Physician Trainee Knowledge Of Radiation Risks Associated With Diagnostic Imaging: A Survey Of ACGME Accredited Residents And Fellows At A Large Academic Medical Center

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Arvind Vijayasarathi MD MBA MPH¹
Richard Duszak Jr. MD²
Thaddeus Hollingsworth MD²
Rondi Gelbard MD³
Mark Mullins MD PhD²

¹UCLA Dept. of Radiological Sciences
²Emory Dept. of Radiology & Imaging Sciences
³Emory Dept. of Surgery
*Authors have no financial disclosures
The link between diagnostic imaging and carcinogenesis is an important patient safety issue.

Ionizing radiation exposure from medical imaging has increased over the past 30 years as CT and nuclear stress tests have become widespread.

While radiation risk assessment remains controversial, scientific consensus holds that radiation protection should assume a “linear no threshold” model.

Even low doses of ionizing radiation could potentially increase the risk of cancer.
Introduction

- Patients undergoing diagnostic imaging exams may have concerns regarding radiation safety.
- In the academic setting, physician trainees (interns, residents, and fellows) often place orders for diagnostic imaging exams.
- Similarly, physician trainees are in a position to discuss the potential risks of radiation with their patients.

AIM:

- To evaluate radiation safety knowledge of postgraduate physician trainees across a variety of specialties.
Materials & Methods

- IRB Exempt Status (Emory University IRB)

- Study population:
  - 1,238 interns, residents and fellows enrolled in ACGME accredited programs at Emory University as of May 2016

- Survey Design:
  - Produced on SurveyMonkey and distributed via email to Emory University Graduate Medical Education listserv.
  - Survey instrument was based on a previously published survey regarding physician knowledge of the costs of imaging.
Materials & Methods

- **Survey Instrument:**
  - Queried respondents for basic demographic information
  - Asked respondents about their prior education related to radiation risk during medical school and training programs
  - Asked respondents to estimate relative radiation exposure for the following studies according to the ACR Relative Radiation Level Scale:
    - Whole body PET/CT scan
    - Dissection protocol CT chest abdomen pelvis
    - MRI Lumbar Spine
    - CT abdomen pelvis with and without contrast
Materials & Methods

- Survey Instrument (cont’d):
  - Respondents were also asked to:
    - Estimate the radiation dose of a chest CT relative to a chest radiograph.
    - Estimate the lifetime relative risk of a radiation induced malignancy for a 25 year old undergoing a CT of the abdomen & pelvis.
    - Choose the appropriate imaging exam to investigate pulmonary embolism in a pregnant patient
Data Analysis:

Statistical Analysis was largely derived from a previously published survey regarding physician knowledge of the costs of imaging.

Answers to the demographic questions were summarized by frequencies.

Answers to the radiation safety portion of the survey were coded as dichotomous responses (correct vs. incorrect).

Incorrect responses pertaining to radiation dose/risk assessment were further categorized into over and underestimates.

Materials & Methods
### Results

Table 1: Response rate and respondent characteristics

<table>
<thead>
<tr>
<th>Survey Response Categories</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Survey Recipients</td>
<td>1238</td>
</tr>
<tr>
<td>Returned Surveys</td>
<td>270 (21.8)</td>
</tr>
<tr>
<td>Incomplete Surveys</td>
<td>24 (1.9)</td>
</tr>
<tr>
<td>Completed Surveys</td>
<td>246 (20)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Level of Training</th>
<th>Number of respondents (%)</th>
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<tbody>
<tr>
<td>PGY 1</td>
<td>48 (19.5)</td>
</tr>
<tr>
<td>PGY 2</td>
<td>50 (20.3)</td>
</tr>
<tr>
<td>PGY 3</td>
<td>40 (16.2)</td>
</tr>
<tr>
<td>PGY 4</td>
<td>51 (20.7)</td>
</tr>
<tr>
<td>PGY 5</td>
<td>38 (15.4)</td>
</tr>
<tr>
<td>PGY 6</td>
<td>14 (5.7)</td>
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<td>PGY 7</td>
<td>4 (1.6)</td>
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<table>
<thead>
<tr>
<th>Status</th>
<th>Number of respondents (%)</th>
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<tbody>
<tr>
<td>Intern</td>
<td>54 (22)</td>
</tr>
<tr>
<td>Resident</td>
<td>145 (58.9)</td>
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<tr>
<td>Fellow</td>
<td>47 (19.1)</td>
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<table>
<thead>
<tr>
<th>Medical School &amp; Residency Education</th>
<th>Number of respondents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participated in a Radiology elective in medical school</td>
<td>142 (57.7)</td>
</tr>
<tr>
<td>Radiation safety education during preclinical years</td>
<td>97 (39.4)</td>
</tr>
<tr>
<td>Radiation safety education during clinical years</td>
<td>98 (39.8)</td>
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</tbody>
</table>

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<tr>
<th>Physician perception of radiation safety</th>
<th>Number of respondents who agree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>It would have been beneficial to have more radiation safety teaching in medical school</td>
<td>168 (68.3)</td>
</tr>
<tr>
<td>I possess adequate radiation safety knowledge to care for and counsel patients</td>
<td>126 (51.2)</td>
</tr>
</tbody>
</table>
Results

Figure 1: Respondents’ Estimates of Relative Radiation Level
Results

Figure 2: Responses to Radiation Risk Questions
Results

- 47.8% (470/984) of radiation dose estimates across four commonly performed imaging studies were correct.
- 50% (123/246) of respondents correctly estimated the radiation dose of a chest CT relative to chest radiograph.
- 29.7% (73/246) correctly estimated the lifetime relative risk of a radiation induced malignancy for a 25 year old undergoing a CT abdomen pelvis.
- 31.3% (77/246) of respondents correctly chose the appropriate imaging exam to investigate pulmonary embolism in a pregnant patient.
- 11.8% (29/246) of respondents correctly estimated the background lifetime incidence of cancer in the United States.
Limitations

- Single site survey
- Limited to physician trainees
- Potential for non-responder bias, given an overall completed response rate of 20%
- Risks of carcinogenesis related to radiation are controversial.
- While questions were written to emulate patient concerns, they may not accurately reflect the way clinicians counsel their patients regarding radiation safety.
Conclusions

- Postgraduate physician trainees demonstrate a limited awareness of radiation safety, and may be unable to adequately address the concerns of their patients.

- Nearly half of trainees consider their radiation safety knowledge inadequate, and approximately two thirds desire more focused education.

- Targeted medical school education and integration of relative radiation dose information into clinical decision support tools / computerized order entry systems could help address this knowledge gap.
References

- Poot, JD, Hartman MS, and Daffner RH. Understanding the US Medical School Requirements and Medical Students’ Attitudes about Radiology Rotations. Academic Radiology, Volume 19, Issue 3, March 2012, Pages 369–373.
- A study of general practitioners’ knowledge of ionizing radiation from diagnostic imaging examinations.