Research in Radiation Protection

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Aims of presentation

• To present the importance of research in Radiation Protection.
• To facilitate for literature review for research in Radiation Protection.
• To present examples of research in Radiation Protection in literature.
• To discuss some research findings by IIUM students related to radiation protection.
Overview of Research

• **Definition:** a systematic and scientific investigation to establish facts.

• **Re-search:** to search again / to reexamine

• To enhance our understanding of certain body of knowledge.

• To communicate the understanding gained to others.

• Research areas - development, testing, evaluation, re-evaluation, contribute to / or enhance and expand generalizable knowledge.
Overview of Radiation Protection

- **All measures** taken to reduce risks to ionising radiations to patient, staff and general public.

- Radiation effects (deterministic and stochastic) are health concerns. Deterministic effects occur at threshold level while Stochastic effects can happen without any threshold level.
Measures as outlined by European guidelines

- The European Guidelines address the three important inter-related aspects of radiation protection:
  - the diagnostic quality of the radiographic image is obtained at the lowest possible radiation dose to the patient with respect to the choice of radiographic technique.

No unnecessary repeat required.
Importance of research in Radiation Protection

• Professional Obligation to look for ways to reduce radiation risks to patients.
• The right of the patient for a safe practice
• Meeting patient expectation and satisfaction
• Changing technology – Health Technology Assessment
• Professional commitment
• Fulfilling religious obligation
Literature search / review

• Perhaps the most important before starting the research proper.

Search:

- Books
- Official documents
- Journals
- online searches
Books

• Library
  - request assistance from the librarian
  - provide him with ISBN number
  - inter-library loan

Specific books:
http://www.amazon.com/ - example
http://www.barnesandnoble.com/

Free online resources

http://www.onlinebooks4free.com/menu/medicine.html
Journals

• Hardcopy – subscription: Radiology, BJR etc
• On-line
  1. Pubmed: example: radiation protection in CT scanning – related articles
Other online journals

- Springer
- American Association of Physicists in Medicine - http://www.aapm.org/
- Health Technology assessment at www.hta.ac.uk
Areas of research in Radiation protection – as derived from Pubmed – as on 18\textsuperscript{th} July 2009

- **Keyword:**
  - Radiation protection : 24311
  - Radiation protection in medical imaging – 3795
  - Radiation protection in medicine – 3482
    - reviews
    - experimental
    - occupational exposure
    - radiographic guidelines
Radiation protection in medicine

- Reviews


Reports


Specific topics

• Pediatric CT radiation dose: how low can you go? Cohen MD. *AJR Am J Roentgenol*. 2009 May;192(5):1292-303


• Professional issues

Strategies for dose reduction


Practice


Clinical Trials


Dose and Image Quality


Dose / Diagnostic reference levels


Optimisation in imaging


Four recommendations have been made to lower patient doses; these are: (1) an increase in applied potential to a minimum of 90 kVp; (2) a film-screen sensitivity of 400; (3) optimization of processor performance and (4) regular radiological audits to reduce repeat rates to a level of 5%. If all of these recommendations are followed, an estimated overall entrance surface dose saving of 53% would result. Changing the applied potential alone will see the variation in the mean entrance surface dose from non-gridded systems reduce from a factor of 4 to a factor of 2.
Publications

• Optimization of the radiological protection of patients undergoing radiography, fluoroscopy and computed tomography
  IAEA, VIENNA, 2004

Available online.
General Education


Some research by IIUM students:

- Yusraa Kasim: Bismuth shielding in CT Brain- An Image analysis (2008)- study using CATPHAN using 4 ply bismuth shielding. Results: Shielding only one side. If shielding opposing sides, artefacts will be produced.

Implications: Possibilities for dose reduction in CT head examinations using bismuth.

Future work: perform on head phantom and if possible to validate for human subjects.
Mazlina Haja Mydin: Effect of magnification and minification on carpal bones images in CR systems (2008)

- using electronic minification and magnification of carpal bones – minified not less than 0.9 times or magnified not more than 1.8 times

- for certain abnormalities of scaphoid #, bone lesions and bone mineralisation best visualised at 1.2 times magnification.

- Dislocations and osteoarthritis 1.8 times magnification is suggested.
• Suraya Sulaiman Khan : Adjusting the Table height in CT Scanning: Effects on image quality (2008)

• Using CATPHAN

• Results: High resolution, low contrast detectability and image uniformity is best at table height 145cm.

• Future work: How this finding can be translated to Image quality and dose to the eyes in CT brain as well as specific lesions to the other parts of the human anatomy.
• Zanariah bt. Mohd: Radiation Protection Policy used for women of childbearing age who undergo pelvic region irradiation - A survey across various radiology departments in central region of peninsular Malaysia.

• 10 private hospitals.

• 80% of the departments surveyed has written radiation protection policies.

• 50% did not follow the 10 day rule for high dose examinations.

• Need for coordination / standardisation in radiation protection policy.
Summary

• Importance of research in radiation protection is very much relevant.
• Institutions should create avenues for a research culture at the work place.
How to do research?

• Identify the specific area to be researched.
  - through observation, questioning and critical thinking
  - list out the present state of affairs
  - list out what could be different to present state of affairs (hypothesis)
  - why is it important to research this area

• Try to forge collaboration with other institutions.
• Specify the objectives of the research
  - the general objective (usually only 1 objective)
    - the specific objectives (many)
    - the hypotheses to these objectives

• Conduct a literature search/literature review
  - to find out current state of affairs
  - to find out if the subject had been researched by others
    - to relate the findings of past research to the findings of the intended research
• Formulate the methodology
  - type of research: experimental, longitudinal etc
  - identify the data collection method: questionnaire etc
  - identify the statistical test to support the data generated.
• Presentation of results
  - Tables, figures, appendix as appropriate

• Discussion : based on the results
  - relate to existing knowledge
  - highlight the significance of the result
  - suggest how others should use the findings

• Conclusion : should relate to the objectives.