


How appropriate are the DRLs given the rapid changes in CT technology?

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A decorative graphic consisting of several sets of concentric circles, resembling ripples in water, located in the bottom right corner of the slide.

Local Coverage

- Leeds Teaching Hospitals NHS Trust (7 diagnostic CT scanners + 4 CT simulators)
- Mid Yorkshire NHS Trust (3 CT scanners)
- North Yorkshire NHS Trust (2 CT scanners)
- Harrogate and District NHS Foundation Trust (1 scanner)

Scanners in the Survey

- 12 scanners out of 13 have returned some data (10 Siemens, 1 GE, 1 Philips)
- 1 single slice scanner
- 2 x 4 slice scanners
- 1 x 8 slice scanners
- 2 x 16 slice scanner
- 1 x 40 slice scanner
- 5 x 64 slice scanners

Examinations collected

- Head
- Abdomen
- Abdo/Pelvis
- Chest abdo/pelvis
- Chest/liver
- HRCT
- Any other examinations you do routinely

Requested Data

- Asked for standard protocol i.e. scan region, kV, effective mAs, slice, CTDIvol, pitch/feed, CARE Dose on/off
- For each patient they recorded ID, scan part, mAs/ref mAs, DLP, total DLP and comments
- Asked to record 30 patients for each examination (did not always get this)

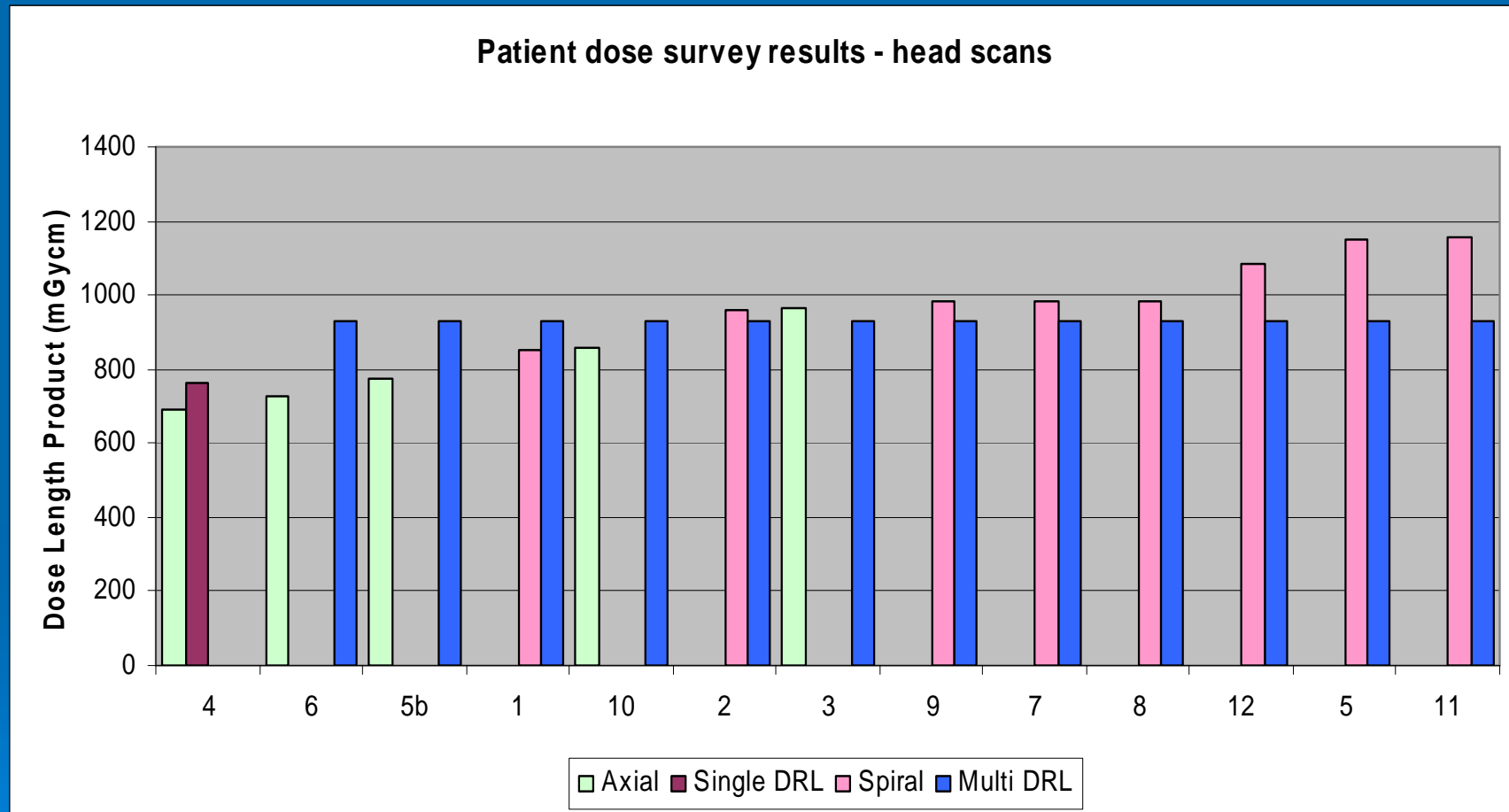
Data analysis

- Corrected displayed DLP data recorded by the radiographers, to take account of individual tube outputs from the scanners.
- Determined the scan length from the ratio of the recorded DLP for the patient and the product of the record mAs and standard normalised CTDIvol.
- $$\text{Length} = \text{DLP}_{\text{patient}} / [(\text{CTDIvol/mAs})_{\text{standard}} * \text{mAs}_{\text{patient}}]$$

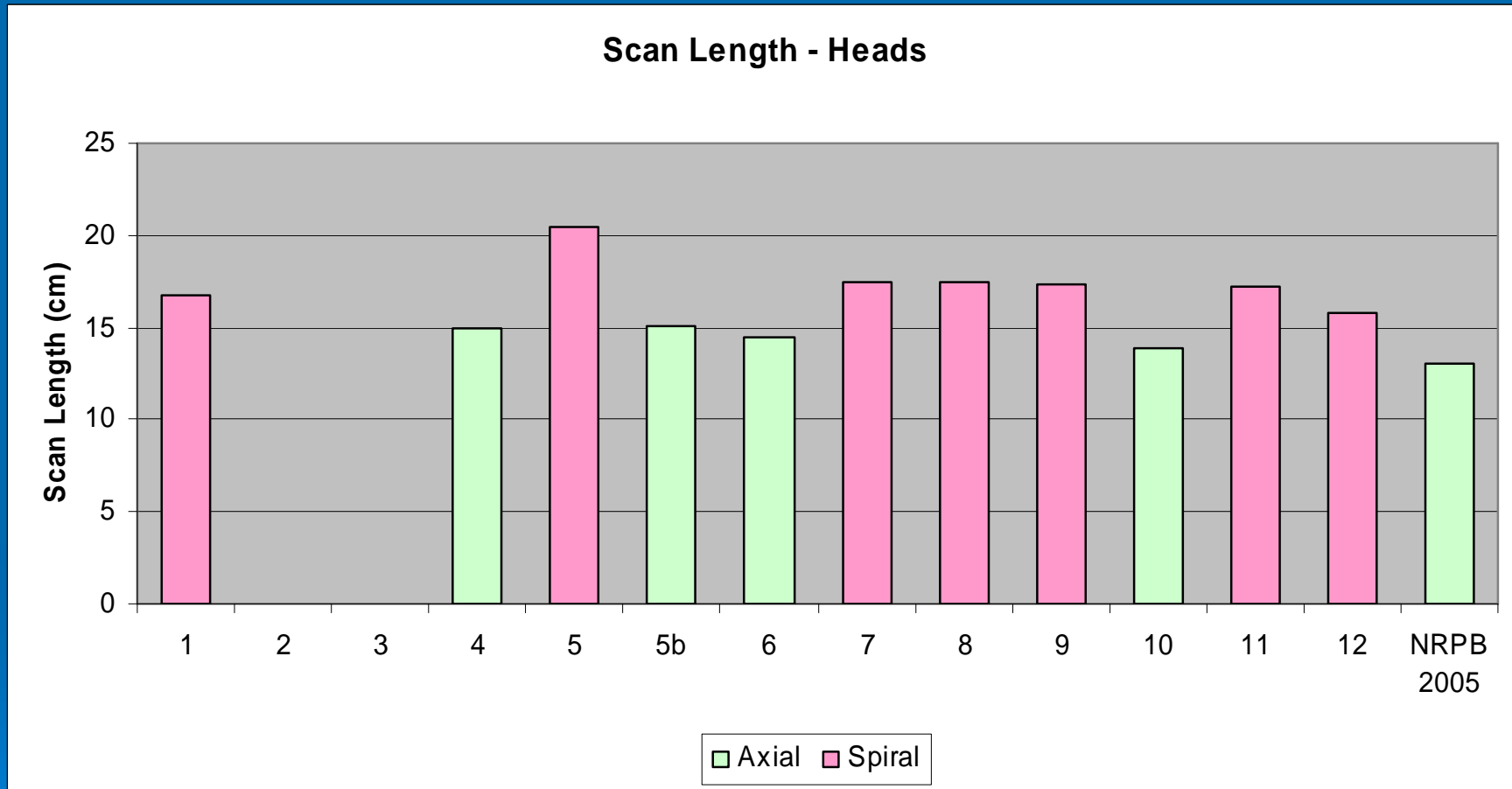
Heads



Head Scans



Head Scans



- Average axial = 14.6 cm, average spiral = 17.5 cm

Why is the head DRL inappropriate?

- Original DRL data based on axial scans, does not account for longer spiral scans with over-scan at each end
- Original DRL data based on acute stroke
- Standard scan lengths from NRPB 2005 do not reflect current clinical practice even for axial scans (measured average = 14.6 cm cf. 13 cm from NRPB 2005)

Why spiral heads?

- Because we can (technology has improved)
 - Previously the best image quality was derived from axial scans. Now radiologists want the same 3D data sets they use in MRI so that reformats can be performed in any plane.
- Because it gives better information for trauma patients in short times
- Because get better 3D reconstructions

Head DRL conclusion

- Instead of having different DRLs for single slice and multi-slice scanners, need separate values for axial and spiral scans
- Need to make clinical staff aware of the dose difference between axial and spiral heads, so that informed choice is made
- Possibly need to audit how often the full 3D data set is used clinically to affect diagnosis or patient management.

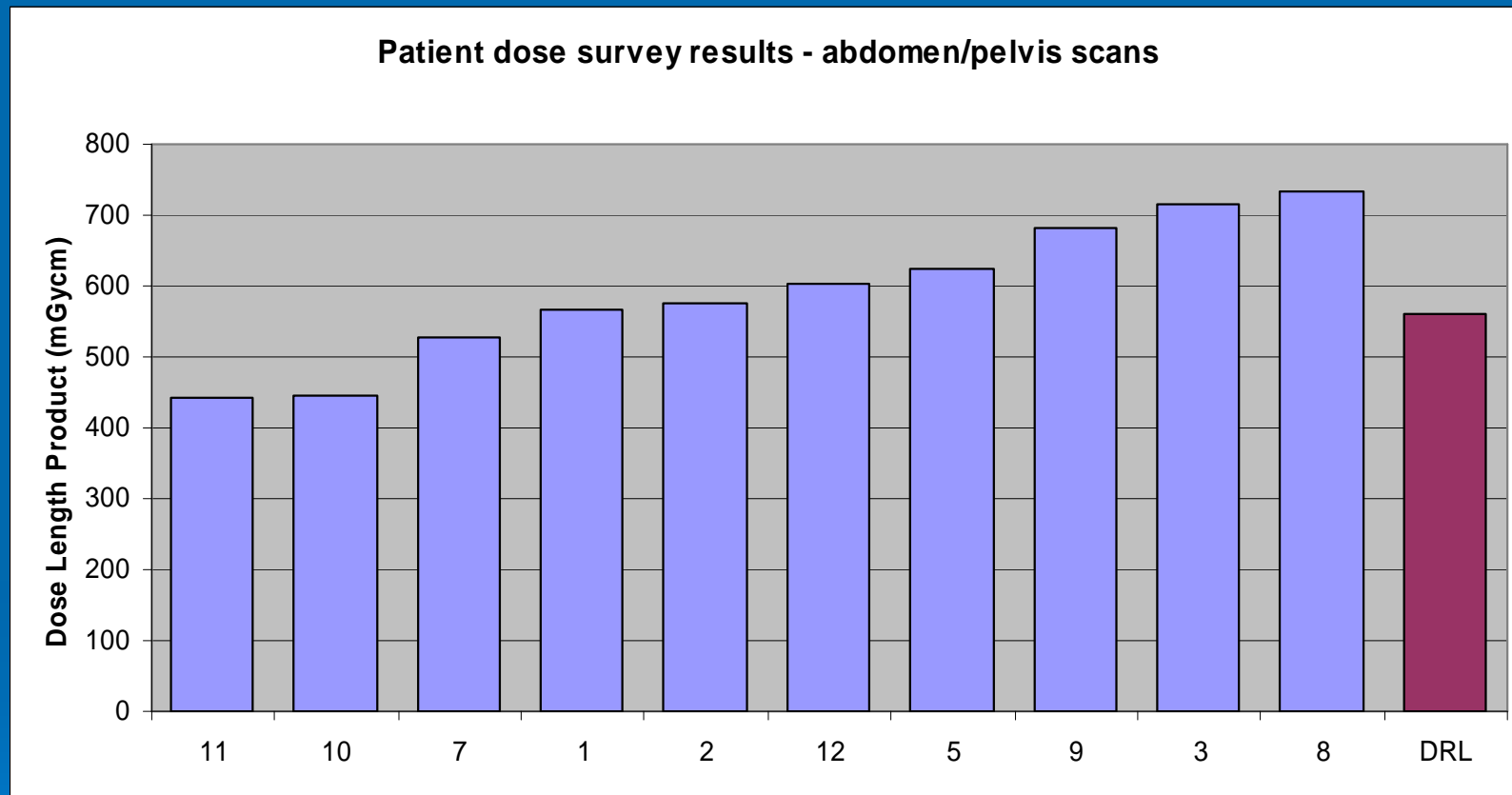
Bodies



Abdomen

- Only 1 centre routinely performs abdomen scans.
- Average 286 mGycm DRL = 470 mGycm
- Is it still appropriate to have a DRL for something which is hardly done (like the DRL we still have for Skull AP/LAT in general radiography)?
- Should we collect data which is for non-routine examinations?

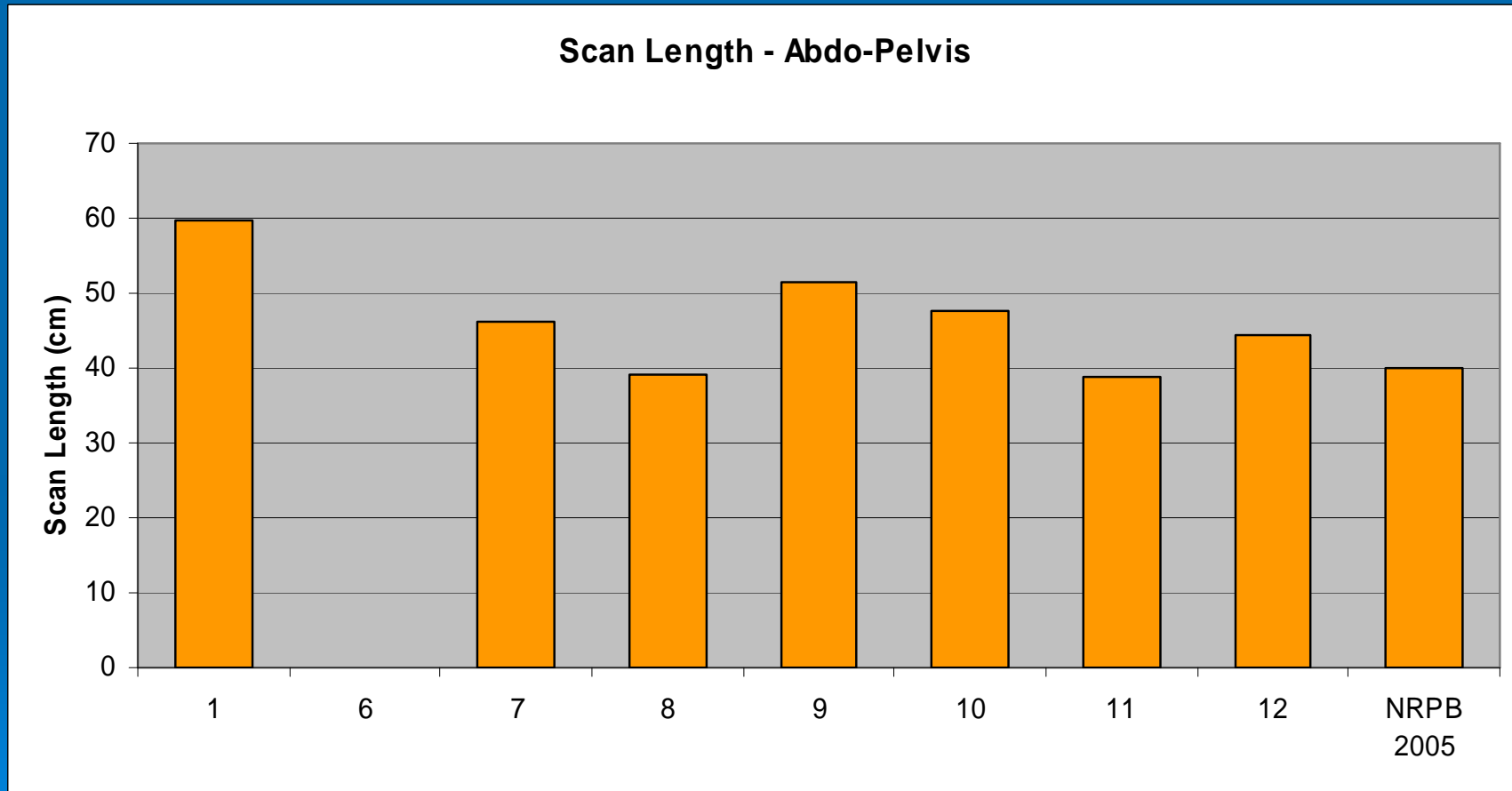
Abdo/Pelvis Scans



➤ Average = 591mGycm

DRL = 560 mGycm

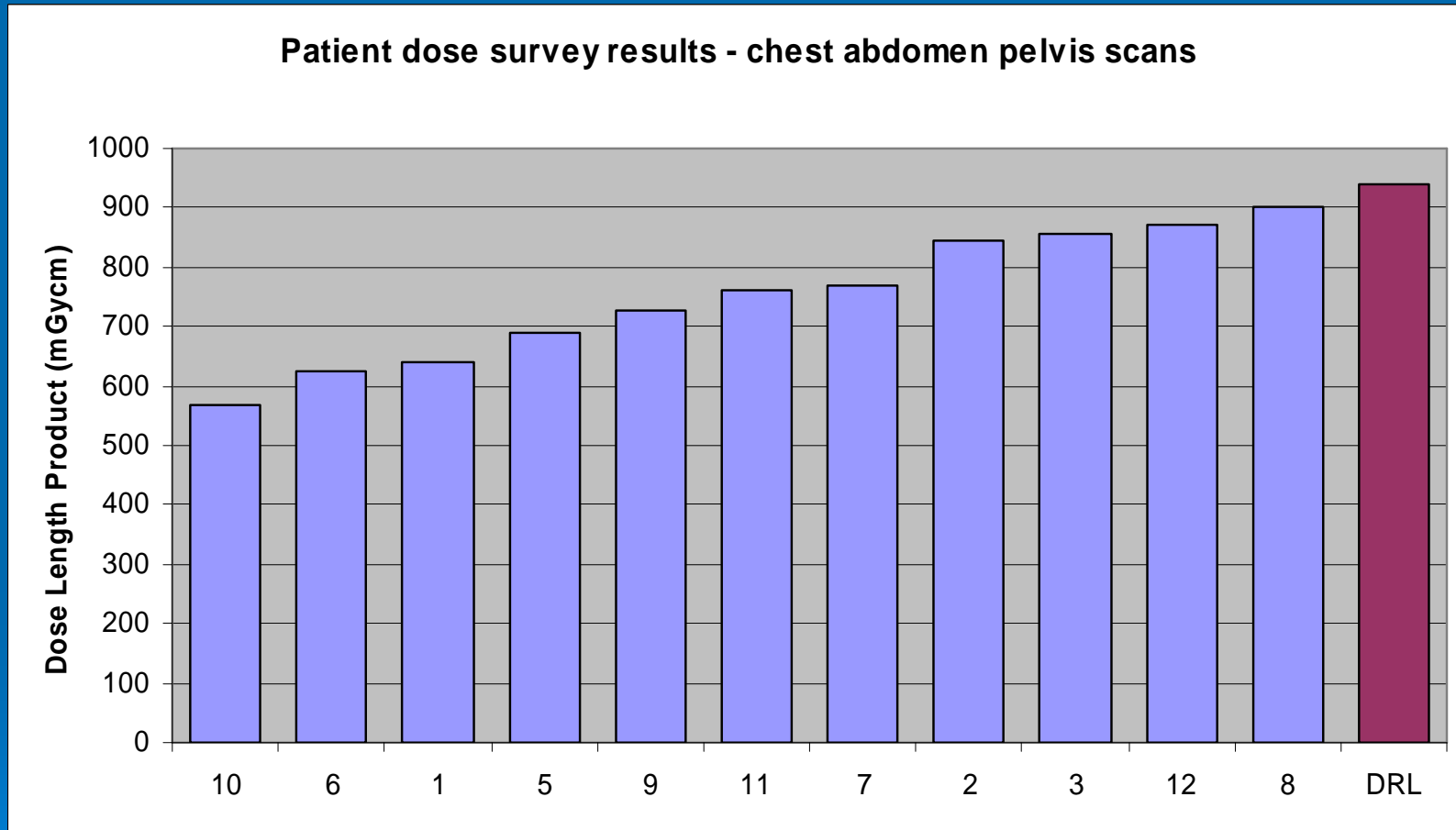
Abdo/Pelvis Scans



Is the DRL for Abdo/Pelvis appropriate?

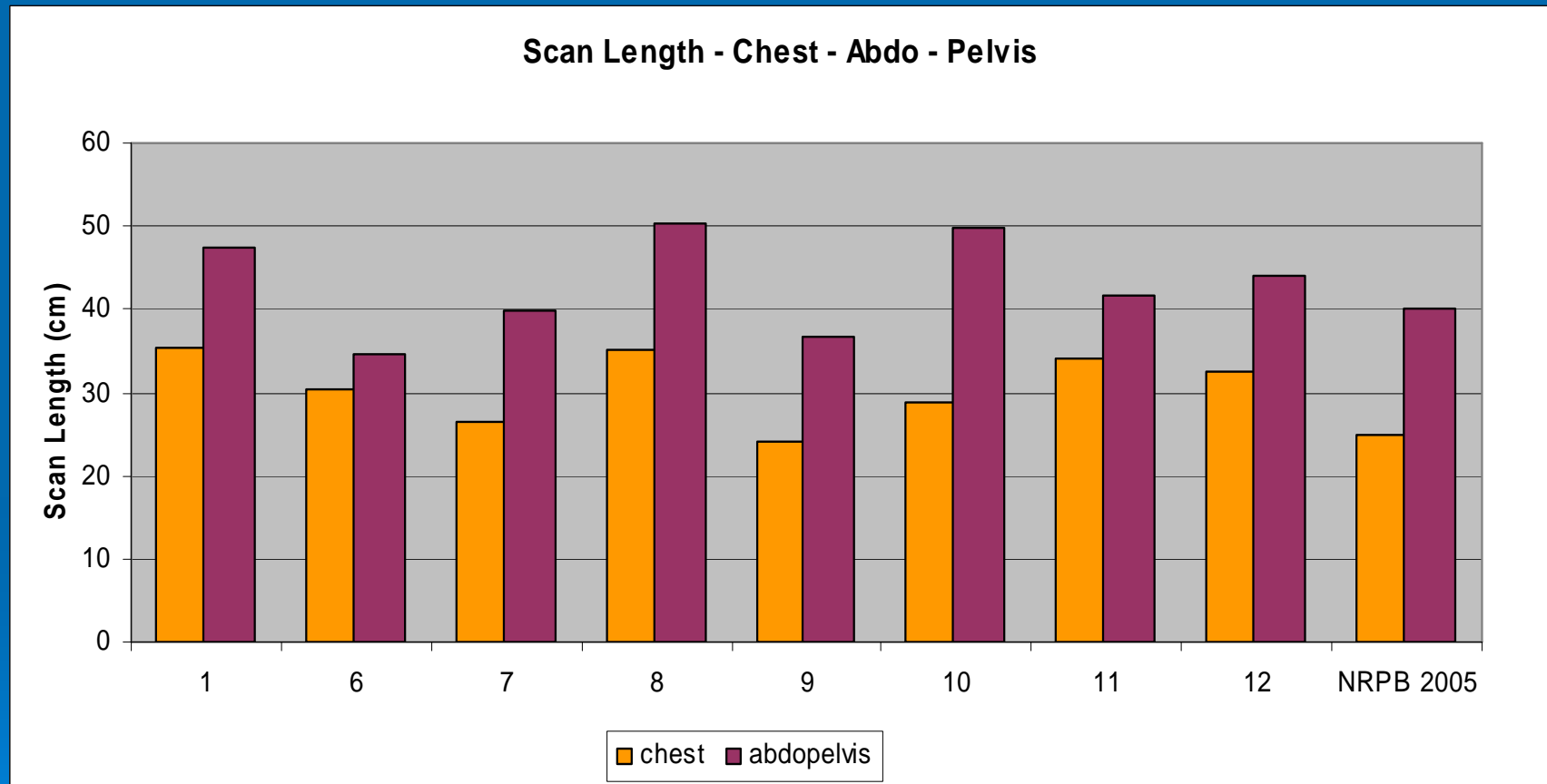
- Note scanner 1 is lower than abdo DRL but is greater than the abdo/pelvis DRL.
- Currently there is only 90 mGycm difference between the DRLs for abdomen (470) and abdo/pelvis (560).
- Previously, compromised on image quality in the pelvis rather than compromise throughput due to heat loading on the tube.
- Improved technology means image quality is kept the same through bony structure in pelvis, hence increasing patient dose.

CAP scans

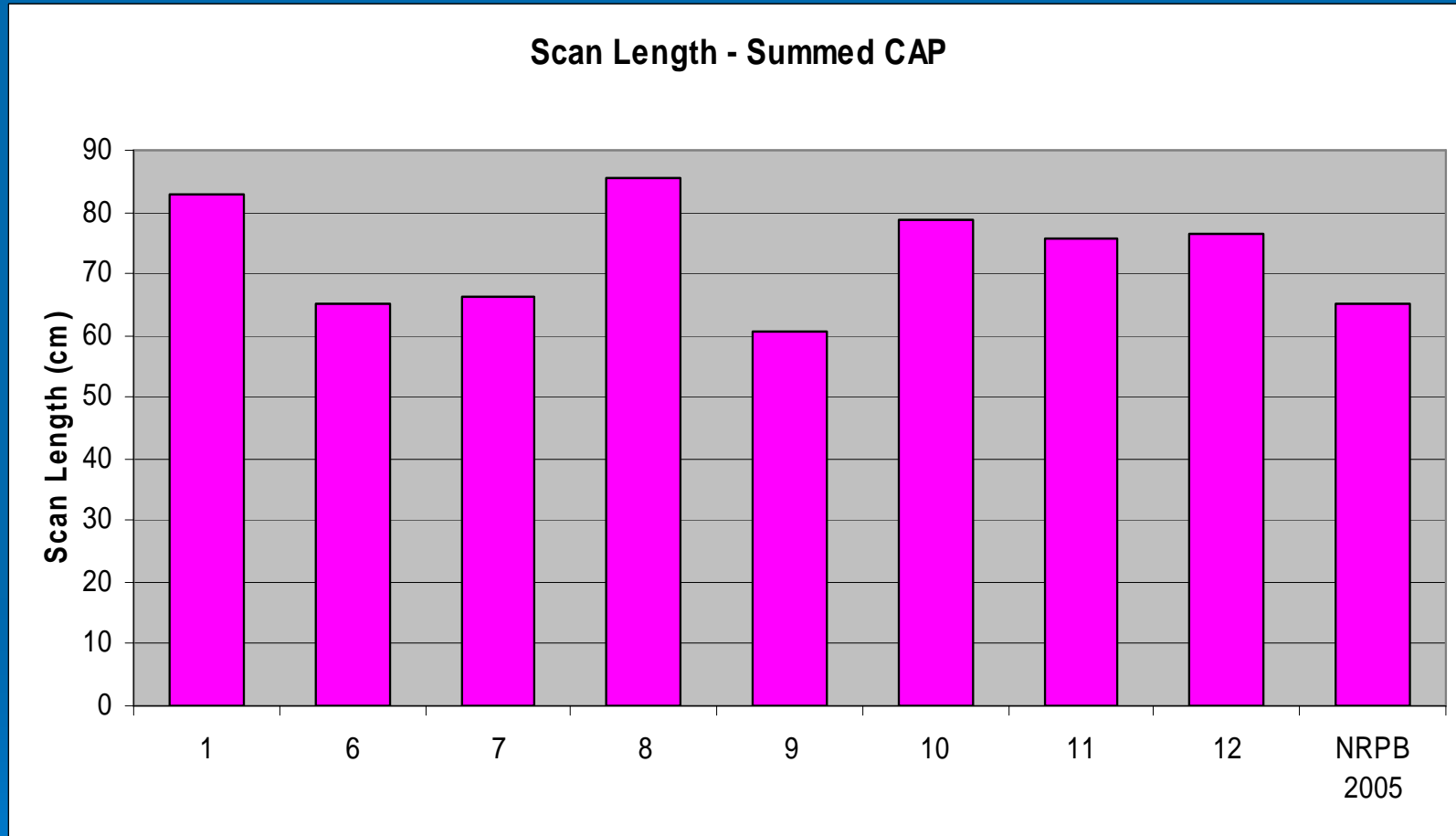


➤ Average = 750 mGycm DRL = 940 mGycm

CAP scans



CAP scans

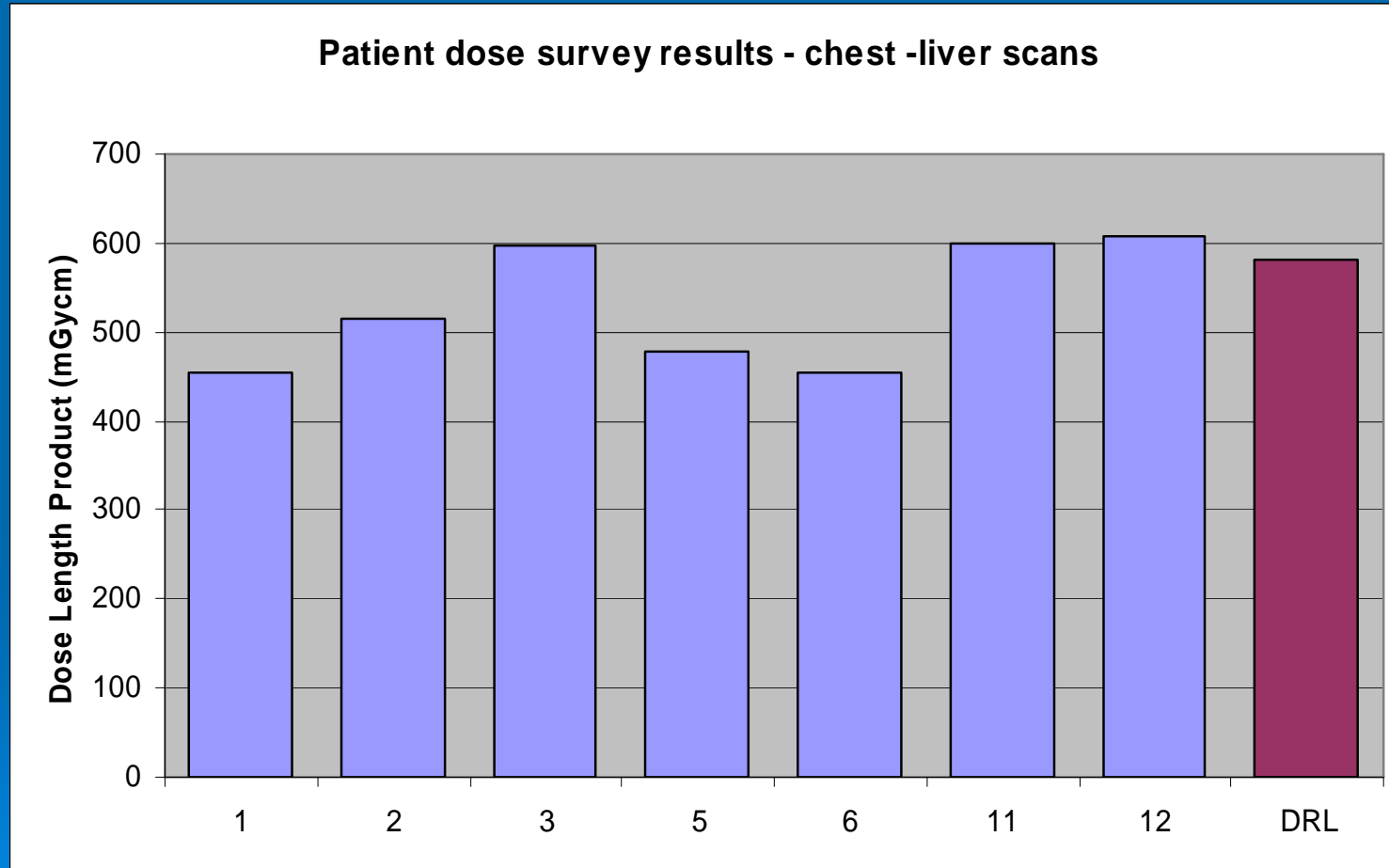


Smallest average = 60.6 cm, largest average = 85.3 cm

CAP DRLs

- All the scanners meet the DRL for chest, but allowed 380 mGycm extra than for an abdo/pelvis. All the scanners use the same factors for abdo/pelvis part of the CAP as for the abdo/pelvis.
- Most scanners exceed the chest and abdo/pelvis lengths from NRPB 2005, however, these lengths are anatomical lengths rather than accounting for overscan with spiral protocols
- Lower doses with axial scans than spiral scans as might be expected.

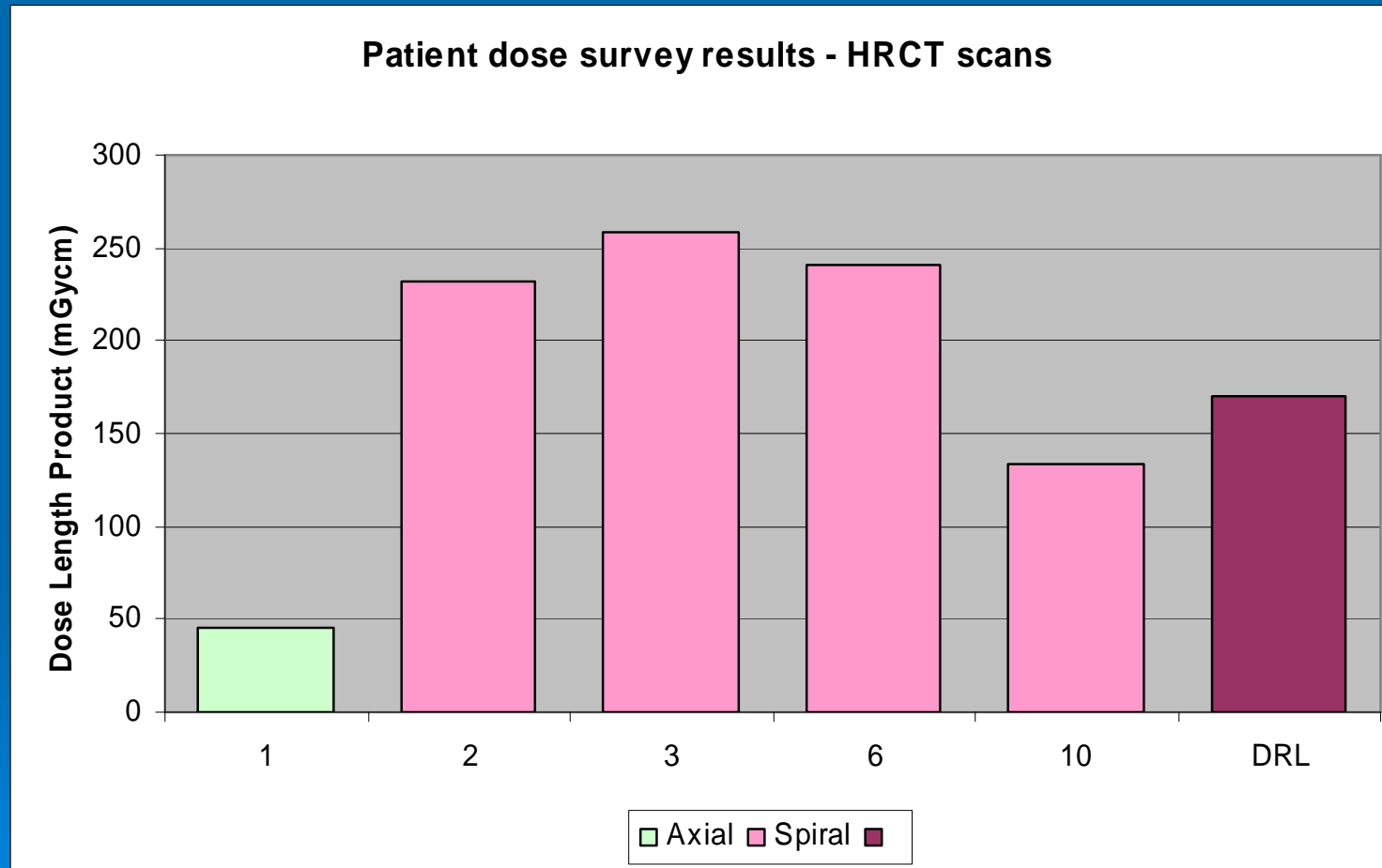
Chest / Liver



Chest / Liver

- Not a full data set. More data to come. Have data for scanners 7,8,9,10 which has not been inputted.
- Average is lower than the DRL, most scanners meeting this value.

High Resolution Chests



High Resolution Chests

- DRL based on axial step and shoot, i.e. thin slice then move 10mm.
- 1 scanner is doing axial scans exclusively (3 more small data sets not shown)
- Data for 4 scanners doing spiral HRCT (3 more small data sets not shown, all averaging greater than DRL)
- Should we have specific DRLs based on clinical indications?

Additional Data

- Radiographers also provided data on KUB, Colon, Urogram and CTPA.
- The above seem to be common examinations, so should have a DRL for these?

Scanner	KUB	CTPA	Colon
1	166	188	
2	593	311	580
3	553		
5		156	
7			451
11	790	141	271

How appropriate are the DRLs given the rapid changes in CT technology?

- Do we have DRLs for the correct examinations?
- Do we need to have clinical specific DRLs rather than just anatomical specific DRLs
- Technology has outpaced the DRLs given the rapid up take in multi-slice scanners
- DRLs may be more necessary, because we may be optimising image quality, and compromising on high patient doses because technology allows us to.