

Experiences of using GE DoseWatch Software for CT Dose Management

Sarah Wayte¹, Ruth Nicol², Andrew Bridges¹
and Christopher Koller¹

1. Radiology Physics Department, University Hospitals Coventry and Warwickshire, Coventry.
2. Radiation Protection, Southampton General Hospital, Southampton

Overview

- DoseWatch system was installed in 2013
 - Connected to 3 CT scanners (+ fluoroscopy & cardiology) & RIS software
- A) 6 common examinations filtered in 4 different ways using data collected over 4 months in 2014
- B) Dose audit:- for each scanner against national DRLs using the same data
- DoseWatch email alert system & other features

3 CT Scanner

- 2 scanners at University Hospital, Coventry
 - GE 750HD in radiology
 - GE VCTx in A&E (2008)
- 1 GE VCT at St Cross Hospital, Rugby (2006)



A) Six Common Examinations

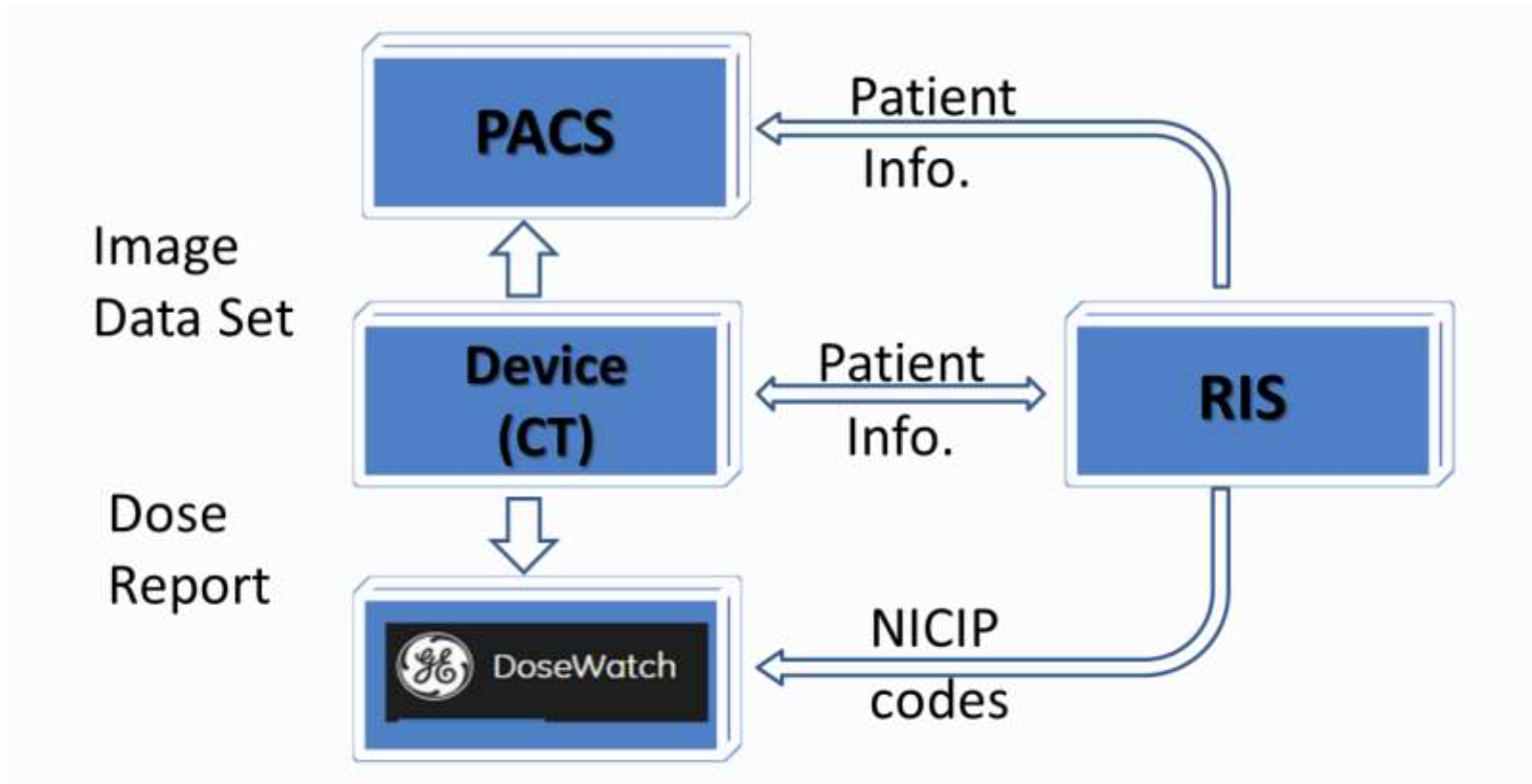
Study description	NICIP code
CT Head ¹	CSKUH ¹
CT Cervical Spine	CCSPN
CT Chest- high resolution ²	CHRC ²
CT Pulmonary Angiogram	CAPUG
CT Kidneys-ureters-bladder (KUB)	CURIT
CT Thorax abdomen pelvis	CCHAPC

1 The head examinations were a mixture of helical and axial

2 The hi-res chest examinations were helical

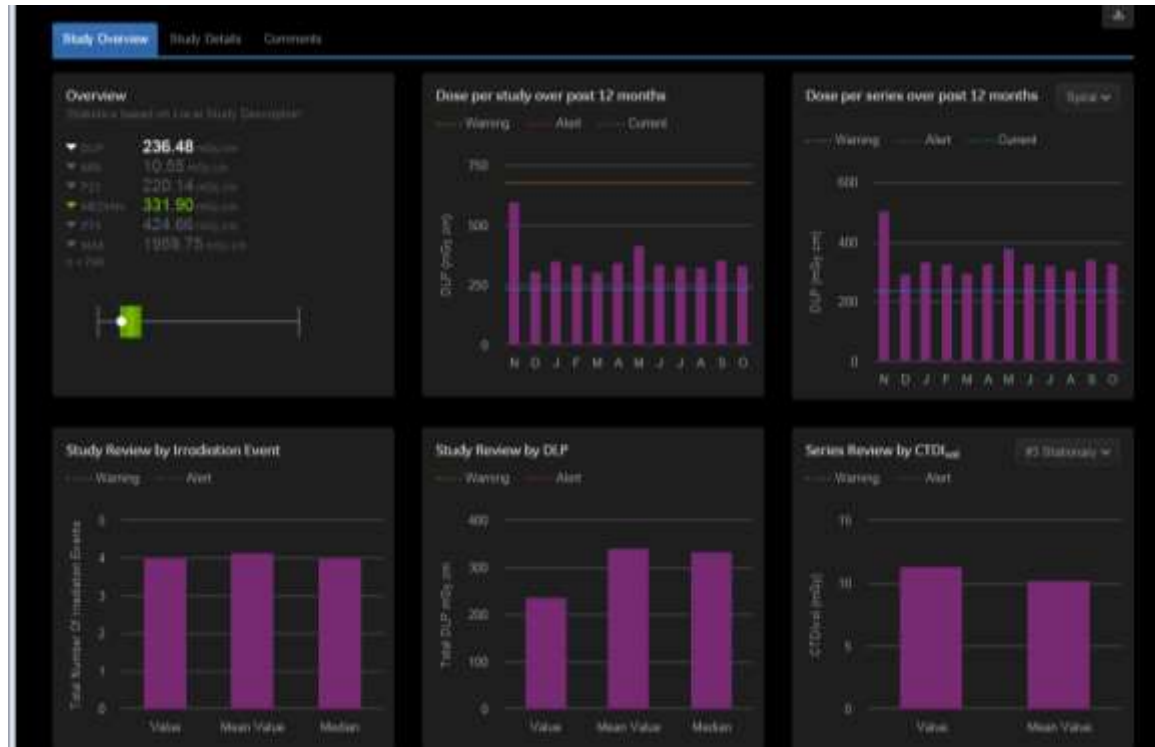


A) NICIP Code Transfer from RIS



A) The 4 Filtering Methods

1. Study description
 2. NICIP code
 3. Protocol name
 4. NICIP code, protocol name, >21 years, number of series (to exclude repeat or added scans) & dosimetry phantom (IEC head or body)
- Filtering 1 to 3 can be done in DoseWatch
 - Filter 4 = [reference data set](#) required exporting to Excel

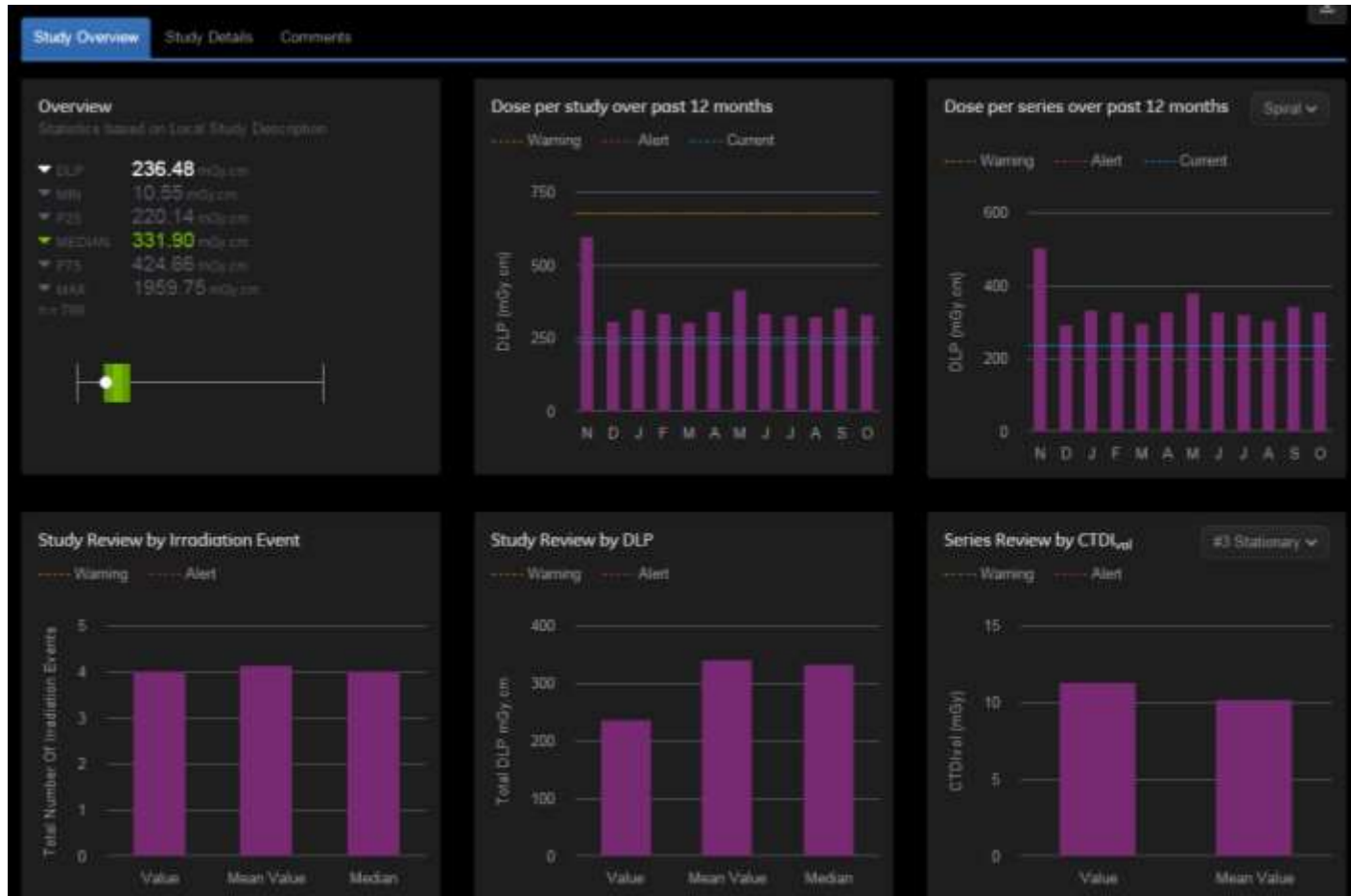


A) Filtering in DoseWatch

The screenshot shows the GE DoseWatch interface. At the top left is the GE logo and the text 'DoseWatch'. On the top right, there is a user role dropdown set to 'ADMINISTRATOR' and a 'Patient Search' button. Below the header is a navigation bar with tabs for 'Tracking', 'Analysis', 'Reporting', and 'Administration'. The main content area is titled 'CT Worklist' and has two sub-tabs: 'Scheduled Studies' and 'Performed Studies'. Below the sub-tabs are filter controls: 'Period' (Customize), 'From' (2015-10-13), 'To' (2015-11-13), 'Site' (UHCW NHS Trust - Radiology), 'Device' (St Cross CT), and 'Study Description' (All). A 'Clear' button and an 'Apply' button are also present. The 'Study Description' dropdown menu is open, showing a list of options: CSKUH, CSKUH,CSKUHC, CSKUH,CTEMP, CSKUHC, CSTRM, CT Abdomen, CT Abdomen and pelvis, and CT Abdomen with contra. Below the filters is a table with columns: Study Dose, Cumul. Dose, Image Quality, Date & Time, BMI, Accession #, Study Description, and Device. The table contains one row of data with the study description 'CT Abdomen with contra' highlighted.

Study Dose	Cumul. Dose	Image Quality	Date & Time	BMI	Accession #	Study Description	Device
			2014-11-24 10:15			CT Abdomen with contra	ED CT

A) Filtering in DoseWatch



- St Cross CT
- 13/10/15 to 13/11/15
- CAPUG= Pulmonary Angiogram (CTPA)

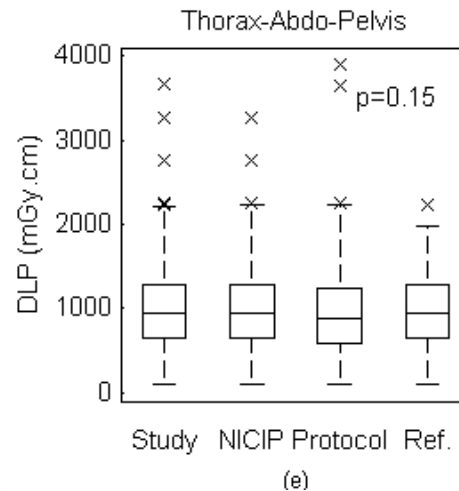
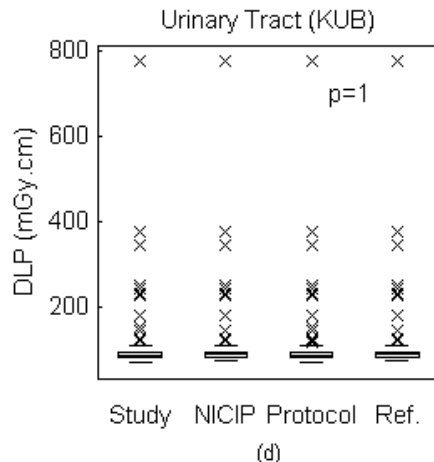
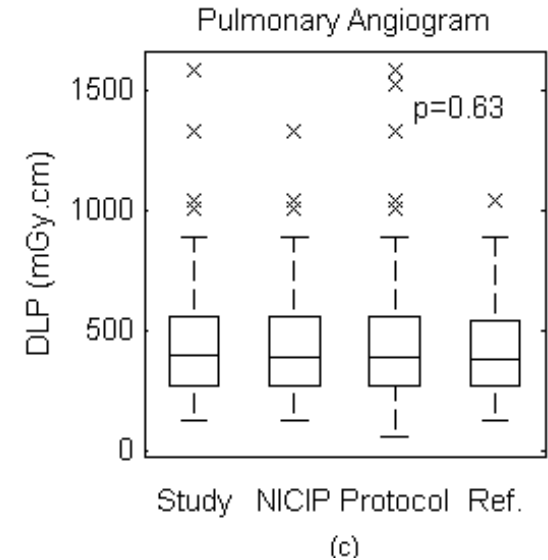
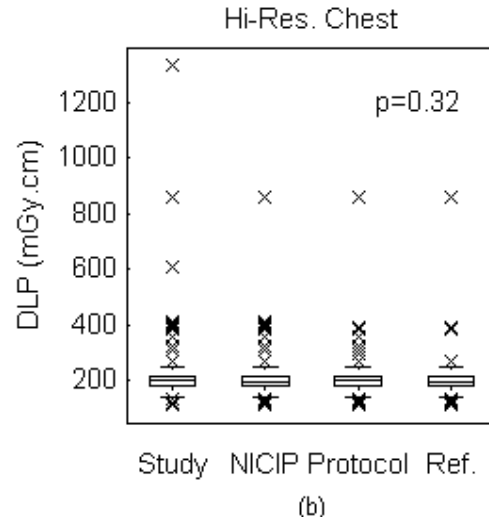
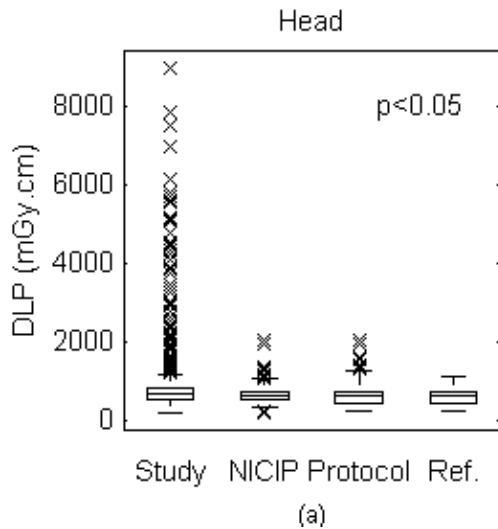
The 'Reference' Data Set: 4th Filtering Method

- 1 months data was downloaded at a time
- Filtered 4 month of data in Excel for:-
 - NICIP code,
 - protocol name,
 - >21 years,
 - number of series (to exclude repeat or added scans)
 - dosimetry phantom (IEC head or body)

Model	Study's protocol name	Patient internal key	Patient ID	Patient birthdate	Age class	Patient sex	Patient weight (kg)	Patient size (cm)	BMI	Total DLP (mGy.cm)	Total number of irradiation event
LightSpeed VCT	1.2 Routine Axial Head (H2)	2257	C51742	1996-04-07	[16-20]	FEMALE	0.00	0.00	N/A	443.97	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2257	C51742	1996-04-07	[16-20]	FEMALE	0.00	0.00	N/A	443.97	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2261	B48992	1926-05-05	[21+]	FEMALE	0.00	0.00	N/A	468.88	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2261	B48992	1926-05-05	[21+]	FEMALE	0.00	0.00	N/A	468.88	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2267	S55101	1958-07-06	[21+]	MALE	0.00	0.00	N/A	401.66	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2267	S55101	1958-07-06	[21+]	MALE	0.00	0.00	N/A	401.66	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2268	K95230	1963-05-21	[21+]	FEMALE	0.00	0.00	N/A	352.61	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2268	K95230	1963-05-21	[21+]	FEMALE	0.00	0.00	N/A	352.61	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2269	AA154394 1	1987-10-26	[21+]	MALE	0.00	0.00	N/A	415.30	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2269	AA154394 1	1987-10-26	[21+]	MALE	0.00	0.00	N/A	415.30	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2275	K85359	1933-10-24	[21+]	FEMALE	0.00	0.00	N/A	403.31	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2275	K85359	1933-10-24	[21+]	FEMALE	0.00	0.00	N/A	403.31	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2276	T36992	1955-09-20	[21+]	FEMALE	0.00	0.00	N/A	391.64	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2276	T36992	1955-09-20	[21+]	FEMALE	0.00	0.00	N/A	391.64	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2280	P24682	1916-11-08	[21+]	MALE	0.00	0.00	N/A	510.84	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2280	P24682	1916-11-08	[21+]	MALE	0.00	0.00	N/A	510.84	4.00
LightSpeed VCT	1.1 Helical Head (H1)	2282	L03812	1970-05-27	[21+]	MALE	0.00	0.00	N/A	1233.63	5.00
LightSpeed VCT	1.1 Helical Head (H1)	2282	L03812	1970-05-27	[21+]	MALE	0.00	0.00	N/A	1233.63	5.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2110	L11372	1934-11-06	[21+]	FEMALE	0.00	0.00	N/A	439.90	4.00
LightSpeed VCT	1.2 Routine Axial Head (H2)	2110	L11372	1934-11-06	[21+]	FEMALE	0.00	0.00	N/A	439.90	4.00

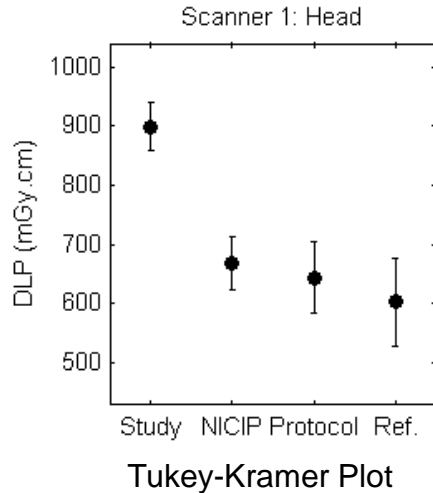


Radiology CT : 750HD



- KUB identical all filters
- Hi-res Chest & CTPA statistically no sig diff

CT Head: Scanner 1



Filter Method	No Exams	Mean DLP (mGy.cm)	Std Dev	1 st Q	2 nd Q
Study Description	781	899.2	32.8	560.3	819.1
NICIP Code	605	667.1	8.0	555.9	763.0
Protocol	334	643.9	14.5	425.8	762.9
Reference	230	603.1	11.8	425.8	743.0

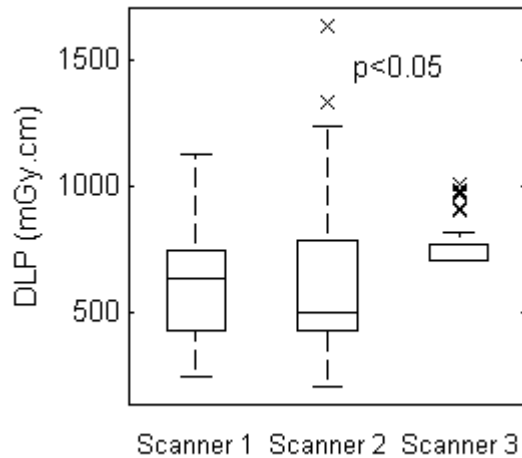
- Study description gave higher mean DLP ($p < 0.05$). No sig diff between other 3 filtering methods
- Due to inclusion of a number of CT trauma scans in 'CT Head' (1st series performed in trauma scan)
ED CT (scanner 2) had similar result for same reason
- Rugby CT also higher dose for study filter because of inclusion of pre & post contrast scans in the 'CT head' study description

Study B

- Using the reference data set, compared the mean DLPs across the 3 scanners for the 6 examinations
- Compared mean DLPs with National DRLs
- All mean DLPs were found to be below, or within 2xSD of the National DRLs 😊
- For all examinations (except C-spine) there was a significant difference between scanner DLPs 😞

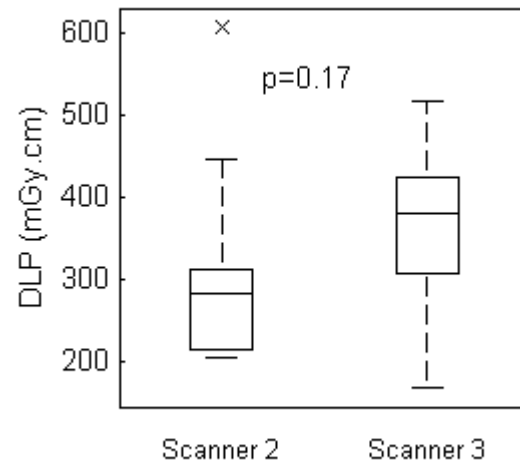
Study B: Comparing Scanner DLPs and against National DRLs

Head



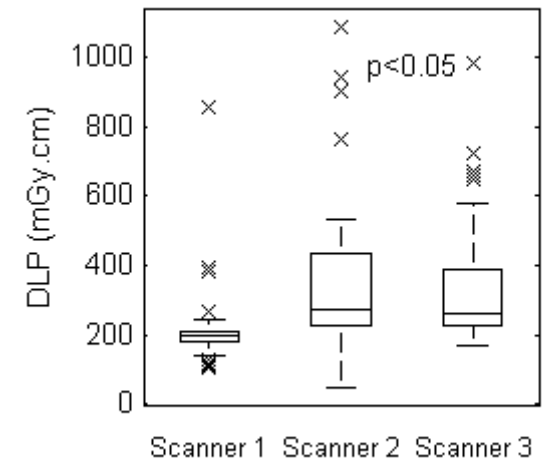
(a)

Cervical Spine



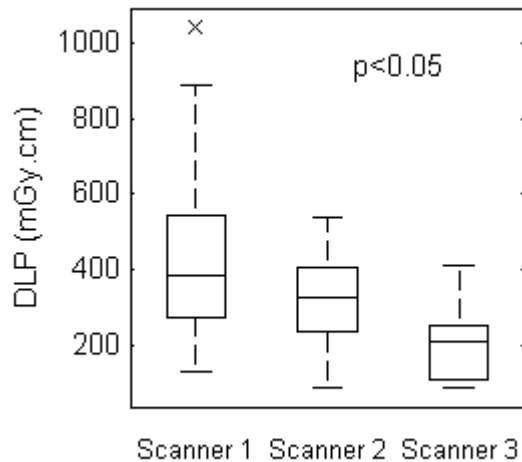
(b)

Hi-Res. Chest



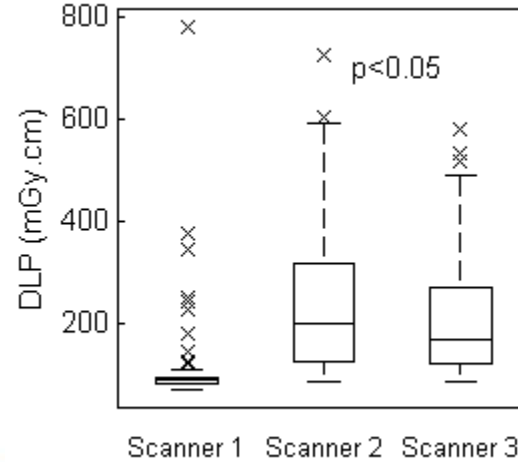
(c)

Pulmonary Angiogram



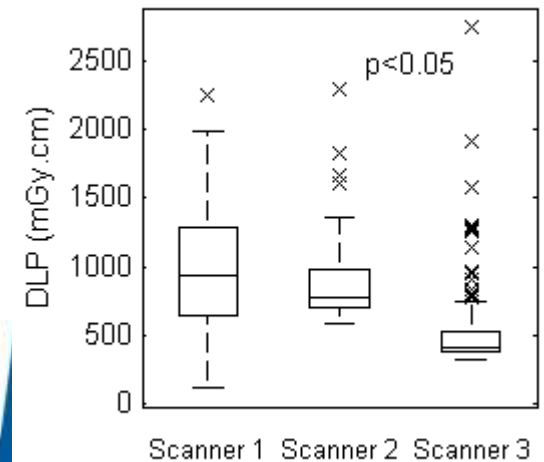
(d)

Urinary Tract (KUB)



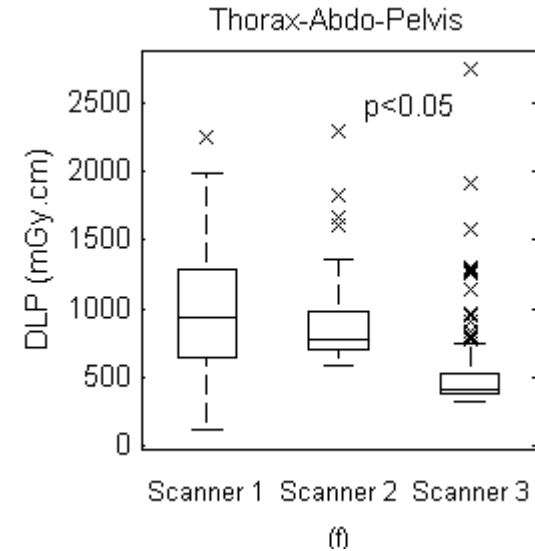
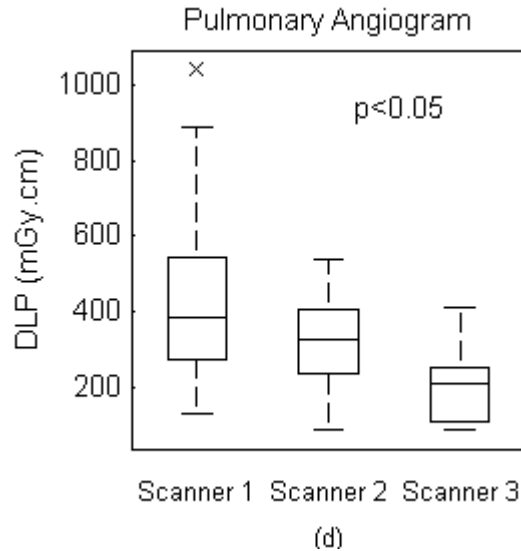
(e)

Thorax-Abdo-Pelvis



(f)

Study B: Protocol Changes



- NDRL= 440mGy.cm
- Max mA allowed on scanner 3 was lower than scanner 1 & 2
- Changed all max mA to equal scanner 2.

- NDRL = 1000mGy.cm
- Scanner 1 mean DLP= 961± 456mGy.cm (N=215)
- Changes: NI 32 to 35, min mA 180 to 150, changed 1st scout PA to AP
- Now mean DLP= 649 ± 428mGy.cm (N=191)

Conclusions: Study A & B

- NICIP code or Protocol Name can be used within DoseWatch for immediate summary of an examination dose. Done by Radiologists, Radiographers and Physicists
- DoseWatch gives a quick and easy method for physics to perform dose audits (we use the reference data set)
- Including a large number of examinations does not compensate for incorrect data
- Quickly highlighted inadvertent difference between scanner protocols, which have been corrected.

DoseWatch: Useful Features

- Can set-up e-mail alert, so immediately know when examination has exceeded pre-set DLP value, or number of series.
- Currently get about 8 to 10 emails per day
- Usually because DoseWatch has temporarily lost connection to RIS & no NICIP code information
- Some genuine alerts



Genuine Alert e-mail

Reason for Notification

This alert is triggered by the following event(s):

- Examination DLP is over DLP threshold

	Current value	Warning	Alert
DLP (mGy.cm)	430.62	124.94	124.94

Study Information

Date / Time:	2015-10-23 - 15:49
Device:	rkb01cts04
Model:	Discovery CT750 HD
Modality:	CT
Site:	UHCW NHS Trust - Radiology
Accession number:	RKB22146574
Study Description:	CORBB,CSINUC
Protocol:	2.6 CT ORBITS
Standard Study Description:	
BMI:	
Weight (Kg):	0.0
Height (cm):	0.0

Alert emails: lost RIS connection

Reason for Notification

This alert is triggered by the following event(s):

- Examination DLP is over DLP threshold
- Total number of irradiation is over threshold

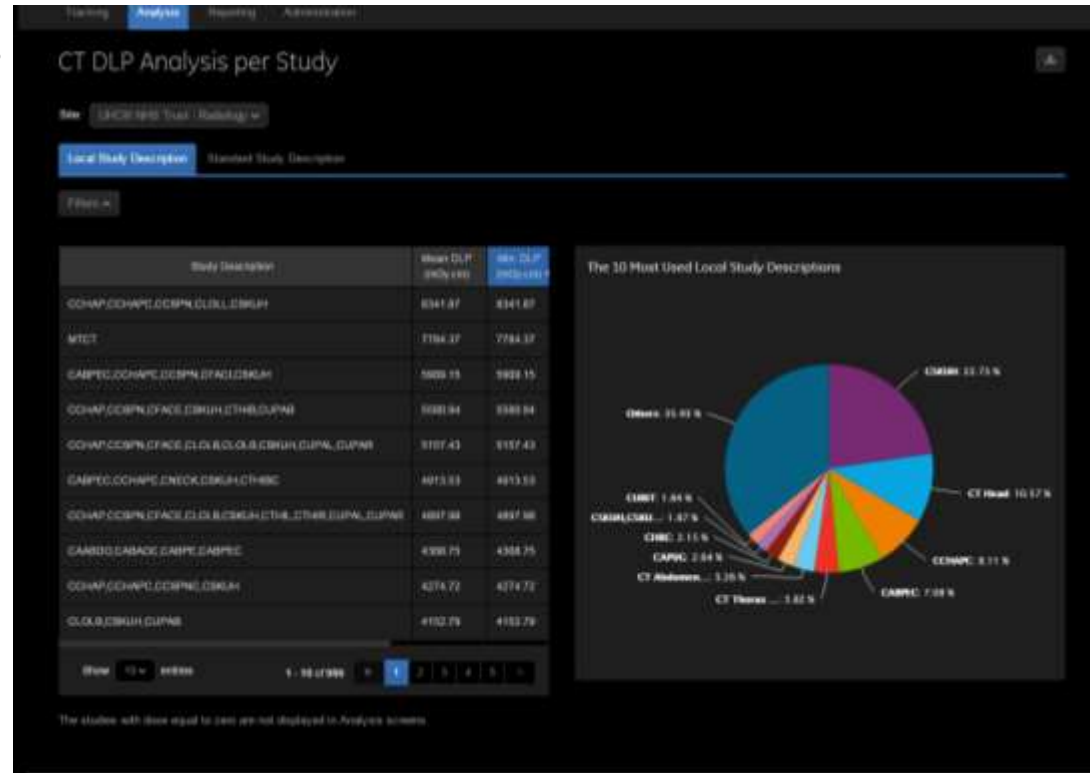
	Current value	Warning	Alert
DLP (mGy.cm)	5114.97	2048.92	1920.48
TNI	7	7	9

Study Information

Date / Time:	2015-11-14 - 21:54
Device:	rkb02cted
Model:	LightSpeed VCT
Modality:	CT
Site:	UHCW NHS Trust - Radiology
Accession number:	RKB22212635
Study Description:	CT Head
Protocol:	1.13 CT MULTIPLE TRAUMA (OVER 50 YRS)
Standard Study Description:	
BMI:	
Weight (Kg):	0.0
Height (cm):	0.0

DoseWatch: Useful Features

- Physics dose audits quick & simple, e.g. audits for medical exposure committee
- Audits using DoseWatch (We haven't customised this yet.)
- Aim to get lead CT radiographers & radiologists more involved in dose audit/optimisation



Acknowledgements

- Chris Koller: Obtaining DoseWatch, enabling connection to RIS, idea for study A & B.
- Ruth Nicol: Carrying out Study A & B, & all the statistical analysis to publish
- Andy Bridges: Protocol changes, helpful suggestions throughout Study A & B

Thank You For Listening

