



Control Number: 535

e-Abstract: E103

Topic: Radiation protection of patients or staff

Title: Update on radiation exposure from CT: Early progress in the third UK CT dose survey

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LEARNING OBJECTIVES:

- Justify the need for a review of current practice.
- 3rd UK national CT dose survey
 - survey format
 - registered interests
 - feedback.
- Projected reporting of results.
- CPD accreditation.

BACKGROUND:

Introduction:

- Computed Tomography (CT) has become the subject of increasing concern in radiation protection in diagnostic imaging

- Particular attention is therefore required for the robust justification of CT procedures and the optimisation of patient protection, especially where patients require follow-up scans over a short period of time.
- The 3rd UK national CT dose survey reviews current multidetector CT (MDCT) practice in the UK following:
 - continuing growth in CT referral (Figure 1)
 - further developments in CT technology since the 2003 review (see Figure 2), including more detectors, reduced scan times and changes to automatic tube current modulation
 - expansion into new clinical applications, including 3-D imaging applications such as 3-D head and virtual colonoscopy (Figure 2).

Annual CT statistics:

- As scanners have become faster, easier to use whilst being more complex technically, and their range of clinical applications has increased, the referral frequency for CT examinations has increased year on year both since the millennium and the last survey in 2003 (see Figure 1).
- Population doses from diagnostic X-rays in the UK and USA show CT is the dominant source of dose from medical X-ray examinations (Figure 3)
 - UK plot shows that 68% of the population dose comes from CT examinations, whilst CT represents only 11% of all of the X-ray examinations performed (excluding nuclear medicine)¹
 - Similarly in the USA 66% of the population dose comes from CT examinations, whilst CT represents 18% of all of the X-ray examinations performed (excluding nuclear medicine)².
- Per caput doses in the UK and USA from CT, natural background radiation and all sources are included in Figure 4
 - The per caput CT dose in the UK is less than five times the equivalent figure in the USA
 - However, in the UK there are typically 56 CT examinations per 1000 population rising to 223 per 1000 in the USA.

IMAGE FINDINGS OR PROCEDURE DETAILS:

Survey objectives:

- Assess changes since the last survey in 2003.
- Provide guidance for some recently established examinations.

- Update existing examination specific national reference doses.
- Use revised national reference doses as the baseline for potential follow-up optimisation studies.

Survey format:

- CT Users Group (CTUG) is hosting the invitation to take part in the CT dose survey on their website
 - This can be accessed using the QR (quick response) code in Figure 5 or using the URL: www.ctug.org.uk/ctsurvey.html
 - CTUG introduction page, included in Figure 6, contains a link to register an interest and download the electronic files required to take part in the survey.
- A brief registration form (Figure 7), hosted online by the electronic questionnaire tool SurveyMonkey (www.surveymonkey.com), needs to be completed before the dose survey electronic files can be downloaded.
- Two electronic files are required to perform the survey work, a PDF file containing the data collection sheet + guidance notes and an Excel spreadsheet with a macro to record the data electronically (Figure 8).
- Once the local data collection has been completed and the data have been added to the spreadsheet, the saved file is returned to HPA by e-mail.
- The received data are checked, modified and uploaded to a custom built database for analysis (Figure 9; image courtesy of Mark Hillier, HPA, Chilton).

Registered interests:

- UK downloaders of the CT dose survey electronic files, up to April 2011, are included on the maps in Figure 10.
- 74 Trusts or single hospital sites (94 people) have downloaded the files
 - Early feedback by the New Year confirmed that 36 sites were collecting data then on at least 127 scanners (~ 25% of scanners nationwide)
 - Four sites have confirmed they are not supporting the survey.
- There has also been international interest in the survey, with 18 sites (19 people) downloading the CT dose survey electronic files (included on the map in Figure 11, all sites up to April 2011).

CT protocols:

- Fifteen CT examinations for specific clinical indications are being investigated for the survey (see Table 1).
- A small sample size of twenty patients for each examination type is required.

- The selected protocols represent established, new and high through-put examinations.
- CT angiography and CT virtual colonoscopy are among newly established examinations that have been included.
- CT Urogram (CTU) was included as well as CT KUB, since CTU has higher average dose and the two protocols are not always differentiated clearly.

CT Protocol	Clinical indications
Head	Acute stroke
C-spine	Fracture
Chest	Lung cancer
Chest High-Resolution	Interstitial lung disease
CTA	Blood vessels
CTPA	PE
Abdomen	Liver metastases
Abdomen and pelvis	Abscess
Virtual Colonoscopy	Polyps/tumour
Enteroclysis	Crohn's disease
KUB	Stones/colic
Urogram	Tumour or stones/colic
Paediatric Head (x3 age groups)	Trauma

Table 1: CT protocols and the clinical indications being used in the dose survey.

Feedback from survey participants:

- “Survey work is an important part of their profession and job, to try and ensure best practice at all times. Therefore they were keen to support the survey”.
- The CPD recognition of extra work done was appreciated and a deciding factor.
- “Whilst the work is time consuming it is manageable where staffing levels are suitable and have been maintained”
 - confirming the earlier results of the pilot study.
- Low responses so far for paediatric patients.
- Data on CT Enteroclysis have only been forthcoming where the survey data collection has been performed retrospectively, due to low throughput despite the recent growth in referrals nationally¹.
- There have been requests for a more oncology specific follow-up dose survey.

Projected reporting of results:

- After statistical analysis HPA will prepare a report during 2011 covering all aspects of the CT dose survey
 - to summarise national practice
 - allow participants to compare local and national practice for an indication of relative performance
 - with a view to optimising imaging service
- Results will be presented nationally to highlight
 - key findings
 - changes since the last survey
 - proposals for improvements where possible.
- Given an e-poster deadline of the beginning of May 2011, data submission, database transfer and analysis are ongoing.
- However, some preliminary data have undergone initial analysis to give an indication of changes since the last survey.
- Typical total dose length product (DLP) data for CT Head, CT Chest and CT Virtual Colonoscopy are included in Figure 12
 - Data from both the 2003 Review³ and early data from the limited returns so far (April 2011) for the 2011 CT dose survey are included
 - Rises in DLP for both CT Head and CT Chest are suggested from early data receipts
 - CT Virtual Colonoscopy data will provide guidance for what is a recently established examination not included in previous surveys
 - NB. Processing of the new submitted data is ongoing and the 2011 data are preliminary indications only.

Continuing Professional Development:

The College of Radiographers has endorsed the survey via CPD Now (Figure 13). Participation will enable practitioners to develop their knowledge and expertise in a range of data collection and dose optimisation techniques.

IPEM also supports the survey work as a key element in satisfying CPD requirements.

CONCLUSION:

The survey aims to identify good practice and provide data on typical patient doses. This will help improve professional standards in CT by encouraging users to monitor scanned patient data, giving guidance on typical dose levels, and suggesting how to optimise patient dose locally.

For the results of the survey to be representative of typical patient doses within the UK a high return of quality data is required from sites nationwide. The larger the sample of data the more useful and robust the reported findings will be.

(To submit data and for any further queries please contact me using stuart.meeson@hpa.org.uk .)

KEYWORDS:

Computed Tomography; CT; radiation dose; national survey; UK

REFERENCES:

1. Hart D, Wall BF, Hillier MC and Shrimpton PC. Frequency and collective dose for medical and dental X-ray examinations in the UK, 2008. Chilton HPA-CRCE-012, 2010, and <http://www.hpa.org.uk/radiation/>.
2. NCRP 2009 Ionizing radiation exposure of the population of the United States. NCRP Report 160. National Council on Radiation Protection and Measurements, Bethesda MD.
3. Shrimpton PC, Hillier MC, Lewis MA, and Dunn M 2005 Doses from Computed Tomography (CT) Examinations in the UK – 2003 Review. Chilton: NRPB-W67, (ISBN 0 859515567), and <http://www.hpa.org.uk/Publications/Radiation/NPRBArchive/NRPBWSeriesReports/2005nrpbw067/>

MeSH:

[Tomography, Spiral Computed \[E01.370.350.600.350.700.810.800\]](#)

[Radiation Dosage \[G03.850.810.250\]](#)

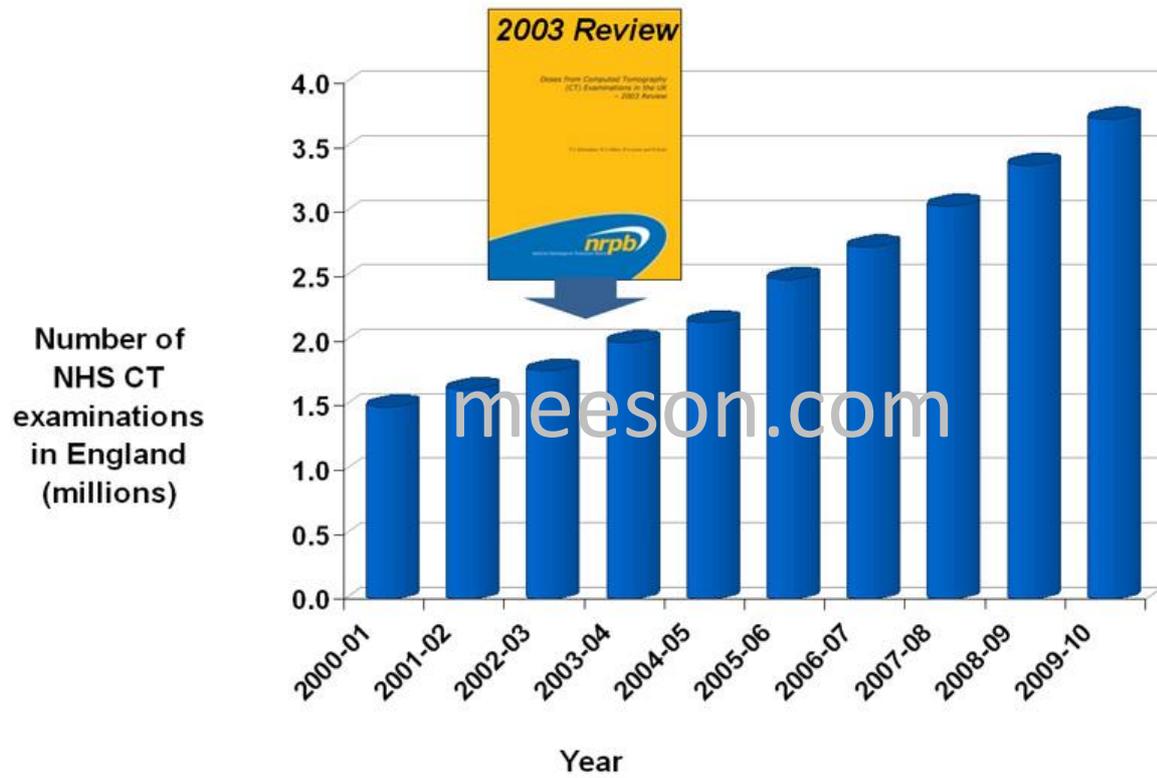
[Data Collection \[E05.318.308\]](#)

Figures

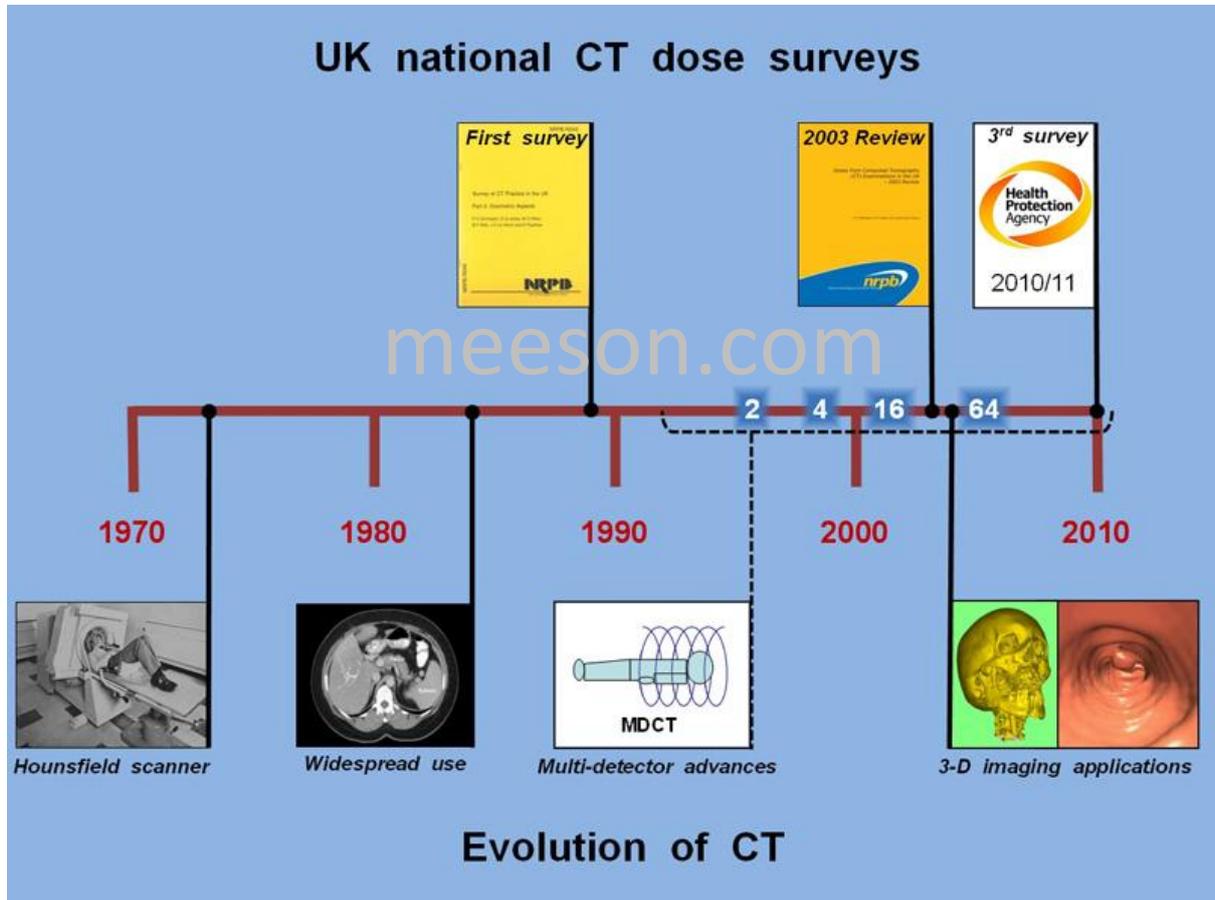
1. Annual numbers of NHS CT examinations in England, showing the growth in frequency of scans since the millennium and the last national survey.
2. Timeline showing scheduling of the UK CT dose surveys in relation to the evolution of CT. Timeline starts from Hounsfield's first head scanner and the widespread use of axial imaging in hospitals.
3. Population dose from diagnostic X-rays in the UK and USA. UK plot shows that 68% of the population dose comes from CT examinations, whilst CT represents only 11% of all of the X-ray examinations performed (excluding nuclear medicine).
4. Per caput doses in the UK and USA from CT, natural background radiation and all sources.
5. QR (quick response) code to CT Users Group page hosting the invitation to take part in the CT dose survey (URL: www.ctug.org.uk/ctsurvey.html).
6. CT Users Group page showing CT dose survey introduction page (www.ctug.org.uk/ctsurvey.html).
7. Brief registration required before volunteers can download the two electronic files required to perform the survey.
8. Two electronic files are required to perform the survey work, a PDF file containing the data collection sheet + guidance notes and an Excel spreadsheet with a macro to record the data electronically.
9. Sample image of the Access 2003 database used to check and import submitted data.
10. UK downloaders of the CT dose survey electronic files (up to April 2011). (Recorded using www.AardvarkMap.net)
11. International downloaders of the CT dose survey electronic files (up to April 2011). (Recorded using www.Aardvarkmap.net)
12. Typical Total DLP data for CT Head, CT Chest and CT Virtual Colonoscopy. Data from both the 2003 Review and early data from the limited returns so far (April 2011) for the 2011 CT dose survey are included. (Processing of new data is ongoing.)
13. The College of Radiographers has endorsed the survey via CPD Now. IPEM also supports the survey work as a key element in satisfying CPD requirements.

Figures

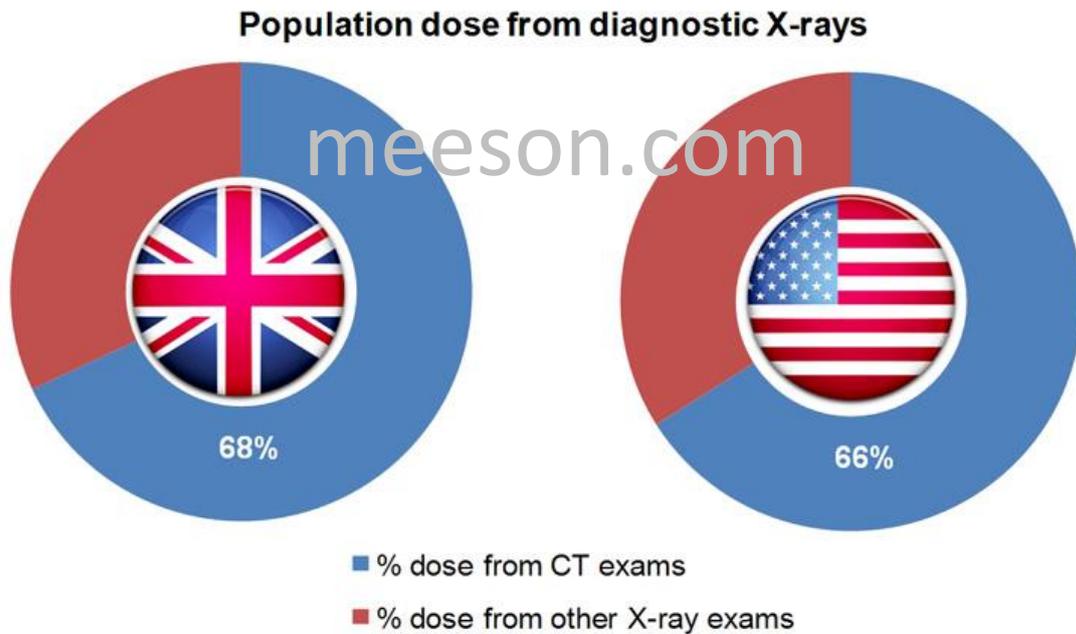
1. Annual numbers of NHS CT examinations in England, showing the growth in frequency of scans since the millennium and the last national survey.



- Timeline showing scheduling of the UK CT dose surveys in relation to the evolution of CT. Timeline starts from Hounsfield's first head scanner and the widespread use of axial imaging in hospitals.

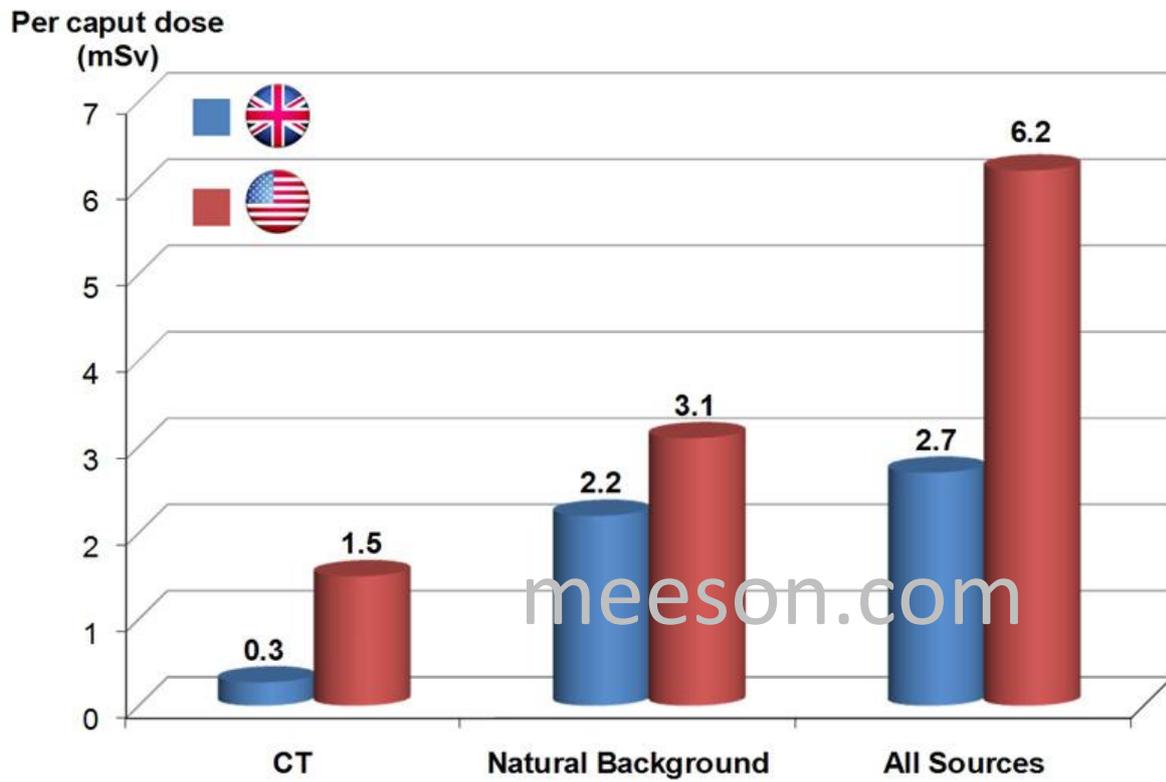


3. Population dose from diagnostic X-rays in the UK and USA. UK plot shows that 68% of the population dose comes from CT examinations, whilst CT represents only 11% of all of the X-ray examinations performed (excluding nuclear medicine).



Whereas CT represents 11% ^[1]  and 18% ^[2]  of all X-ray examinations

4. Per caput doses in the UK and USA from CT, natural background radiation and all sources.



5. QR (quick response) code to CT Users Group page hosting the invitation to take part in the CT dose survey (URL: www.ctug.org.uk/ctsurvey.html).



6. CT Users Group page showing CT dose survey introduction page (www.ctug.org.uk/ctsurvey.html).

The screenshot shows a Windows Internet Explorer browser window displaying the CT Users Group website. The address bar shows the URL <http://www.ctug.org.uk/ctsurvey.html>. The page title is "CT Users Group" and the main heading is "Welcome... to the CT Users Group". A search bar is located in the top right corner. The left sidebar contains a navigation menu with the following items: Home (CTUG home page), About (About the CTUG), Meetings (Info and talks from meetings), Contact (How to contact us), Mail list (ctusers mail list), Links (Some useful links), and Search (Search and site map). The main content area features a section titled "October 2010: Third UK National CT dose survey". The text in this section describes the HPA's survey of CT practice across the UK, the CTUG's support for the survey, the types of data being collected, and the importance of participation. It also provides contact information for Dr. Stuart Meeson and Dr. Paul Shrimpton.

CT Users Group
Welcome... to the CT Users Group

search for:

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October 2010: Third UK National CT dose survey

The HPA is conducting a third survey of CT practice covering the whole of the UK. The aims are to assess changes since the last survey in 2003, provide guidance for some recently established examinations, update existing examination specific national reference doses, and provide a baseline for potential follow-up optimisation studies.

The CTUG strongly supports this work, and encourages as many of our members as possible to participate.

HPA wish to collect from as many CT centres as possible information relating to twelve specific adult CT protocols and clinical indications, using samples of twenty patients for each protocol. Similar data are also requested in relation to paediatric head CT examinations, where sites have sufficient attendances, with patients being divided into three age ranges (reflecting significant differences in patient size and imaging technique).

Your help in participating in this voluntary survey is vital and very much appreciated. All data will be stored and managed appropriately. No site, centre or study will be traceable from publications or presentations that refer to the survey. All participants will be acknowledged and participation in the survey is a valid CPD activity.

Data collection can be either retrospective or prospective, at your discretion. The study period for each CT centre should typically be about three months, but longer for low frequency examinations and can involve up to one year of records where performed retrospectively. **Two electronic files** are required for data collection. Please try to return spreadsheets of data to the HPA by February 2011.

Contacts: Dr. Stuart Meeson (stuart.meeson@hpa.org.uk) and Dr. Paul Shrimpton (paul.shrimpton@hpa.org.uk).

7. Brief registration required before volunteers can download the two electronic files required to perform the survey.



meeson.com

CT dose survey files for download

1. Registration

Before downloading the PDF and Excel spreadsheet (MS Office 97-2007, PC-compatible) files, please answer the three questions below:

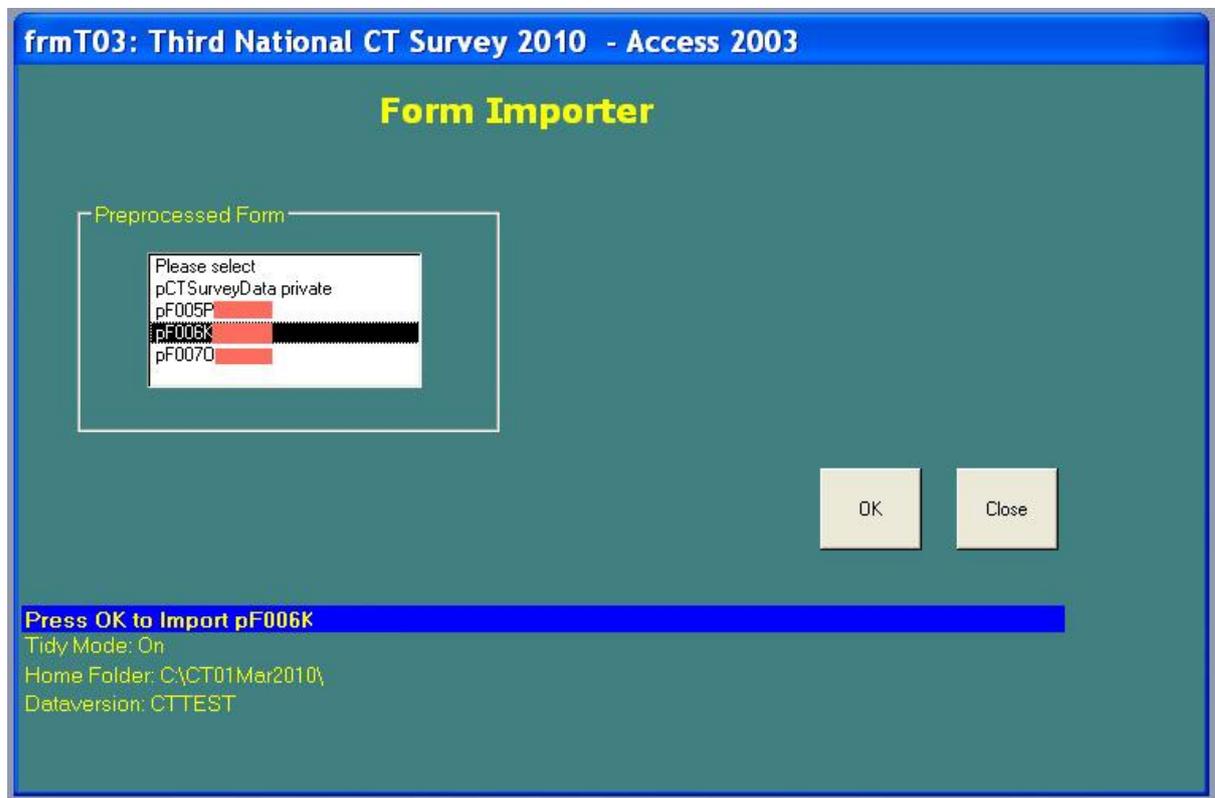
*1. Name

*2. Organisation

*3. E-mail address

Next

9. Sample image of the Access 2003 database used to check and import submitted data (Trust names anonymised).



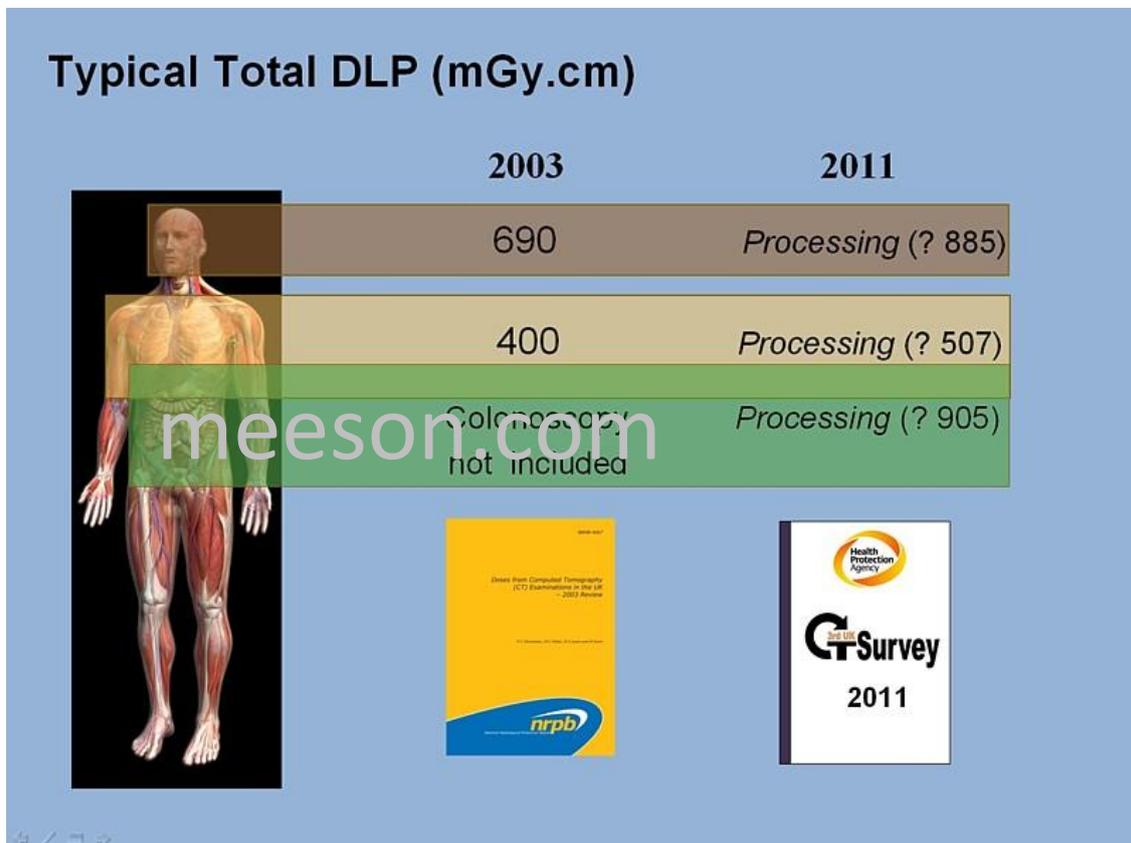
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