Non Medical Referrer IRMER Training Session

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A WARM WELCOME

09:00 – 09:05	Course Introduction
09:05 – 09:30	An Introduction to Ionising Radiation – Kate Rowe, DCH Medical Physics
09:30 – 10:30	Focus on IR(ME)R – Jim Thurston, DCH Medical Physics
10:30 – 10:50	IR(ME)R Referrer Responsibilities – Kate Lewins – DCH Diagnostic Imaging
10:50 – 11:00	Quiz and Feedback forms

HAVE YOU SIGNED THE ATTENDANCE SHEET?

All presentations may be found on the Non-Medical Referrers info page on DCH StaffNet

Presentations will be emailed out to all non-DCH staff following the session today

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Non Medical Referrers Training Session

FOCUS ON IONISING RADIATION

Kate Rowe
Clinical Scientist
Medical Physics

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Presentation topics

- The interaction of x-rays with the body
- Risks of ionising radiation
- Radiation legislation

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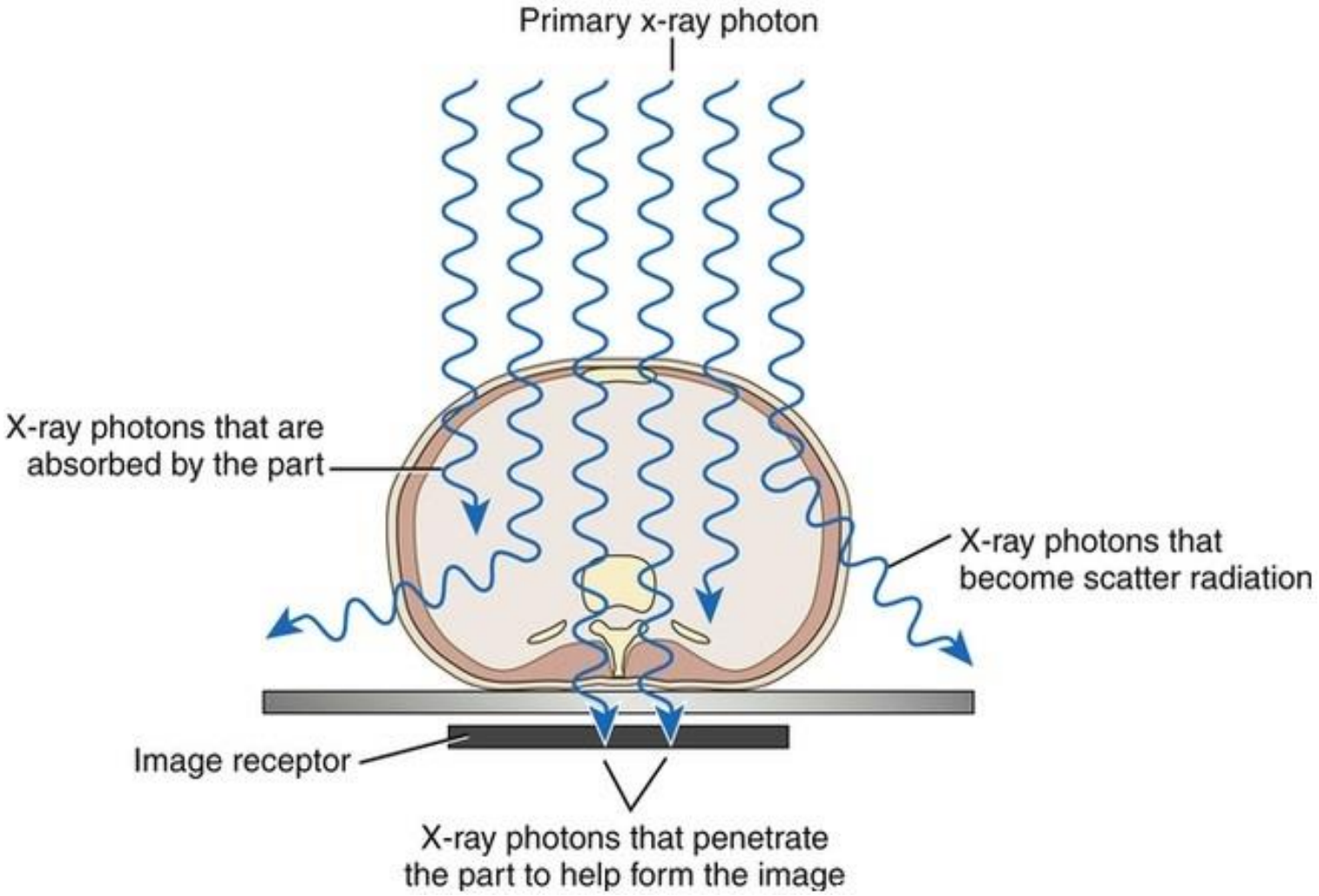
The interaction of ionising radiation with the tissues of the body

Medical Physics Department

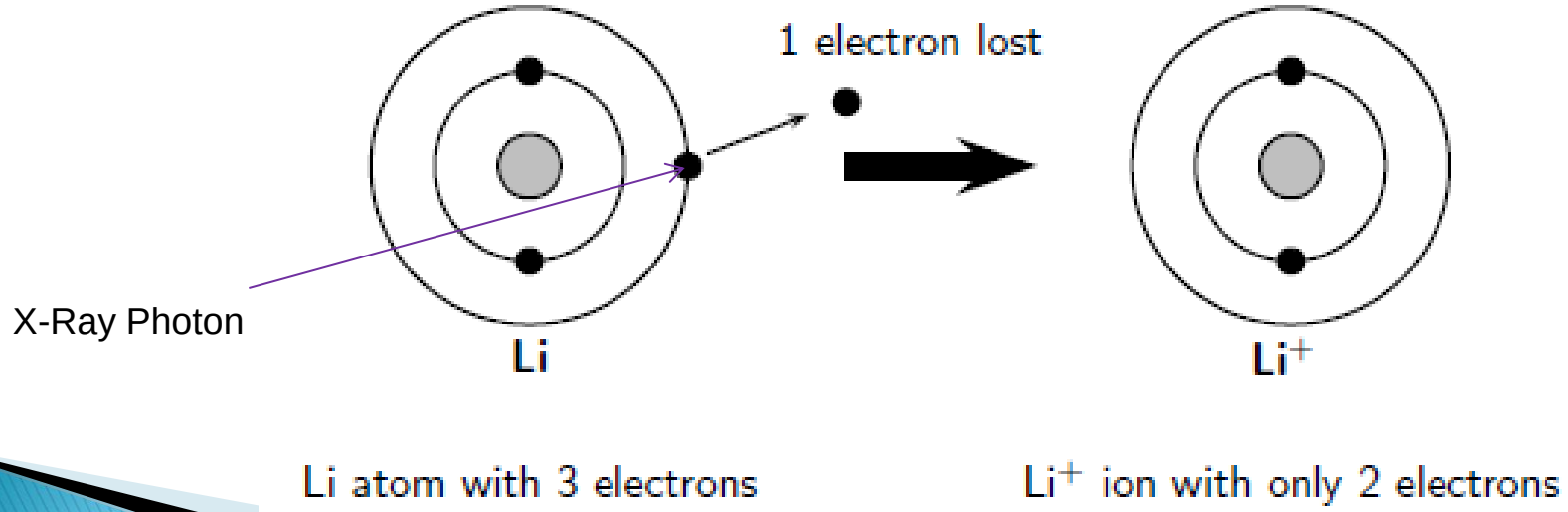
To be treated with caution!

The x-ray beam



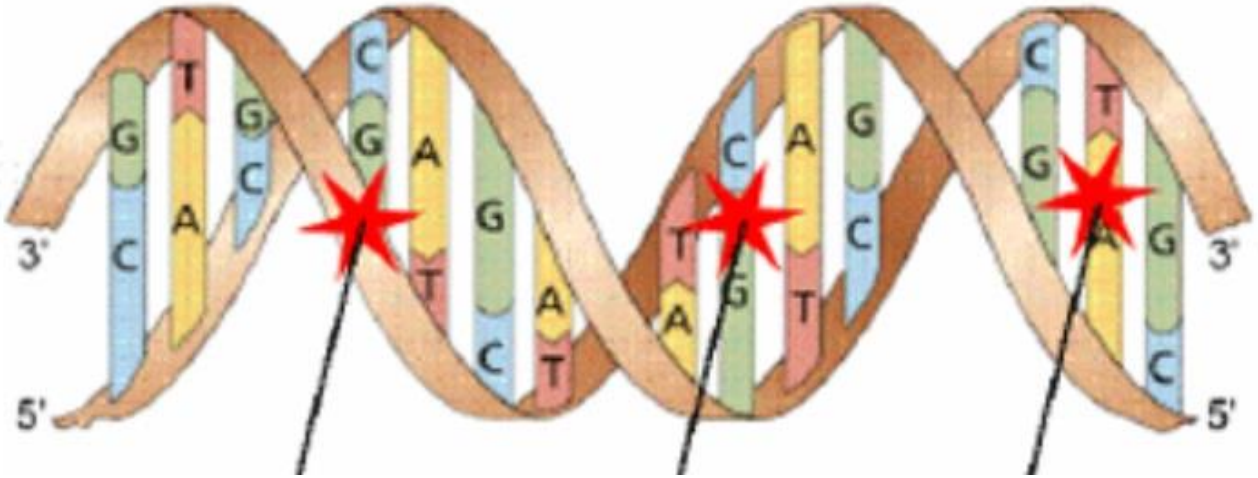
X-ray Interaction With Body Tissue

- A portion of the x-ray beam does not have enough energy to penetrate right through the body and its energy is absorbed by the body tissues.
- The energy of the beam will be absorbed by the body tissues in an effect called “Ionisation”. Affects the cells of the body on an atomic level.



The effect of ionising radiation on DNA

- DNA is particularly susceptible to the damaging effects of radiation – single and double strand breaks and damage to base pairs.



- DSB is a classic sign of radiation damage.
- When DNA is damaged, this can prevent or interfere with cell division so leading to cancers, leukaemia's and other blood changes.

X-ray Interaction With Body Tissue

- Some body tissues are more sensitive to the effects of ionising radiation.
- Dependant on the “Cell Reproducibility Rate” – areas where cells are rapidly dividing
- Cells with a higher CRR include the blood forming cells, the skin, foetal tissue, bone marrow, gonads and breast tissue
- Paediatrics are more vulnerable as they have more areas of cell division – growing!

Effects of ionising radiation

DETERMINISTIC EFFECTS

There is a threshold below which, effects will not occur

- Effects increase with dose
  - Erythema (skin reddening)
  - Epilation (hair loss)
  - Nausea/ vomiting

Can be likened to sunburn

Effects of ionising radiation

STOCHASTIC EFFECTS

- Governed by chance
- Radiation induced cancers:
  - Leukaemia
  - Solid Cancers
  - Genetic effects
- There are no ‘safe limits’, all doses carry some risk
- The greater the dose received, the greater the ***probability*** of the effect occurring.

Can be likened to smoking

X-ray doses in perspective

Unit of measure for radiation - SIEVERT – “Sv”

NATURAL BACKGROUND RADIATION DOSE

Background radiation for people living in Dorset averages 2.6 mSv (0.0026Sv) a year

GOING ON YOUR HOLS

Transatlantic Flight (London to New York) - 0.10 mSv

Radiation doses from imaging

Transatlantic Flight (London to New York) - 0.10 mSv

Examination	Dose*
Extremity X-ray	0.01 mSv
Chest X-ray	0.10 mSv
Spinal X-ray / Mammo	1.50 mSv
Barium swallow	6.0 mSv
CT Head	2.0 mSv
CT Abdomen/Pelvis	10 mSv

* Effective (whole body) dose

Balance of Risk vs Benefit

Examination	Risk of inducing a cancer
Extremity X-ray	< 1 in 1,000,000
Chest X-ray	1 in 1,000,000
Spinal X-ray / Mammo	1 in 10,000 to 1 in 100,000
Barium swallow	1 in 1,000 to 1 in 10,000
CT Head	1 in 10,000 to 1 in 100,000
CT Abdomen/Pelvis	1 in 500 to 1 in 1,000

Small risk compared to natural cancer risk of 1 in 2

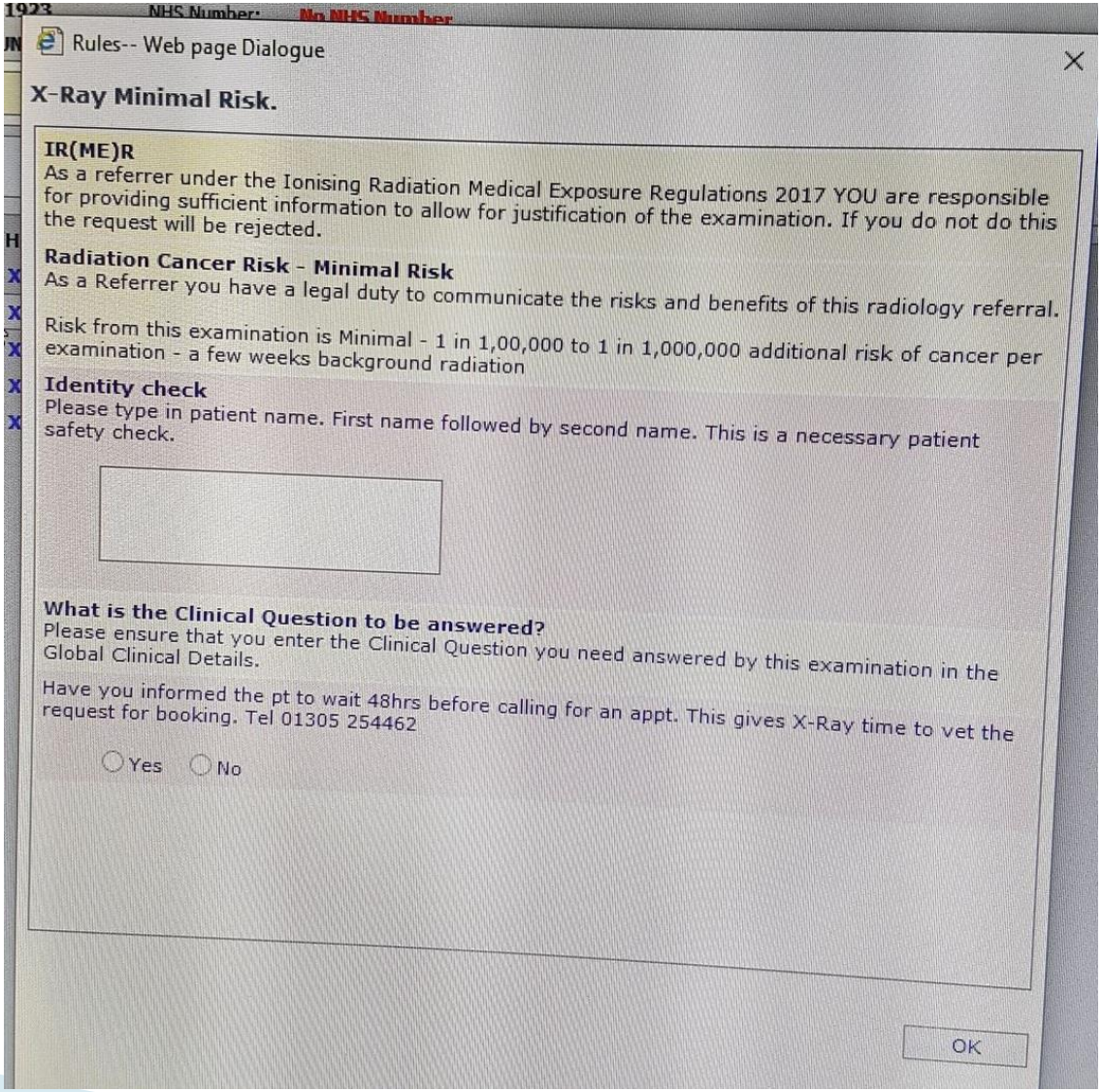
HOW DO WE COMMUNICATE THIS RISK TO OUR PATIENTS?

Balance of Risk vs Benefit

Examination	Risk of inducing a cancer
Extremity X-ray	Negligible Risk
Chest X-ray	Negligible Risk
Spinal X-ray	Minimal Risk
Barium swallow	Very Low Risk
CT Head	Very Low Risk
CT Abdomen/Pelvis	Low Risk

Another way of putting it?

ICE information

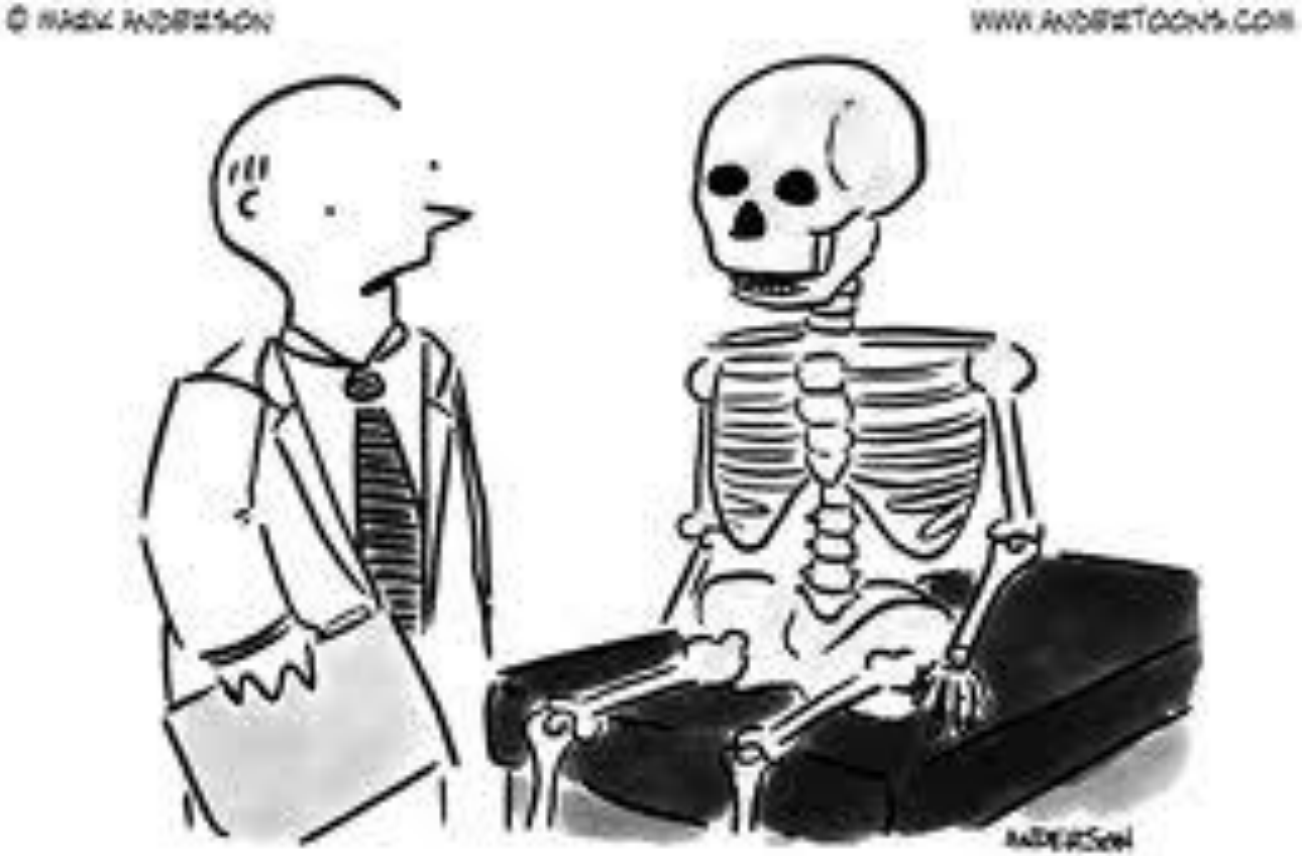


Background dose equivalent

Activity	Effective Dose	Background Dose Equivalent
Eating a banana 	0.1μSv	20 mins
Intra-oral dental x-ray	1μSv	1 day
Chest x-ray	20μSv	5 days
Flight to Hong Kong	50μSv	1 week
Mammogram	400μSv	2 months
Lumbar spine x-ray	600μSv	6 months
CT Head	1400μSv	8 months
Barium swallow	1500μSv	8 months
CT Chest/abdo/pelvis	10000μSv	4.5 years

What do you think it the best way to communicate risk and benefit?

Still with me?



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The legislation governing the use of medical ionising radiation

Medical Physics Department

Radiation and the law

There are two main regulations governing the use of ionising radiation in medicine – both form part of the Health and Safety at Work Act

- **Ionising Radiations Regulations 2017** – aimed at the protection of the public and health of staff who work with x-rays (HSE)
- **Ionising Radiations (Medical Exposure) Regulations 2017** – safety of patients – justification of requests, optimising services and limiting doses. Includes the area of research (CQC)

Both updated for implementation in 2018

Any Questions?

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