questions included
      • Dose data for IC personnel
      • Requirements for monitoring
        • Number of dosimeters
        • Wearing position(s)
## Contacts & Responses

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
<th>RB contacted</th>
<th>RB responses</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>35</td>
<td>35</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>29</td>
<td>37</td>
<td>17</td>
<td>46</td>
</tr>
<tr>
<td>Europe</td>
<td>49</td>
<td>49</td>
<td>26</td>
<td>53</td>
</tr>
<tr>
<td>Latin America</td>
<td>21</td>
<td>21</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>North America</td>
<td>2</td>
<td>49</td>
<td>23</td>
<td>47</td>
</tr>
<tr>
<td><strong>Global</strong></td>
<td><strong>136</strong></td>
<td><strong>191</strong></td>
<td><strong>81</strong></td>
<td><strong>42</strong></td>
</tr>
</tbody>
</table>
### Dose data – availability of usable data

- **Occupational doses** of workers in Interventional Cardiology in 2008

<table>
<thead>
<tr>
<th>Region</th>
<th>% of responses with usable dose data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>40%</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>53%</td>
</tr>
<tr>
<td>Europe</td>
<td>50%</td>
</tr>
<tr>
<td>Latin America</td>
<td>40%</td>
</tr>
<tr>
<td>North America</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Global</strong></td>
<td><strong>36%</strong></td>
</tr>
</tbody>
</table>
Reasons for non-availability of usable dose data

• Data not available
  • No central dose register
  • Dose register, but not readily accessible by RB

• Data available, but not “useful”
  • No specific classification for IC
  • Mixed corrected & uncorrected doses
  • Only doses above some action level available
## IC occupational dose data - 2008

<table>
<thead>
<tr>
<th></th>
<th>No of countries</th>
<th>No of persons</th>
<th>Annual effective dose (mSv)</th>
<th>Average country median</th>
<th>Average country Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians</td>
<td>23</td>
<td>1432</td>
<td></td>
<td>0.73 ± 0.62</td>
<td>1.09 ± 0.69</td>
</tr>
<tr>
<td>Other professionals</td>
<td>17</td>
<td>825</td>
<td></td>
<td>0.76 ± 0.68</td>
<td>1.10 ± 1.09</td>
</tr>
</tbody>
</table>
Distributions of country median & third quartile annual effective doses for physicians and for other personnel, in 2008
Are these values truly representative?

- Published values suggest a typical range 1 - 4 mSv per year
- Reported values from survey probably under-estimate true values
Why might they be an under-estimate?

- Interventional cardiologists may not wear their dosimeter(s) all the time
- Other reasons include
  - Interventional cardiologists may perform procedures in more than 1 facility
Regulatory requirements for monitoring in IC

• ~ 60% of RBs stated that they specify the number and position of dosimeters

• Of these:
  • 20% specify 2 dosimeters
    • 1 above and 1 below the apron
  • 40% specify 1 dosimeter
    • Most (~ 80%) above the apron
  • 40% did not provide information

No consistent approach to the number of dosimeters or their position
• Implications for establishing a world-wide IC dose database
  • RBs probably not the best source of dose data
  • Compliance with wearing dosimeters is an issue
Future regular dose data collection in IC

- Discussed at the 2\textsuperscript{nd} WGIC meeting, Oct 2009

- Data collection method
  - IC facilities directly
    - Better identification of persons, occupations, roles
    - Better control over the dosimetry
    - Some scope for assessing compliance with being monitored
  - Need to convince the facilities re the added value of participating

- Initial pilot test Dec 2009 – Jan 2010
3rd WGIC meeting, 1-3 March 2010

• Discussion of initial pilot test – 8 IC facilities
  • Asia-Pacific – 2
  • Europe – 2
  • Latin America – 2
  • North America – 2

• Despite a WGIC member “presence” there were difficulties with the data
  • Number of procedures
  • Compliance with wearing dosimeters
  • Administrative doses
### Initial pilot test – doses per procedure

<table>
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<tr>
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<th>$H_p(10)$ over apron per procedure</th>
<th>(μSv / procedure)</th>
</tr>
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<tr>
<td></td>
<td>Mean ± SD</td>
<td>(Range)</td>
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<td>8 IC Facilities</td>
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<td>Interventional Cardiologists (66)</td>
<td>15.4 ± 22.3</td>
<td>(0.0 – 115.0)</td>
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<td>Electrophysiologists (32)</td>
<td>12.1 ± 16.1</td>
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<td>15.4 ± 22.3 (0.0 – 115.0)</td>
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<td>Good compliance with being monitored</td>
<td>36.2 ± 24.3 (7.1 – 115.0)</td>
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<td>12.1 ± 16.1 (0.0 – 63.3)</td>
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<tr>
<td>Good compliance with being monitored</td>
<td>22.8 ± 19.6 (8.9 – 63.3)</td>
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Extended pilot test – April 2010 to early 2011

- Expanded to include a larger number of IC facilities to try to quantify:
  - Can IC personnel dose data be obtained directly from IC facilities?
  - Are the data sufficiently robust?
Interim results from the extended pilot test

- 16 IC facilities
  - 5 Asia-Pacific
  - 6 Europe
  - 3 Latin America
  - 2 North America
### Estimates of annual effective doses - 2009

<table>
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<tr>
<th>Interventional Cardiologists (284)</th>
<th>Effective dose per year (mSv)</th>
<th>Mean ± SD (range)</th>
<th>Median</th>
</tr>
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<tr>
<td></td>
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<td>1.5 ± 2.4 (0 – 15.6)</td>
<td>0.4</td>
</tr>
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| Electrophysiologists (44)         |                                | 1.3 ± 2.1 (0 – 9.7)   | 0.2    |
Interventional Cardiologists - annual effective dose vs workload

200 ± 50 procedure per year, 33 ICs
Annual effective dose (mSv):
  Average = 1.94 ± 2.41
  Median = 0.98
  Range: 0 – 10.3
20% had “zero” dose
Conclusions

• 2009 Survey of RBs showed
  • For a world-wide IC dose database
    • RBs are probably not the best source of dose data
    • Compliance with wearing dosimeters is an issue

• Interim results of 2010 Pilot Test show
  • Dose data can be obtained directly from IC facilities
    • Compliance with wearing dosimeters is still an issue

• You are invited to participate in this project:
  • Recruiting interventional cardiology facilities
  • Please visit ISEMIR web pages on IAEA ORPNET website, or
  • Email: John.Le.heron@iaea.org
Thank you