Staff and Patient Protection in Interventional Radiology: a UK Perspective

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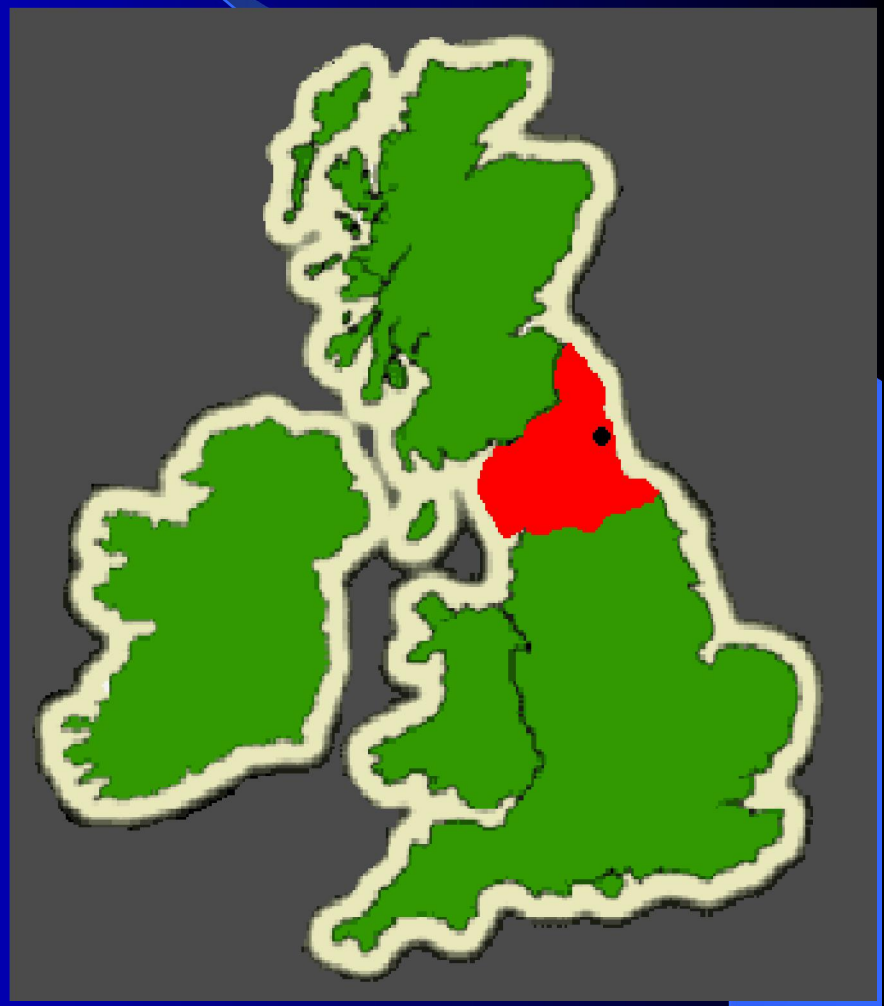
WHERE I AM FROM…

Newcastle upon Tyne



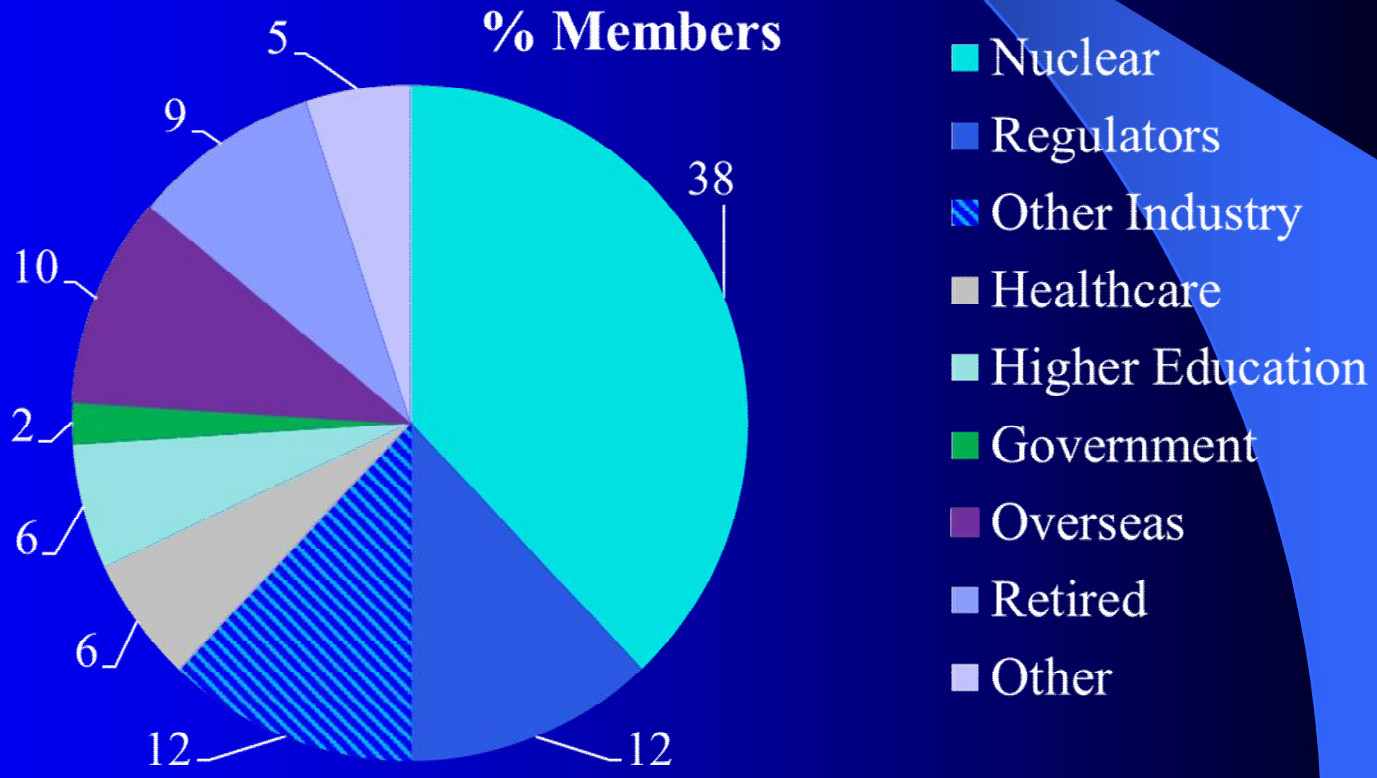
Newcastle upon Tyne Hospitals NHS Foundation Trust

- Providing services for > 250 yrs
- One of largest NHS Trusts in England
- Wide range of specialist services
- 6 Sites including Great North Children's Hospital
- Over 1800 beds
- Includes Cardiothoracic Centre & Major Trauma centre

Society for Radiological Protection

UK IRPA Affiliate Society

1600 members



INTERVENTIONAL RADIOLOGY IN UK

Contribution of Interventional Radiology dose in UK

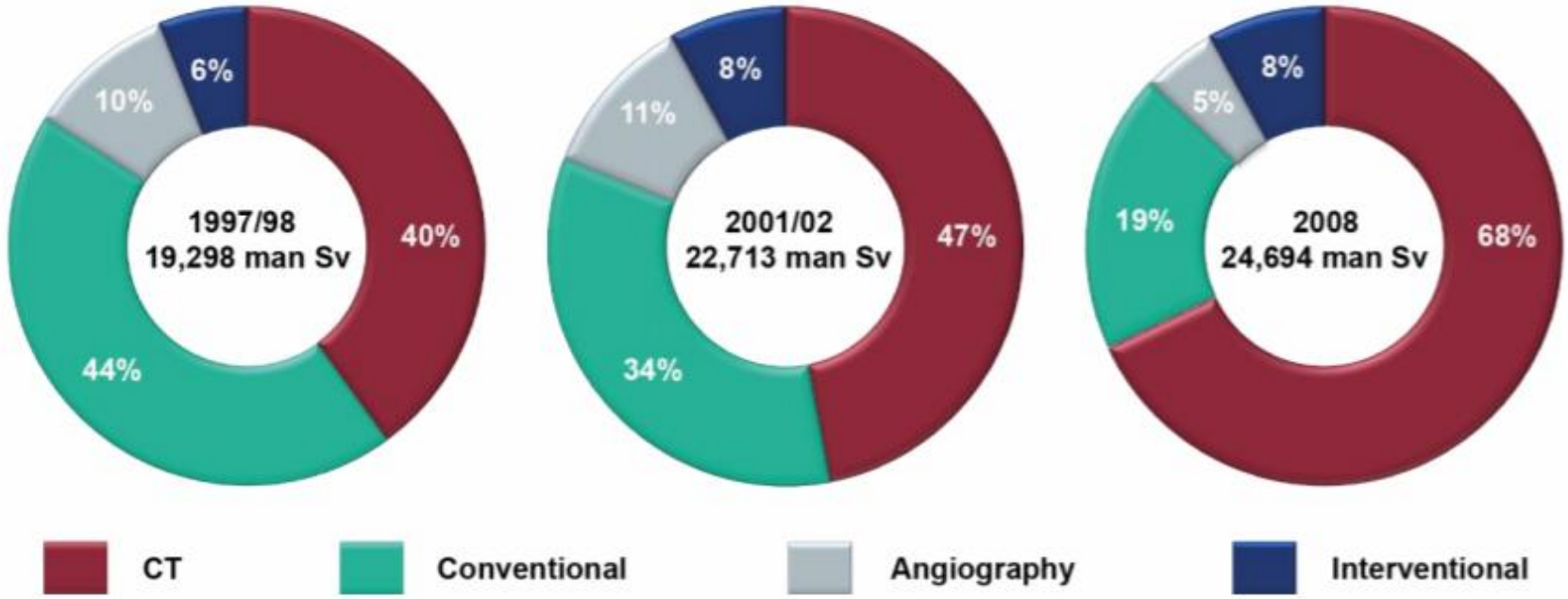


Figure 2: UK collective dose from different diagnostic radiology examinations carried out in the 1997/98 and 2001/02 financial years, and in the 2008 calendar year

From PHE-CRCE-026 (2016)

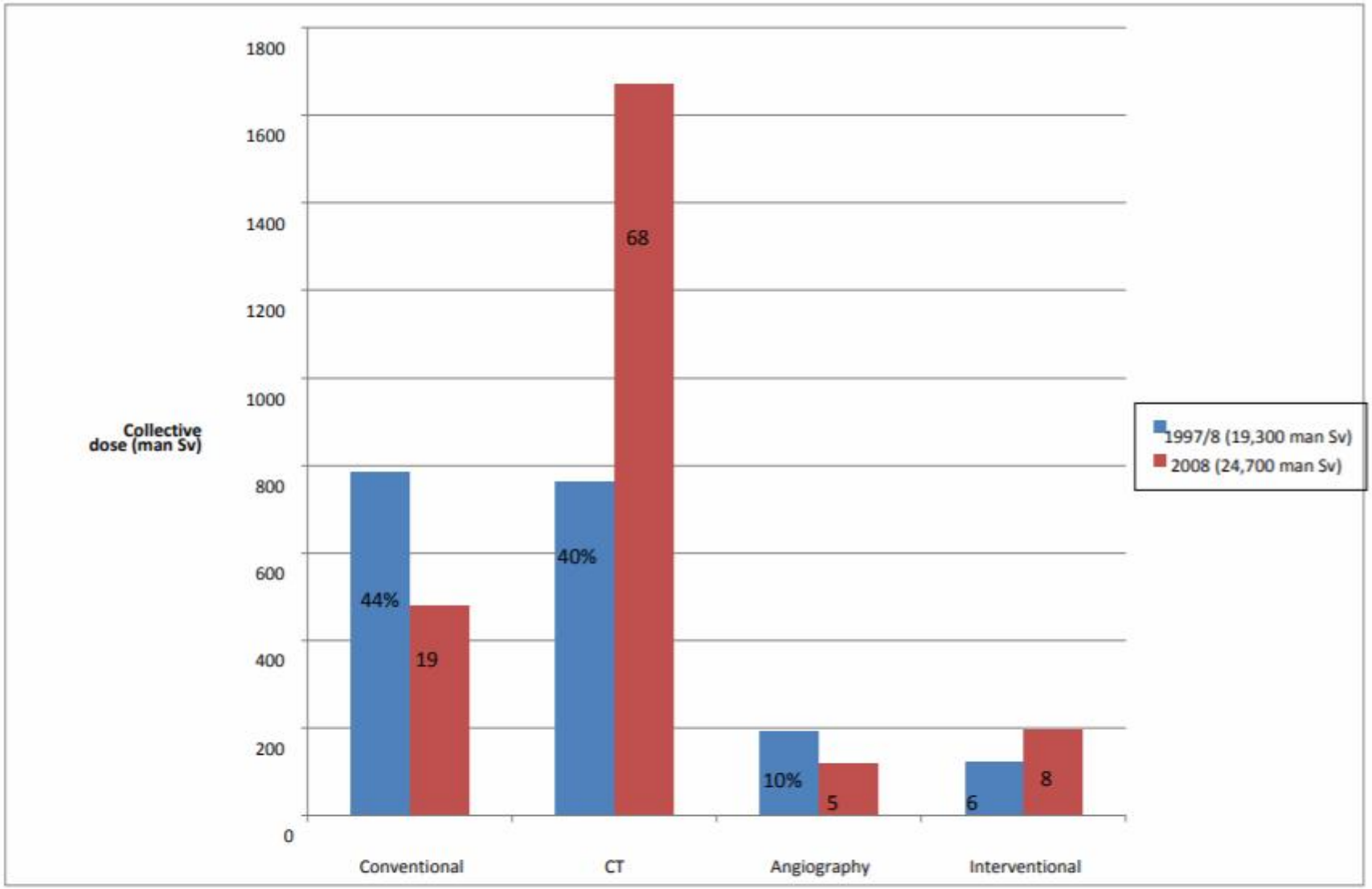


FIGURE 3 Comparison by broad type of contributions to UK collective dose from medical and dental X-ray examinations

Most frequent interventional procedures from national dose survey

- Percutaneous transluminal coronary angioplasty
- Pacemaker
- Facet Joint Injection
- Hickman Line Insertion
- Nephrostomy
- Biliary Intervention
- Oesophageal Stent

Highest dose procedures

From 2010 National Review

- Transjugular intrahepatic portosystemic shunt
- Embolisation of iliac artery
- Embolisation of mesenteric artery
- Stenting of abdominal aortic aneurism

REGULATORY CONTROL

UK Implementation of BSS

- Ionising Radiation Regulations 2017
  - Protection of Employees and the Public
- Ionising Radiation (Medical Exposure) Regulations 2017
  - Protection of the Patient

Key Implementation Issues for Interventional Radiology

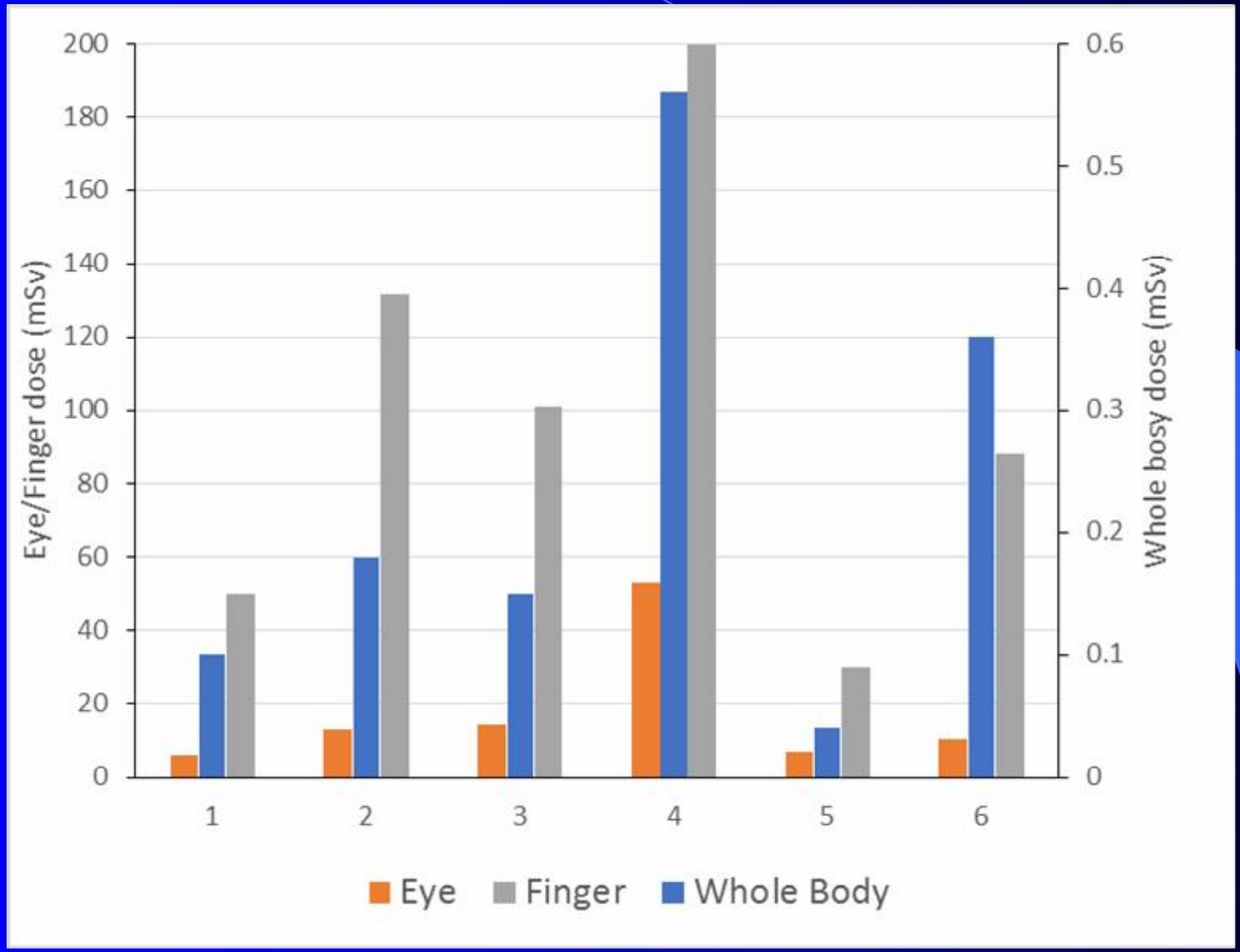
- Reduction in eye dose limit
  - Increased classification (at 15mSv)
  - Dosimetry problems
- Application of Diagnostic Reference Levels
- Risk/benefit information for patients

RADIATION PROTECTION OF STAFF

Dosimetry used

- **WHOLE BODY** – under apron
- **EYE** - variety of locations
  - Forehead
  - Collar
  - Stem of eyewear
  - Behind eyewear
- **FINGER** – Ring or finger tip dosimeters

Typical Doses (annual)



Dosimetry issues

- Formal eye dose as measured - no correction factors approved
- Infection control for ring dosimeters
- Multi-site working
- Poor culture for wear and return
- High loss rate

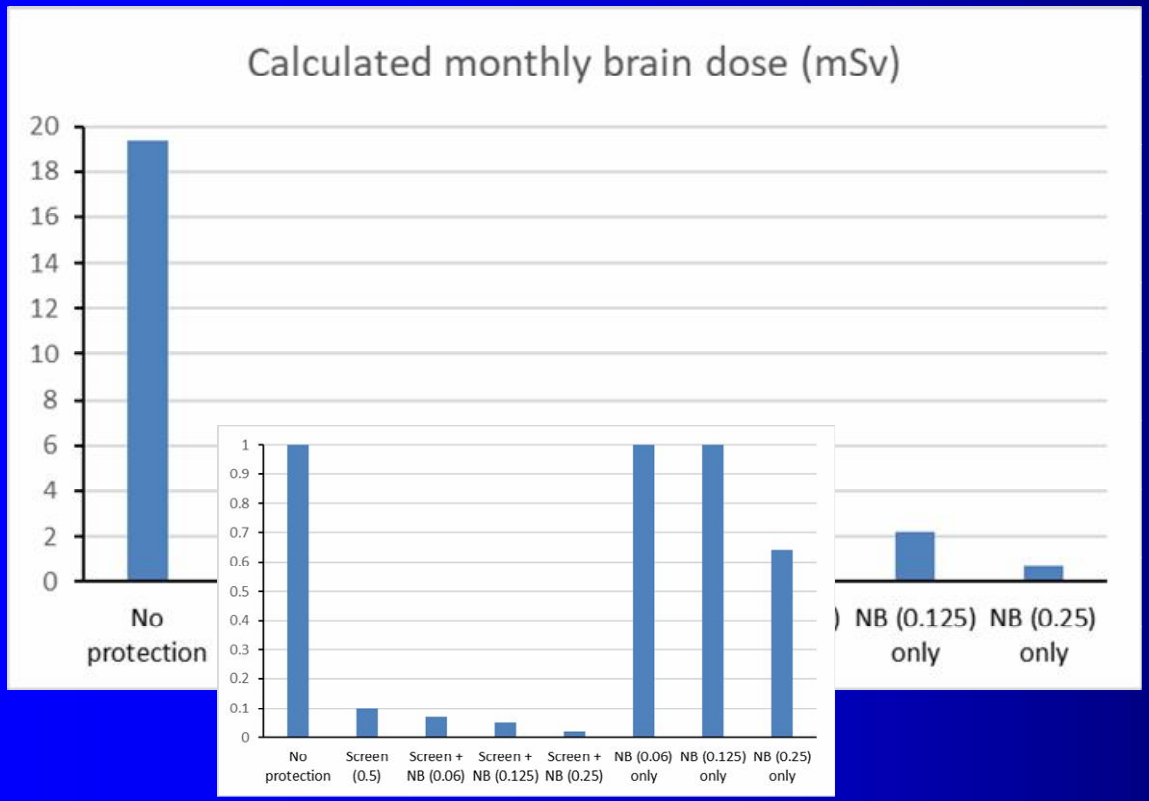
Influencing factors on measured eye dose

- Design of glasses
- Position of dosimeter
- Type of dosimeter
- Angle of head to patient
- Height of operator

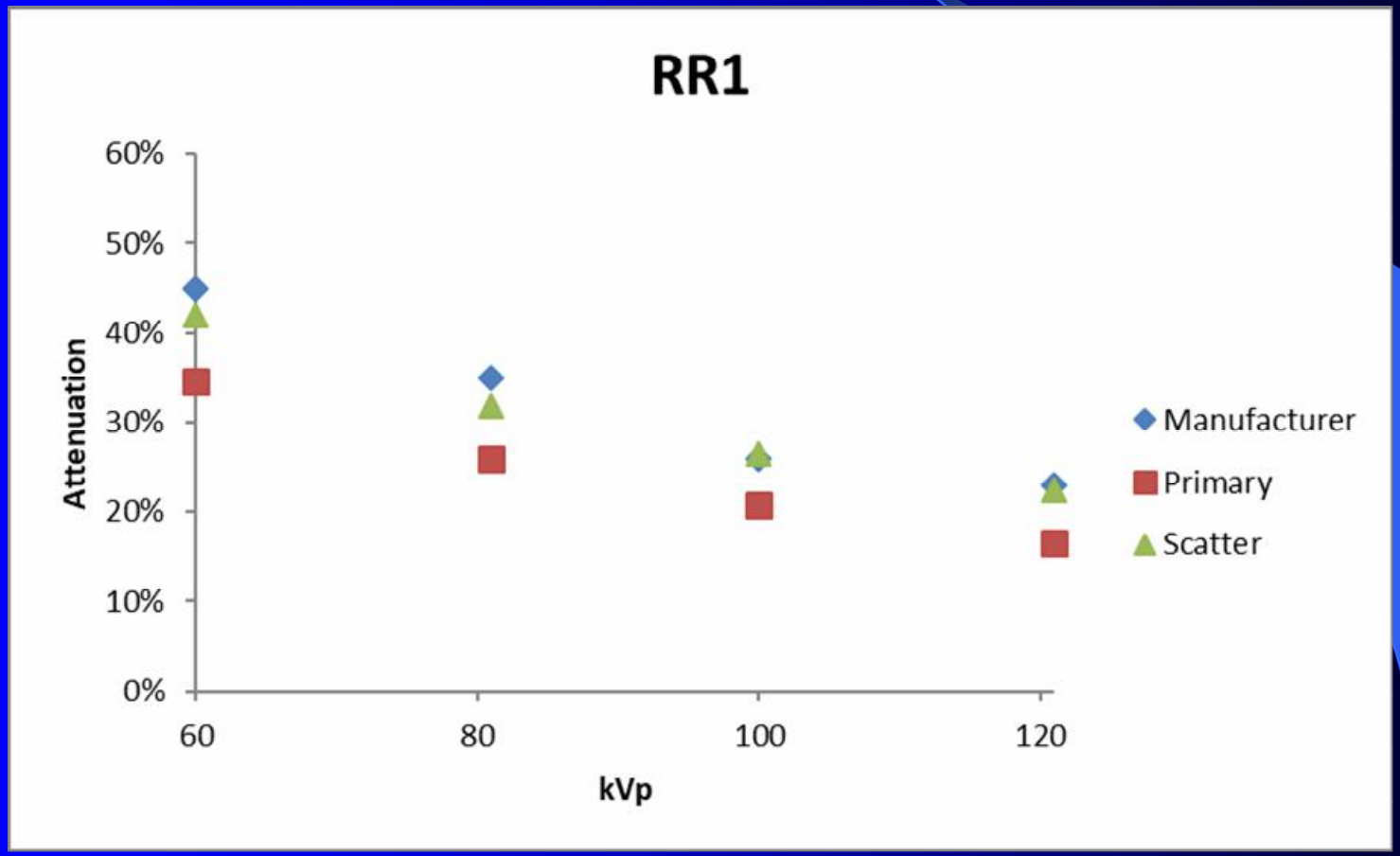
Staff protection – aprons, collars, glasses

Staff protection – screens

Staff protection – attenuating headwear (no-brainer)



Staff protection – lead gloves



Staff protection – lead sheets

- Positioning important
  - Patient dose increase of up to 500% if in primary beam with automatic brightness control
- Scatter reduction of up to 60%
- Decrease in patient dose also (cuts scatter from collimator)

Staff protection – positioning (example)

- High doses for 1 individual investigated
- Complex workload (Fenestrated EVAR)
- Lateral projection used
- Positioning of display screen requires standing by tube
- Scattered doses significantly higher than by detector
- Additional display screen ordered

Staff Protection - Training

Information provided on

- PPE – what and how to use
- Dosimetry – storing, wearing and changing
- Positioning – high and low scatter areas
- Local Rules – instructions for working safely
- Doses likely and associated risks

RADIATION PROTECTION OF PATIENTS

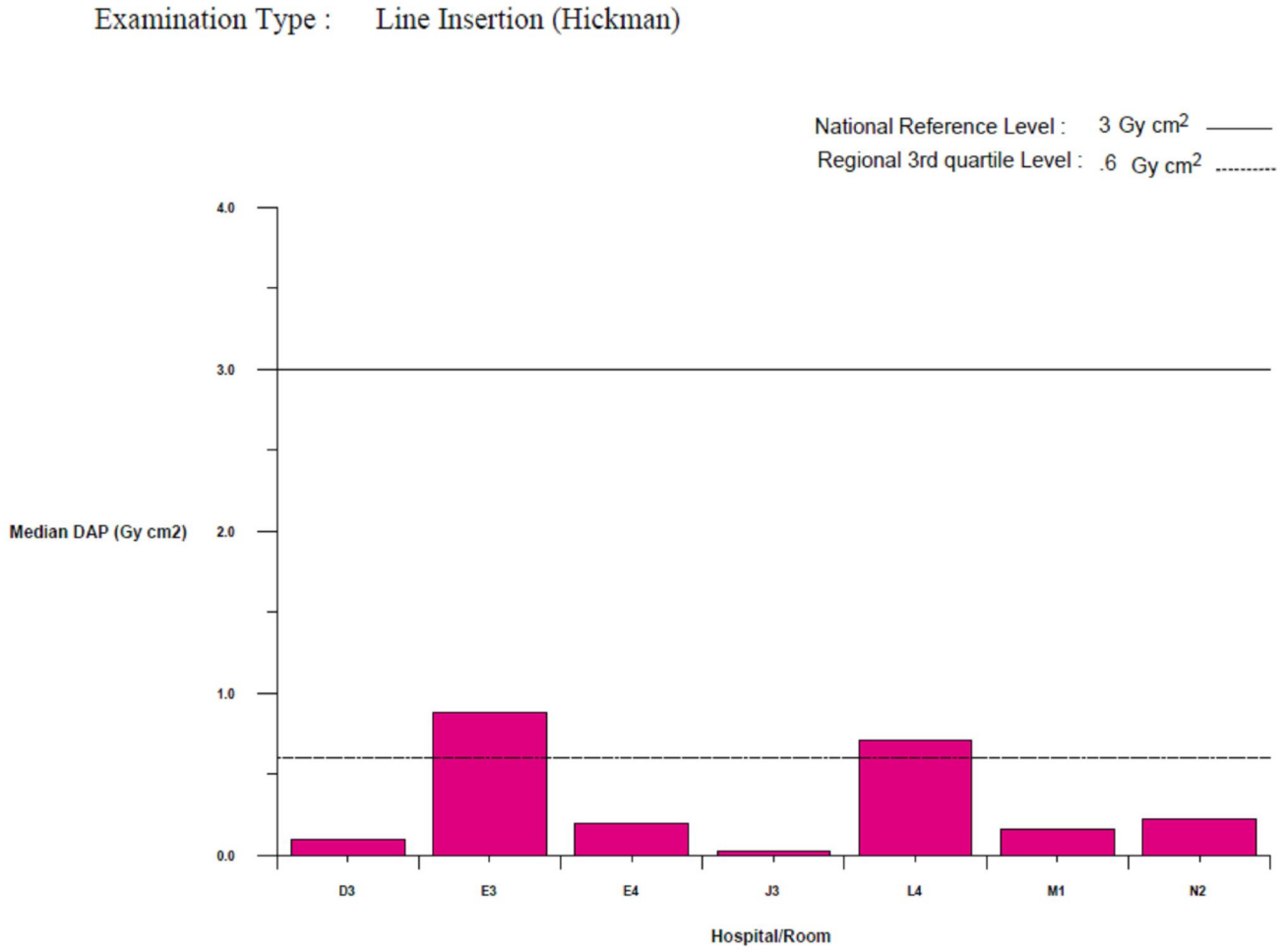
Interventional dosimetry issues

- Consistent units
- Standardisation of dosimetry methods
- Classification of procedures
- Consideration of uncertainties
- Calibration of dose measurement devices
- Collection of factors influencing dose

National DRLs for interventional procedures

Examination	DAP ($Gycm^2$)	Fluoro time (min)
Biliary intervention	43	14
Facet joint injection	6	1.4
Hickman line insertion	3	1.5
Nephrostomy	13	6.7
Oesophageal stent	13	5
Pacemaker (permanent)	7	6
Percutaneous transluminal coronary angioplasty (PTCA)	40	11.3

Local doses


Examination Type : Line Insertion (Hickman)
National Reference Level : 3 Gy cm2
Regional 3rd quartile Level : .6 Gy cm2
Median DAP (Gy cm2)
4.0
3.0
2.0
1.0
0.0
D3
E3
E4
J3
L4
M1
N2
Hospital/Room

Calculating effective dose

- Typically involves dose indicator and conversion factor
- Conversion factors variable
  - Beam angle
  - Beam energy
  - Filtration
  - Patient size

Patient protection - equipment

- Modern technology
- Routine Quality Assurance programme
  - Medical physics
  - Local staff
- Room layout

Patient protection - technique

- Frame rate/Low pulse rate fluoroscopy
- Filtration
- Choice of projection
- Experienced operators

Informing patient

- Risk benefit information sheets developed regionally
- Can be used as part of consenting process
- Follow up required if skin effects likely
  - Can use reference DAP or entrance dose display

EPIDEMIOLOGY STUDIES

Paediatric Cardiology study

- Doses assessed from collected technique and dose data with individual Monte Carlo simulated conversion coefficients
- Cancer registry used to determine cancer statistics for patient cohort plus transplant statistics
- Cancer rates high compared to general population
- Linked most strongly to transplant status
  - Imunnosuppressants
  - Higher radiation doses

Cancer risks

- Risk of cancer associated with radiation exposures from cardiac catheterizations is relatively low
- Attributable risk of cancer was estimated at around 35 (male) and 133 (female) per 100,000 – for normal life expectancy
- Reduced life expectancy gives greatly reduced radiation-related cancer risks

In Summary

- Staff training is key
- Use combination of PPE, according to practicality
- Screens most effective
- Good dosimetry important for patient and staff

Grazie!