



---

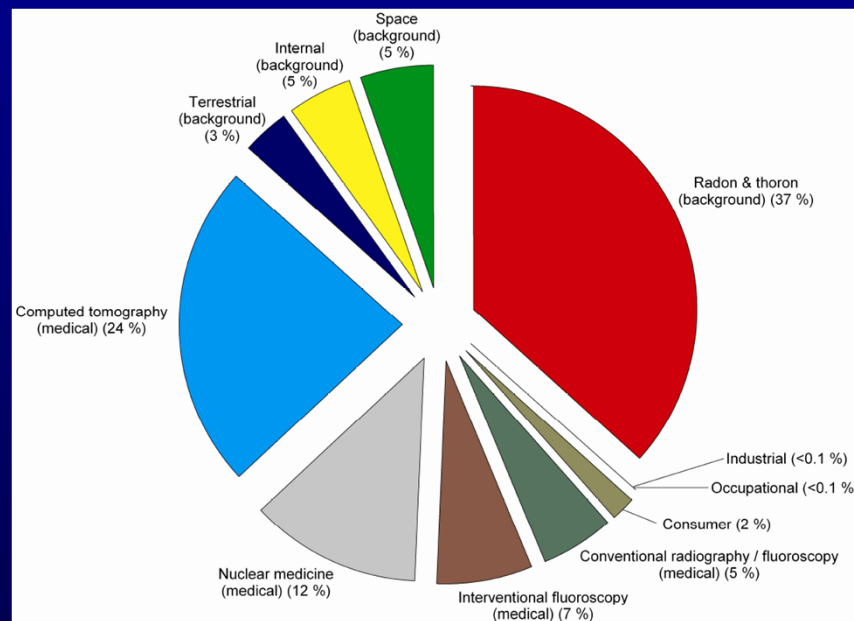
# *ACR Dose Index Registry*

Richard L. Morin, Ph.D.  
Mayo Clinic Florida  
Chair, ACR DIR



## *Why a Dose Index Registry?*

CT scans contribute 25% of radiation dose



From NCRP Report No. 160, "Ionizing Radiation Exposure of the Population of the United States" (2009)



---

*What is the national average level of radiation administered by imaging facilities for a CT of the head?*





## *What is the Dose Index Registry?*

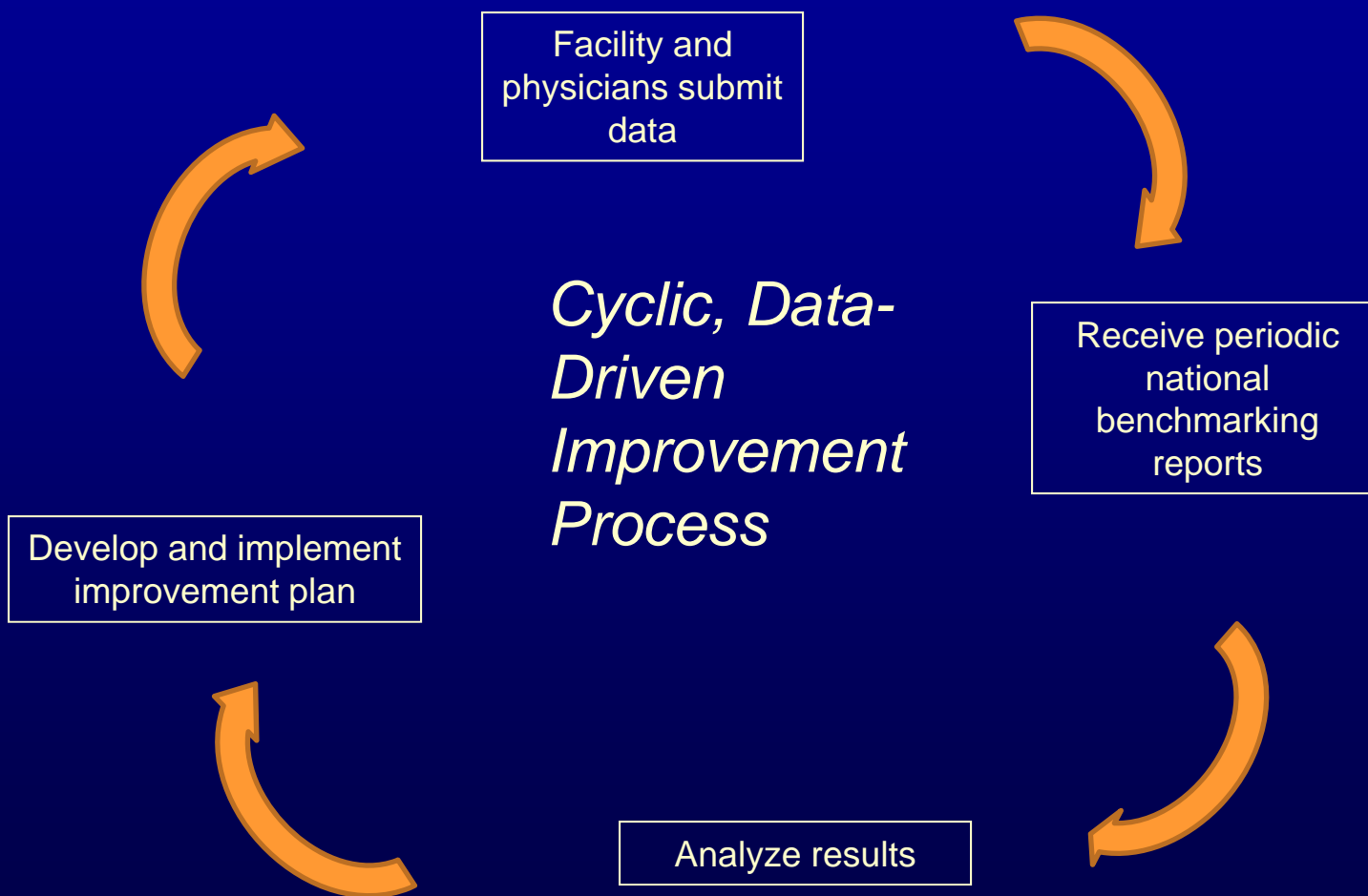
---

- One component of the National Radiology Data Registry
- Collects and compares dose index information across facilities
- Uses standard methods of data collection
  - DICOM SR, IHE REM Profile
- Establishes national benchmarks and practice patterns in dose indices



# Guiding Principle Behind Registries

---





## *Does It Work?*

---

- Evidence of data-driven improvement in performance from:
  - Medicine in general (outside radiology)
  - CT dose (for CCTA)
  - ACR registries (for recent registries)



## Evidence on CABG mortality from the Society of Thoracic Surgeons National Adult Cardiac Database

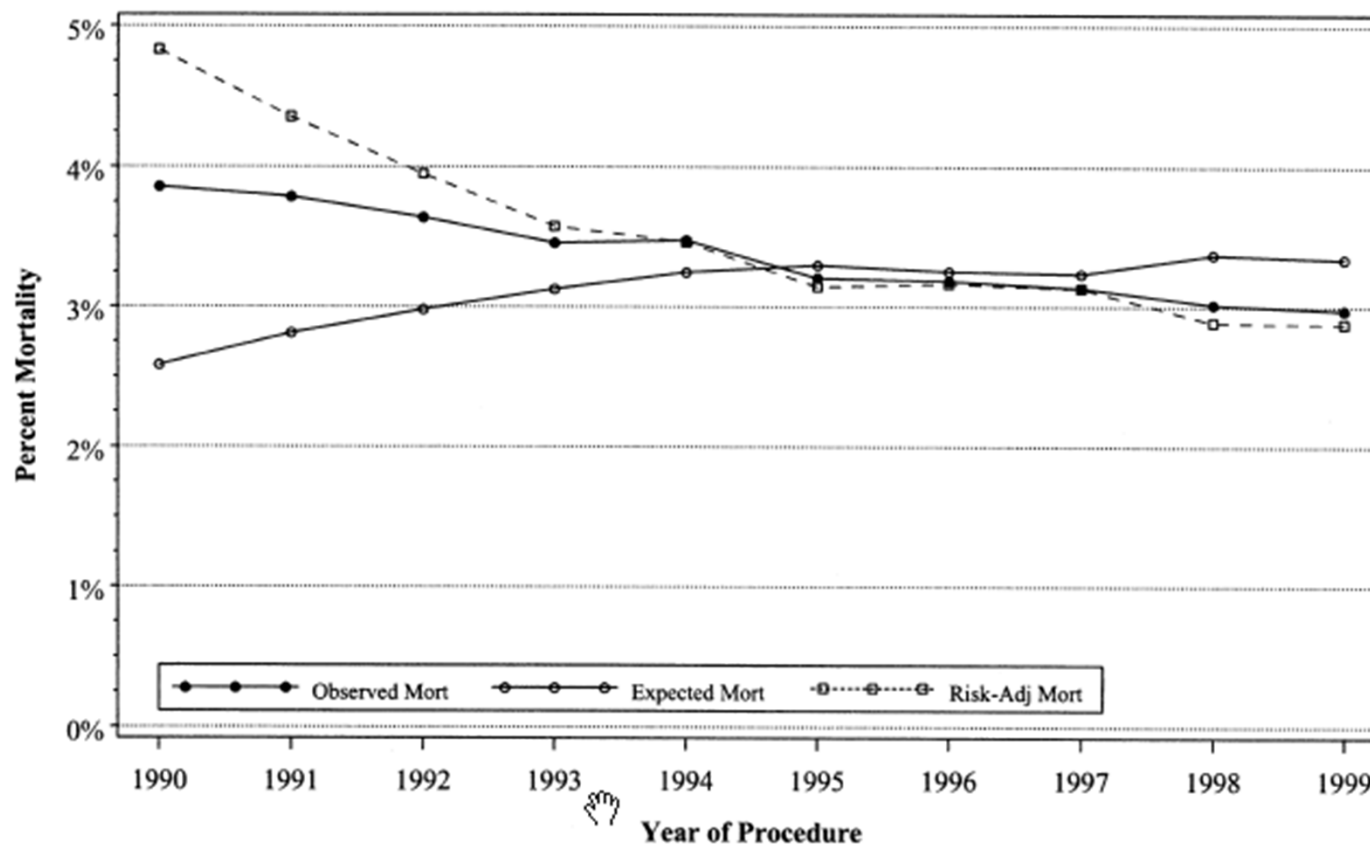
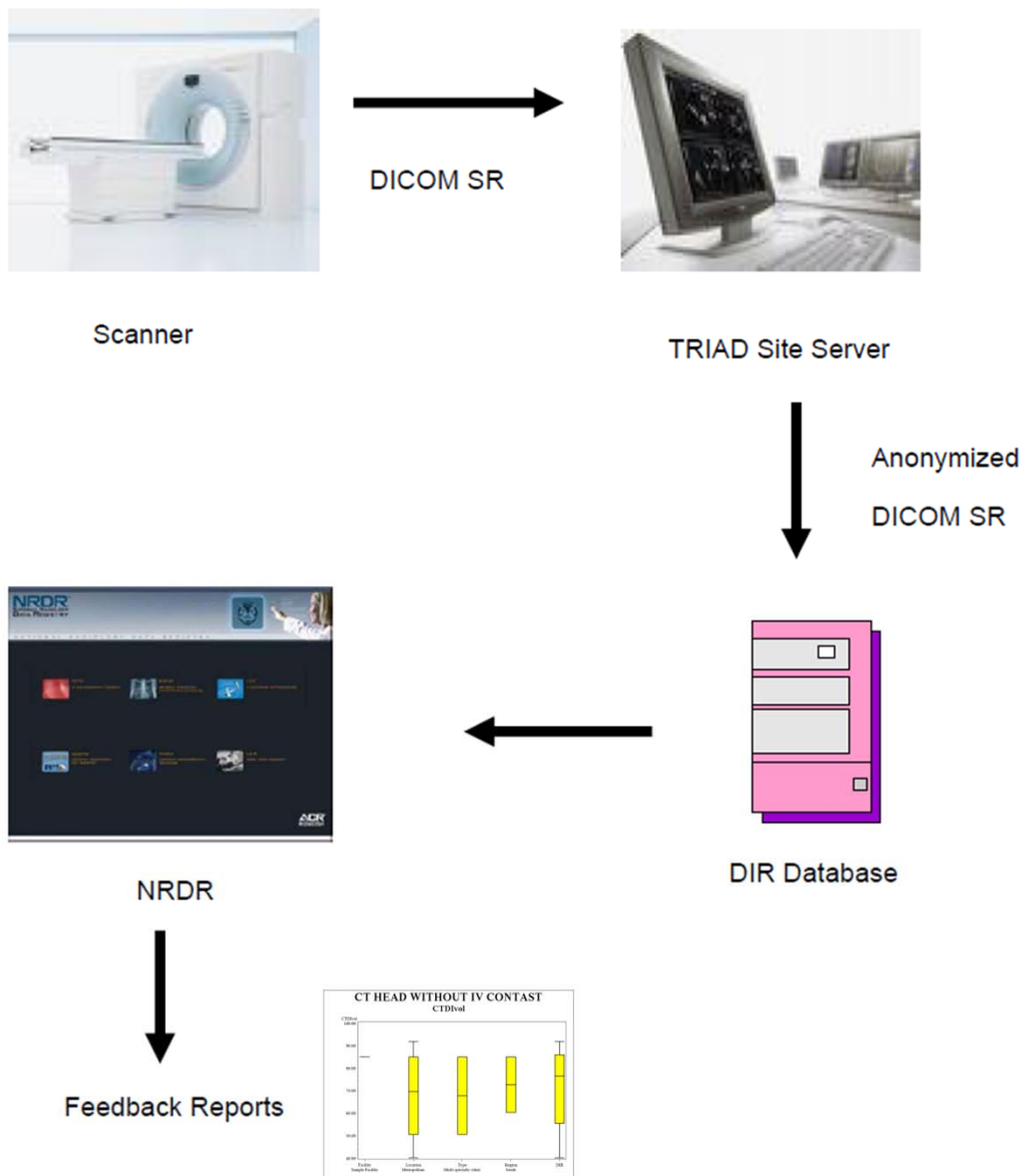


Fig 1. Observed, expected and risk-adjusted mortality, 1990 to 1999. Entire coronary artery bypass grafting population (n = 1,154,486).

Ferguson TB Jr, Hammill BG, Peterson ED, DeLong ER, Grover FL; STS National Database Committee. A decade of change--risk profiles and outcomes for isolated coronary artery bypass grafting procedures, 1990-1999: a report from the STS National Database Committee and the Duke Clinical Research Institute. Society of Thoracic Surgeons. *Annals of Thoracic Surgery* 2002 February;73(2):480-9.



## How does it work?





## *Registration Process*

---

- Sign Participation Agreement
- Register on NRDR website
- Download software to transmit data
  - We will contact you and walk you through the installation
- Configure scanners (or PACs)
- Data transmission to NRDR is **completely automated** – no personnel required beyond initial setup

**NRDR**<sup>TM</sup>  
NATIONAL RADIOLOGY  
DATA REGISTRY



N A T I O N A L   R A D I O L O G Y   D A T A   R E G I S T R Y

Welcome to the National Radiology Data Registry

[Enter NRDR](#)



**CTC**

CT COLONOGRAPHY REGISTRY

> [CLICK HERE TO ENTER](#)



**GRID**

GENERAL RADIOLOGY  
IMPROVEMENT DATABASE

> [CLICK HERE TO ENTER](#)



**ICE**

IV CONTRAST EXTRAVASATION

> [CLICK HERE TO ENTER](#)



**NOPR**

NATIONAL ONCOLOGIC  
PET REGISTRY

> [CLICK HERE TO ENTER](#)



**NMD**

NATIONAL MAMMOGRAPHY  
DATABASE

> [CLICK HERE TO ENTER](#)



**DIR**

DOSE INDEX REGISTRY

> [CLICK HERE TO ENTER](#)



**QUIRCC**

QUALITY IMPROVEMENT REGISTRY  
FOR CT SCANS IN CHILDREN

> [CLICK HERE TO ENTER](#)

Comparing practice performance to regional and national benchmarks is an important tool for improving the quality of patient care. ACR's NRDR - the National Radiology Data Registry - will help your facility benchmark outcomes and process-of-care measures and develop quality-improvement programs.



[ACR NRDR Homepage](#)

User Name: administrator | User Type: Facil

## Information For Facilities

## Participation Agreement

## Registries

## Registration

CTC

DIR

## GRID

ICE

**NMD**

**NOPR**

QuIRCC

## Facility Management

### Registration Information

## Manage Users

## Manage Patients

## NRDR

The National Radiology Data Registry is a data warehouse for the registries listed below. The primary purpose of NRDR is to aid facility data to that of their region and the nation. A practice or facility may choose to participate in any or all registries as a information to be shared across registries within the facility.

## CTC

The CT Colonography Registry collects measures critical to evaluating CT colonography procedures. Data collected in this registry

## DIR

The Dose Index Registry (DIR) is a data registry that allows facilities to compare their CT dose indices to regional and national values from the ACR, and stored in a database. Institutions are then provided with periodic feedback reports comparing their results by body part to national benchmarks for CT dose indices.

GRID

The General Radiology Improvement Database (GRID) collects information about imaging facilities which is then aggregated turnaround times, patient wait times, incident rates and many other process and outcome measures with other facilities and practitioners.



☐ ACR NRDR Homepage

Information For Facilities

Participation Agreement

☐ Registries

Registration

CTC

DIR

GRID

ICE

NMD

NOPR

QuIRCC

☐ Facility Management

Registration Information

Manage Users

Manage Patients

User Name: administrator | User Type: Facility

## Participation Agreement

After completing the **Register New Facility** Form, the facility must send an executed NRDR Participation Agreement to the ACR. The

[NRDR Participation Agreement \(signatures required on Pages 9 and 15\)](#)

The signed document can be sent to the ACR by e-mail, fax or post using the contact information below:

Lu Meyer  
NRDR Administrator  
American College of Radiology  
1891 Preston White Drive  
Reston, VA 20191-4397

Fax number: (703) 264-5287

E-mail address: [lmeyer@acr.org](mailto:lmeyer@acr.org)

\*Acrobat Reader can be downloaded free of charge by clicking [Download Acrobat Reader](#)

## Dose Index Registry

### DIR Registry

New Facility Registration

FAQ

DIR Sample Report

NRDR

User Type: ACR Staff

### DIR

The Dose Index Registry (DIR) is a data registry that allows facilities to compare their CT dose indices to regional and national values. Information related to CT dose indices is collected, stored in a database. Institutions are then provided with periodic feedback reports comparing their results by body part and exam type to national benchmarks for CT dose indices.

Integrating the Healthcare Enterprise (IHE) is a global initiative that creates the framework for passing vital health information seamlessly. IHE in collaboration with the American College of Radiology (ACR) has developed a profile that allows all vendors to collect and transmit the information related to CT dose indices and techniques in a similar manner (see [http://medical.nema.org/medical/dicom/2009/09\\_16pu.pdf](http://medical.nema.org/medical/dicom/2009/09_16pu.pdf)). The CT Dose SR defines the data elements related to the specific dose information that should be stored. The DIR collects the dose information in the DICOM CT Dose SR and some additional information contained in the metadata in the DICOM CT Dose SR. Information related to the patient (e.g., age in years, sex) is transmitted to the registry. Patient identifiers are removed at the facility before the data is transmitted to the registry.

To participate in the registry, a facility enrolls in the DIR through the NRDR portal and is assigned a unique facility identifier. The ACR's TRIAD system automatically sends the appropriate DICOM SR object to the PC for every CT exam performed on the scanner. TRIAD is used to anonymize and transmit the NRDR portal comparing their results to aggregate results by exam type. Comparisons to both regional and national data are provided.

Currently there is no standard for naming exam types across facilities. For example, an adult CT of the head without contrast might be labeled as "Head CT" or "Head CT without contrast". To handle this problem, the DIR is implementing the Radlex Playbook. The Playbook is the list of standard-name procedures with a Radlex Playbook ID so that accurate comparisons can be made.

The DIR has begun a pilot at facilities located across the country. The pilot is testing the first implementation of the IHE REM profile for a registry. Once this pilot is complete, the DIR will then be ready to launch nationwide in Spring 2011.

Headquarters Office: 1891 Preston White Dr, Reston, VA 20191, (703) 648-8900  
Clinical Research Office: 1818 Market St, Suite 1600, Philadelphia, PA 19103, (215) 574-3150  
Government Relations Office: 505 9th St., N.W., Suite 910, Washington, DC 20004, (202) 223-1670  
© 2004-2006 American College of Radiology

Version: 7.48.297



## ACR NRDR Homepage

Information For Facilities

New Facility Registration

Participation Agreement

## Registries

CTC

DIR

GRID

ICE

NMD

NOPR

QuIRCC

News

FAQ

IRB Exemption

NRDR User Guide

User Type: Facility Adm

## Register New Facility

\* - Required

## 1. Facility Information

\* Facility name

\* Facility category

\* Location

\* Trauma Center Level

\* Street line 1

Street line 2

\* City

\* Country

State or province

ZIP or postal code

\* Telephone

--

...Please select category... ...Please select Location... ...Please select... United States ...Please select state...

New Facility Registration - Windows Internet Explorer

http://192.168.1.118/Portal/Nrdr/Main/NewFacilityRegistration/page.aspx

File Edit View Favorites Tools Help

★ Favorites DIR Registry New Facility Registration x

**ACR NRDR Homepage**

Information For Facilities

New Facility Registration

Participation Agreement

Registries

CTC

DIR

GRID

ICE

NMD

NOPR

QuIRCC

News

FAQ

IRB Exemption

NRDR User Guide

**User Type:** Facility Admini

## Register New Facility

\* - Required

### 1. Facility Information

\* Facility name Reston Radiology

\* Facility category Freestanding imaging center ▼

\* Location Metropolitan (> 100,000) ▼

\* Trauma Center Level II ▼

\* Street line 1 1891 Preston White Dr

Street line 2

\* City Reston

\* Country United States ▼

State or province VIRGINIA ▼

ZIP or postal code 20191

\* Telephone 703-999-9999

\* Fax 703-888-8888

Medicare Provider Number

NPI

Radiology group ? Radiology AAA

### 2. Facility Administrator Information

Medicare Provider Number

NPI

Radiology group

**2. Facility Administrator Information**

\* First name

\* Last name

\* E-mail

\* Confirm E-mail

\* Password

\* Confirm Password

Specialization

Office phone

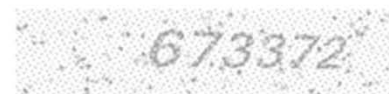
Mobile phone

Address

Additional information

**3. \* Security Text**

Enter the code you see on the image:

**Register**



ACR NRDR Homepage

Information For Facilities

New Facility Registration

Participation Agreement

Registries

CTC

DIR

GRID

ICE

NMD

NOPR

QuIRCC

News

FAQ

IRB Exemption

NRDR User Guide

User Type: Facility Admini

Registration information successfully saved.  
Thank you for submitting the Facility Registration form.

You are now registered as the Facility Administrator for your facility.  
Your Facility ID# is 100378  
Your User Name is administrator

Please click the Continue button to select the registries in which you would like to participate.

Continue



☐ ACR NRDR Homepage

Information For Facilities

Participation Agreement

☐ Registries

Registration

CTC

DIR

GRID

ICE

NMD

NOPR

QuIRCC

☐ Facility Management

Registration Information

Manage Users

Manage Patients

User Name: administrator | User Type: Facility

## Registration

Registry Name	Status
CTC	<input type="button" value="Register"/>
DIR	<input type="button" value="Register"/>
GRID	<input type="button" value="Register"/>
ICE	<input type="button" value="Register"/>
NMD	<input type="button" value="Register"/>
QuIRCC	<input type="button" value="Register"/>

DIR Registry

Registry Management

Registration Information

FAQ

DIR Sample Report

NRDR

User Name: administrator | User Type: Facility

## Registration Information

Facility Id: 100378

1. NUMBER OF PARTICIPATING RADIOLOGISTS: 

2. PARTICIPATING PHYSICIANS (optional):

You must first add physicians to the NRDR physician dictionary before adding them to the registry.

[Add Physician](#)

3. STAFF - who are allowed to enter data into the database. A username and password will be emailed to the staff person.

Last Name	First Name	E-mail	
Coombs	Laura	lcoombs@acr.org	Facility Adm

[Add Facility User](#)

4. NAME OF PERSON COMPLETING THIS FORM

First name

Last name

Submission Date

 (mm/dd/yyyy)

# Dose Index Registry

DIR Registry

Registry Management

[Registration Information](#)[FAQ](#)[DIR Sample Report](#)[NRDR](#)

User Name: administrator | User Type: Fac

**Registration information saved successfully.****Thank you for submitting the DIR Facility Registration Form.****An e-mail confirmation and an invoice will be sent to the Facility Administrator.****Your facility can begin entering data once we receive the DIR addendum to your NRDR Participants Agreement and an**[Continue](#)

Headquarters Office: 1891 Preston White Dr, Reston, VA 20191, (703) 648-8900  
Clinical Research Office: 1818 Market St, Suite 1600, Philadelphia, PA 19103, (215) 574-3150  
Government Relations Office: 505 9th St., N.W., Suite 910, Washington, DC 20004, (202) 223-1111  
© 2004-2006 American College of Radiology

Version: 8.53.569

## Summary of Data Submitted to DIR

05/23/2011

Facility Name	# of Exams	# of Series	Last Exam Received
Kingtest City State Community Facility	11,685	33,610	2011.03.27 22:37:52



## AAPM 2011 Summit on CT Dose

Dose Information By Exam Report for facility #100001 - Windows Internet Explorer

http://192.168.1.118/Portal/Parts/DIR/Reports/ShowReport.aspx?Report=DoseInformationByExamReport&FacilityId=100001&DateFrom=6/1/2010&DateTo=

1 / 1 100% Export to Excel 97-2000

### Dose Information by Exam

06/01/2010 - 07/31/2010

Facility ID	Study	Institution	Total CTDIvol (mGy)	Total DLP (mGycm)	Study Date
100001	Abdomen^01_ABD_PEL_WO (Adult)	MJH	25	1966	20100618
100001	Abdomen^01_ABD_PEL_WO (Adult)	MH CT P	14	248	20100617

DIR Summary of Irradiation Events  
05/23/2011

Patient's Pseudo ID	Study Start Date	Age	Sex	Study Description	Event Description
87	06/17/2010	053Y	F	Head^04_TEMP_BONES (Adult)	Head_Constant Angle Acquisition_CT without contrast
87	06/17/2010	053Y	F	Head^04_TEMP_BONES (Adult)	Head_Spiral Acquisition_CT without contrast
88	06/17/2010	077Y	F	Thorax^01_CHEST_WO_SLHR (Adult)	Chest_Constant Angle Acquisition_CT without contrast
88	06/17/2010	077Y	F	Thorax^01_CHEST_WO_SLHR (Adult)	Chest_Spiral Acquisition_CT without contrast
89	06/17/2010	072Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Constant Angle Acquisition_CT without contrast
89	06/17/2010	072Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Spiral Acquisition_CT without contrast
89	06/17/2010	072Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Stationary Acquisition_CT without contrast
89	06/17/2010	072Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Stationary Acquisition_Diagnostic radiography with contrast media
89	06/17/2010	072Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Spiral Acquisition_Diagnostic radiography with contrast media
89	06/17/2010	072Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Spiral Acquisition_Diagnostic radiography with contrast media
89	06/17/2010	072Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Spiral Acquisition_Diagnostic radiography with contrast media
90	06/17/2010	065Y	M	Abdomen^07_DE_RENAL_MASS (Adult)	Abdomen_Constant Angle Acquisition_CT without contrast
90	06/17/2010	065Y	M	Abdomen^07_DE_RENAL_MASS (Adult)	Abdomen_Spiral Acquisition_CT without contrast
90	06/17/2010	065Y	M	Abdomen^07_DE_RENAL_MASS (Adult)	Abdomen_Spiral Acquisition_CT without contrast
90	06/17/2010	065Y	M	Abdomen^07_DE_RENAL_MASS (Adult)	Abdomen_Spiral Acquisition_CT without contrast
90	06/17/2010	065Y	M	Abdomen^07_DE_RENAL_MASS (Adult)	Abdomen_Spiral Acquisition_CT without contrast
90	06/17/2010	065Y	M	Abdomen^07_DE_RENAL_MASS (Adult)	Abdomen_Spiral Acquisition_CT without contrast
91	06/17/2010	080Y	F	Pelvis^1_BONE_PELVIS (Adult)	Pelvis_Constant Angle Acquisition_CT without contrast
91	06/17/2010	080Y	F	Pelvis^1_BONE_PELVIS (Adult)	Pelvis_Constant Angle Acquisition_CT without contrast
91	06/17/2010	080Y	F	Pelvis^1_BONE_PELVIS (Adult)	Pelvis_Spiral Acquisition_CT without contrast
92	06/17/2010	039Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Constant Angle Acquisition_CT without contrast
92	06/17/2010	039Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Constant Angle Acquisition_CT without contrast
92	06/17/2010	039Y	F	Abdomen^04_4PH_LIVER (Adult)	Abdomen_Spiral Acquisition_CT without contrast

## Dose Index Registry

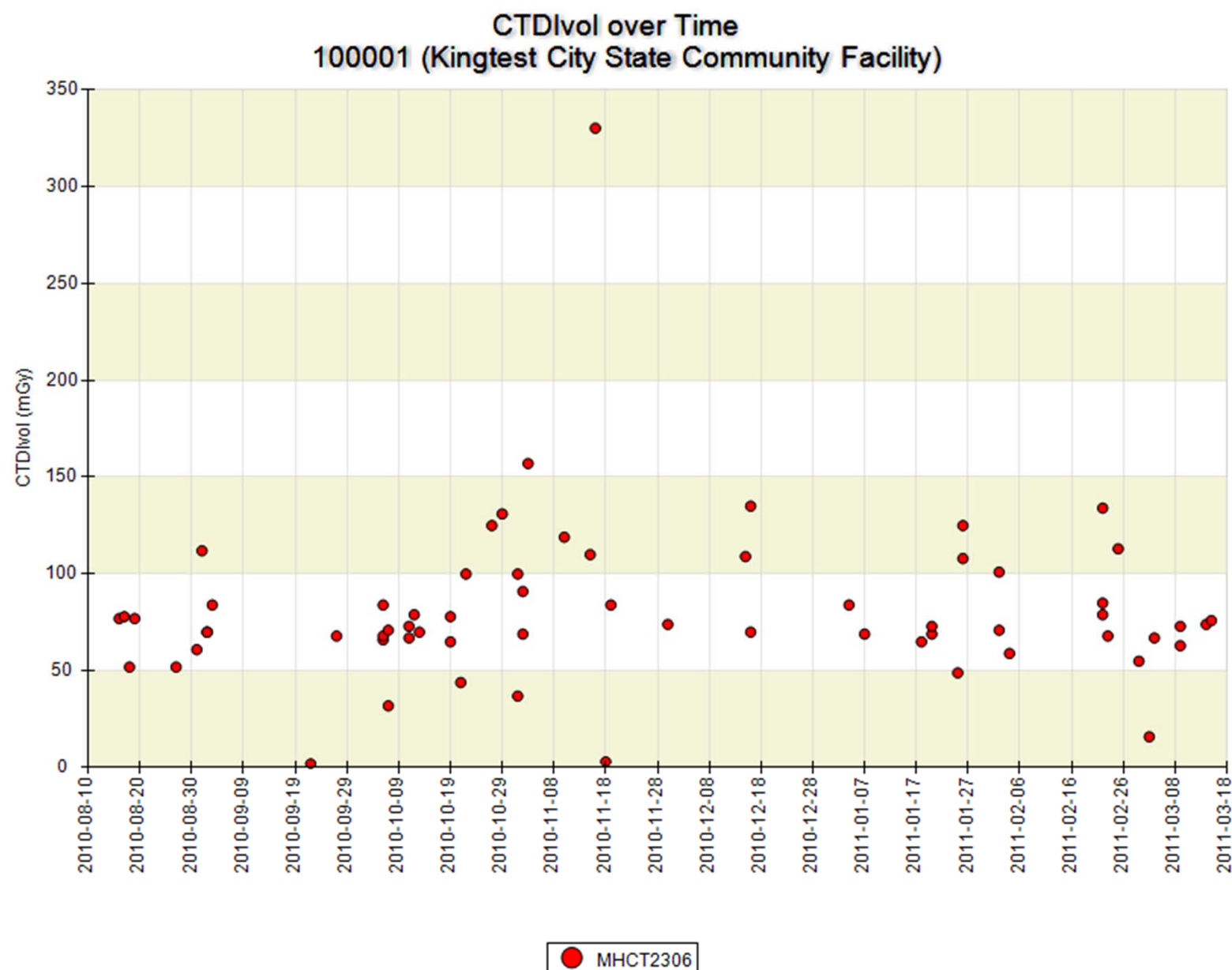
DIR Registry
Reports
Summary Of Data Submitted
Dose Information by Exam
Summary of Irradiation Events
<u>CTDIvol Over Time</u>
CTDIvol Box Plot
Aggregate Reports
Registry Management
Registration Information
FAQ
DIR Sample Report
NRDR

User Name: administrator | User Type: Facility Administrator | Fa

### CTDIvol Over Time

DIR Facility Number	100001
DIR Facility Name	Kingtest City State Community Facility
Start and Stop Date Period	__/__/__ to __/__/__
DIR Facility Scanner Types	All CT54715 MHCT2306
DIR Facility Exam Types	Cardiac^02_FLASH_CCTA (Adult) Cardiac^03_A_FIB (Adult) Cardiac^03_BYPASS_GRAFT (Adult) Cardiac^03_XXL_CCTA (Adult) Cardiac^04_DS_CASCOE_SEQ_HIGH_HF Cardiac^04_DS_CASCOE_SPIRAL (Adult)

Submit



Scanners:

MHCT2306

## Dose Index Registry

DIR Registry
Reports
Summary Of Data Submitted
Dose Information by Exam
Summary of Irradiation Events
CTDIvol Over Time
<u>CTDIvol Box Plot</u>
Aggregate Reports
Registry Management
Registration Information
FAQ
DIR Sample Report
NRDR

User Name: administrator | User Type: Facility Administrator |

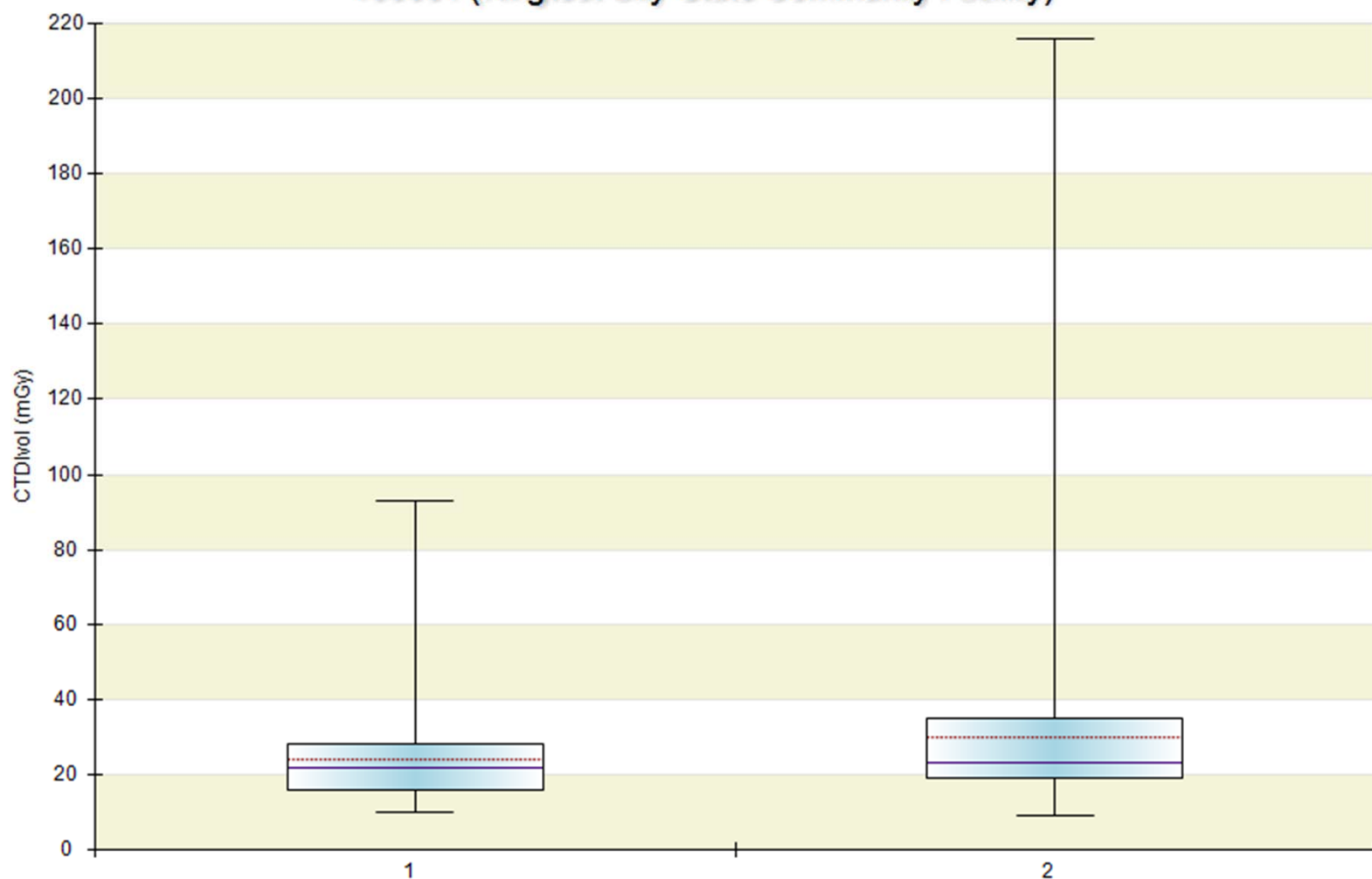
### CTDIvol Box Plot

DIR Facility Number	100001
DIR Facility Name	Kingstest City State Community Facility
Start and Stop Date Period	__/__/__ to __/__/__
Box Plot Type	By Exam Type
Scanner	All CT54715 MHCT2306
Exam Type	All Abdomen^01_ABD_PEL_WO (Adult) Abdomen^02_ABD_PEL_W (Adult) Abdomen^03_ENTEROGRAPHY (Adult) Abdomen^04_2PH_LIVER (Adult) Abdomen^04_3PH_LIVER (Adult)

## Summary stats

	1	2
N	121	329
Mean	24	30
Median	22	23
Min	10	9
Max	93	216

Boxplots for Facility  
100001 (Kingtest City State Community Facility)





---

## *Sample Feedback Report*

# NRDR™

NATIONAL RADIOLOGY  
DATA REGISTRY

NATIONAL RADIOLOGY DATA REGISTRY



## CTC

CT COLONOGRAPHY REGISTRY



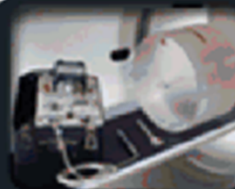
## GRID

GENERAL RADIOLOGY  
IMPROVEMENT DATABASE



## ICE

IV CONTRAST EXTRAVASATION



## DIR

DOSE INDEX REGISTRY



## NOPR

NATIONAL ONCOLOGIC  
PET REGISTRY

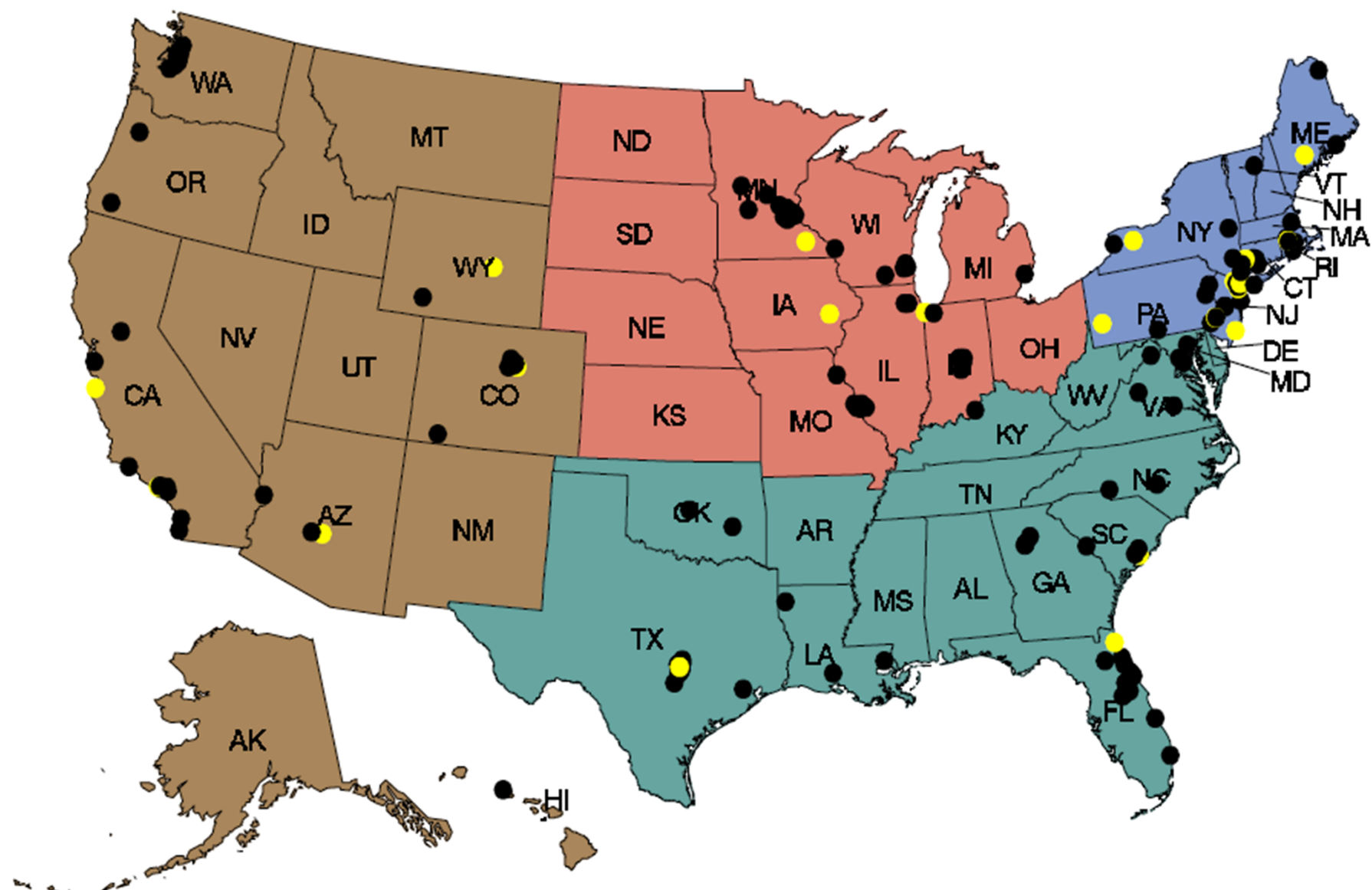


## NMD

NATIONAL MAMMOGRAPHY  
DATABASE

ACR®  
AMERICAN COLLEGE OF  
RADIOLOGY

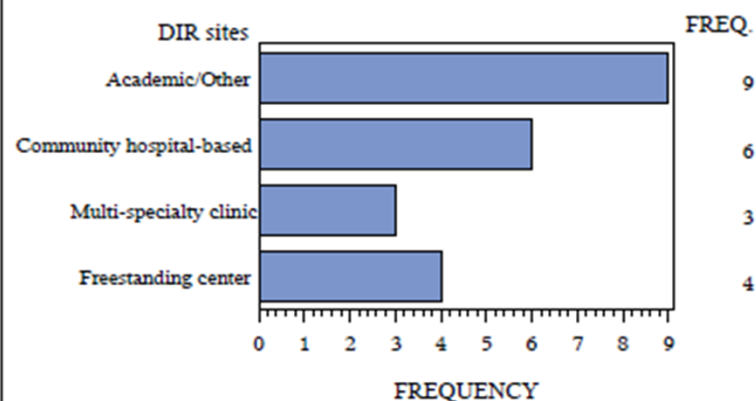
DIR Facilities  
May - July 2011



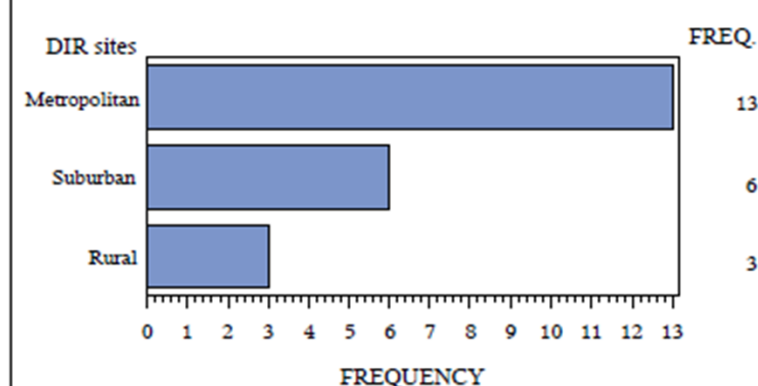
Yellow dots indicate DIR facilities registered and contributing data.  
Black dots indicate DIR facilities registered but not yet contributing.

*DIR Facility Characteristics*  
*Summer 2011*

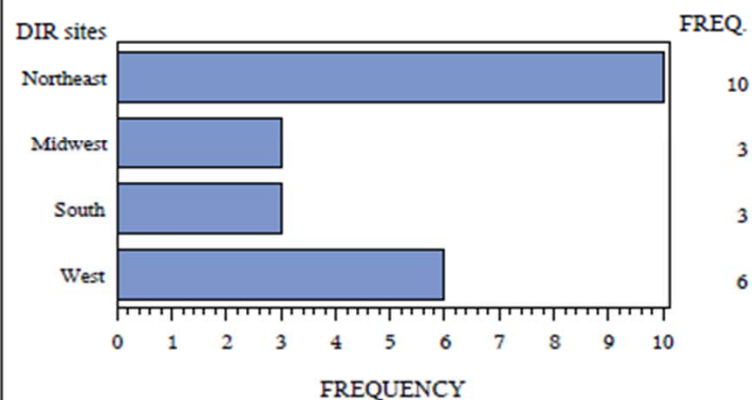
**Facility type**  
Sample Facility: Academic/Other.



**Location**  
Sample Facility: Metropolitan.



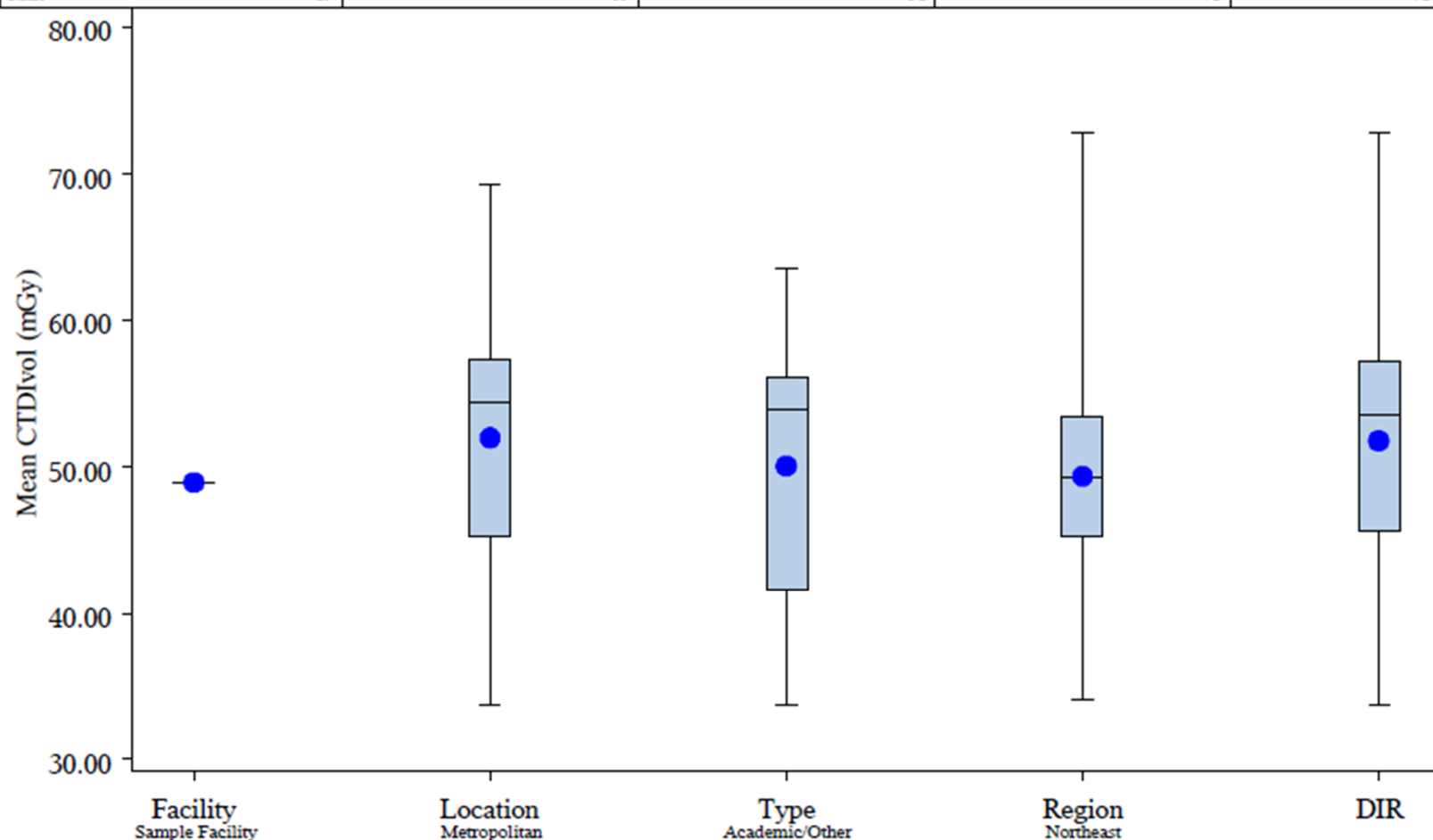
**Census region**  
Sample Facility: Northeast.



# CT HEAD WITHOUT IV CONTRAST

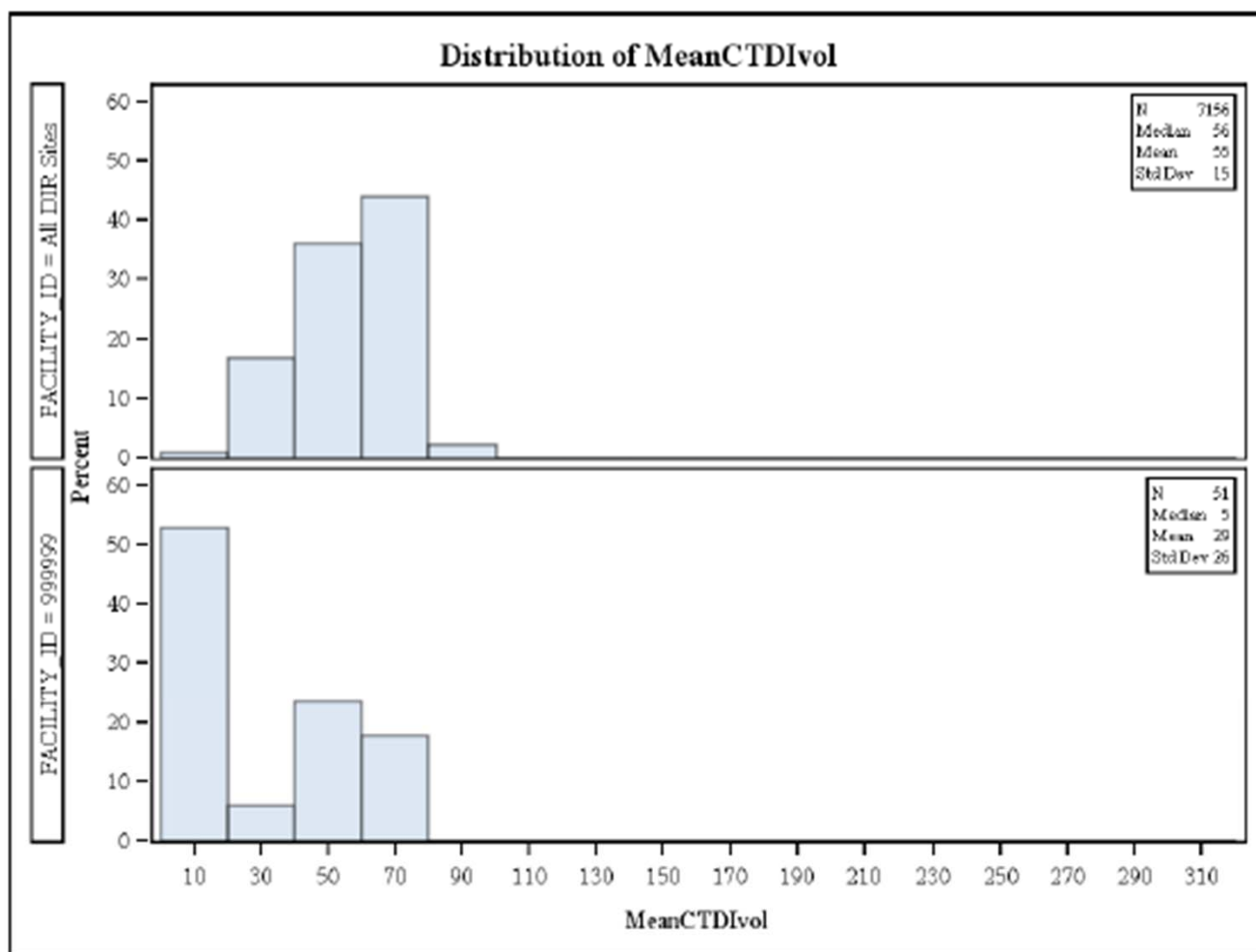
## Mean CTDIvol (mGy) per Scan

Summary stats					
N	1	11	8	9	20
Median	49	54	54	49	54
Mean	49	52	50	49	52
Min	49	34	34	34	34
Max	49	69	64	73	73





**CT HEAD WITHOUT IV CONTRAST**  
**Per Scan**





## *Mapping*

---

- Radlex Playbook
- Each facility will map exam descriptions



# *DIR Preliminary Data*

## *Total CTDIvol per Exam*

Analysis Variable : TotalCTDIvol TotalCTDIvol							
Exam	N	Mean	Std Dev	Coeff of Variation	Minimum	Maximum	Range
CT HEAD WITH IV CONTRAST	114	112.17	51.37	45.80	37.68	331.72	294.04
CT HEAD WITHOUT IV CONTRAST	4944	78.89	39.60	50.20	2.71	416.22	413.51
CT CHEST WITH IV CONTRAST	1306	29.57	28.09	95.01	0.86	281.92	281.06
CT CHEST WITHOUT IV CONTRAST	1746	20.56	25.44	123.75	1.69	256.78	255.09
CT HEAD PERFUSION	96	364.10	497.08	136.52	48.68	2854.79	2806.11

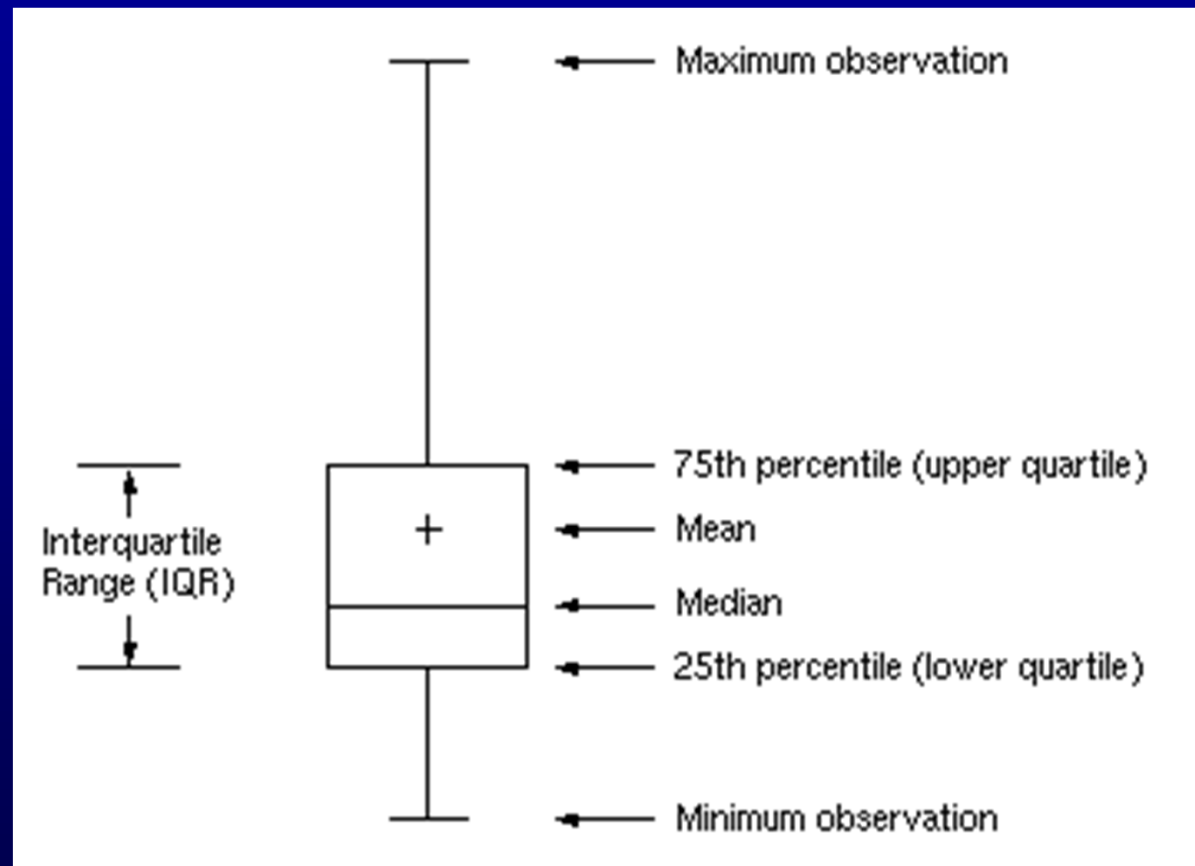


## CT HEAD WITHOUT IV CONTRAST

Analysis Variable : TotalCTDIvol TotalCTDIvol								
FACILITY_ID	N Obs	N	Mean	Std Dev	Coeff of Variation	Minimum	Maximum	Range
1	19	19	57.10	1.84	3.22	54.05	59.38	5.33
2	5	5	38.18	0.00	0.00	38.18	38.18	0.00
3	5	4	80.37	53.88	67.04	52.84	161.19	108.35
4	359	358	64.82	25.57	39.45	51.88	332.61	280.73
5	117	117	76.33	30.47	39.92	60.09	181.95	121.86
6	674	667	76.25	37.62	49.34	32.17	379.67	347.50
7	940	938	38.68	19.39	50.14	2.71	384.35	381.64
8	1272	1268	84.05	37.63	44.77	27.21	416.22	389.01
9	21	21	66.46	16.41	24.68	59.43	127.09	67.66
11	175	175	97.89	31.81	32.49	83.54	285.04	201.50
12	33	33	77.23	25.59	33.13	36.41	167.70	131.29
13	318	318	90.05	23.00	25.54	19.99	300.50	280.51
14	257	257	47.85	71.42	149.27	31.41	599.76	568.35
15	225	225	49.79	6.21	12.48	36.31	64.37	28.06
16	2137	2132	118.39	32.30	27.28	16.21	410.44	394.23
17	1113	1106	66.83	32.90	49.23	32.98	371.64	338.66
18	926	922	74.85	15.28	20.42	33.85	192.38	158.53
19	3129	3100	62.37	25.38	40.69	10.73	319.40	308.67
20	491	489	51.61	19.66	38.09	32.99	196.89	163.90
21	192	190	48.10	6.27	13.03	20.98	95.02	74.04
22	908	905	57.99	20.96	36.15	37.52	236.50	198.98

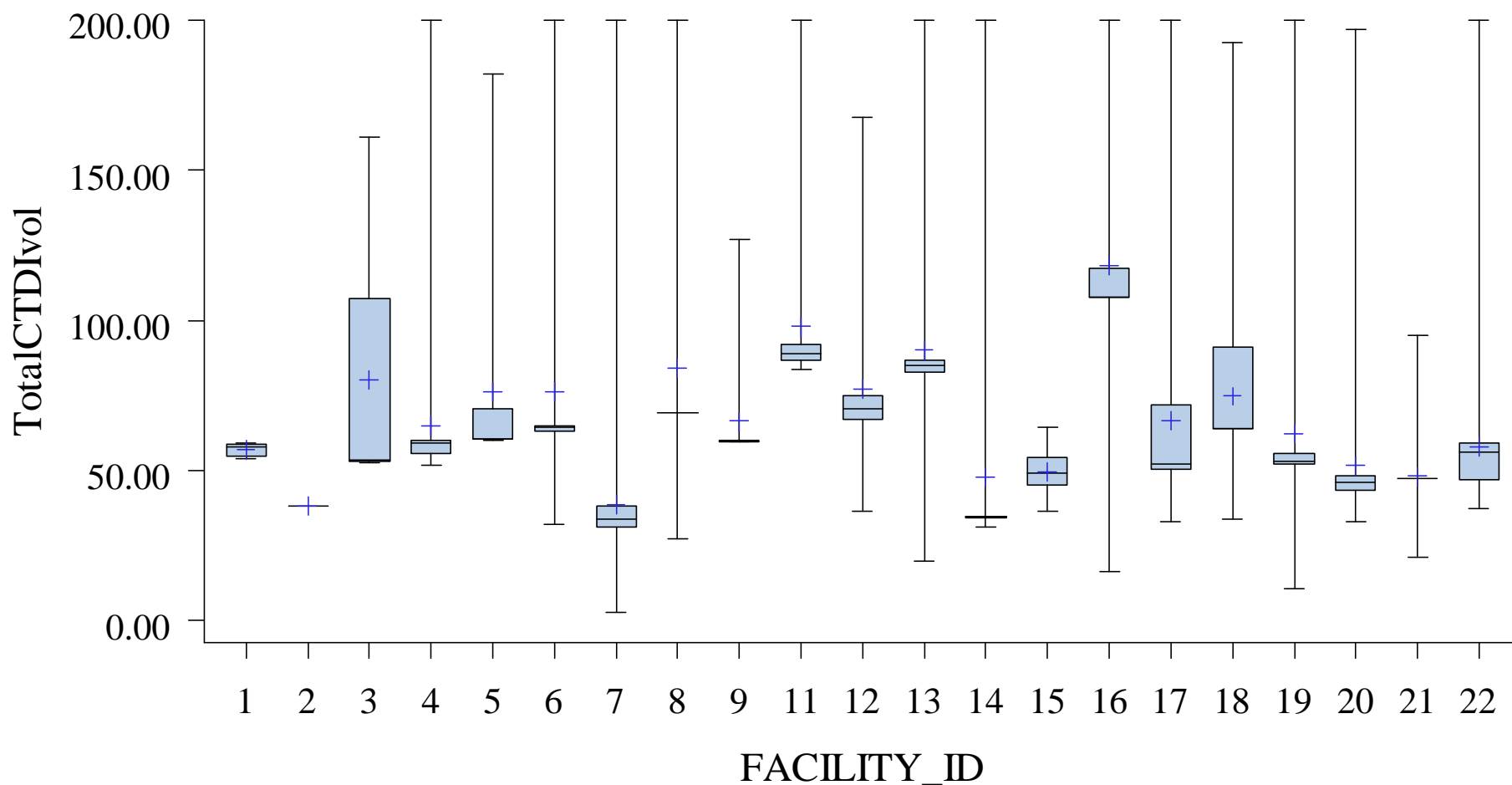


## Box Plots



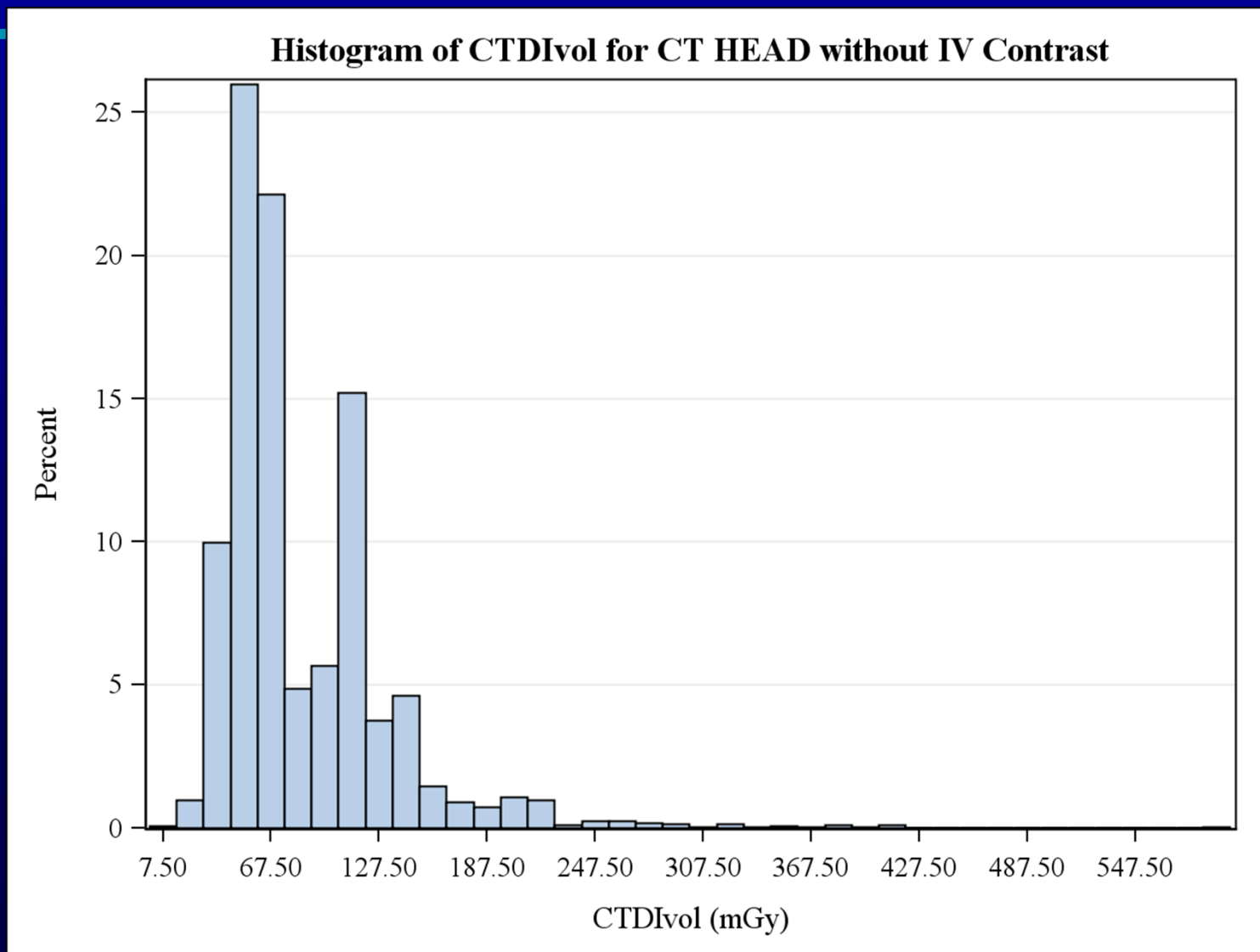


# Analysis of DIR Preliminary Data (May01-Aug31 2011) CT Head Without IV Contrast





## *Analysis of DIR Preliminary Data (May01-Aug31 2011)*





## *Summary of DIR Data as of September 13, 2011*

---

- 214 sites registered
- 79 sites actively submitting data
- 157,663 exams
- 407,016 irradiation events



## Participation fees

---

- One time registration fee of \$500
- Annual participation fee based on number of radiologists in practice and number of sites.
  - For most practices which have fewer than 5 sites, the annual participation fee is \$500-\$2000
  - For practices with 6 or more sites, the annual fee is \$1,000-\$10,000.
- The annual fee allows a facility to contribute data to any of five NRDR registries as a facility chooses. The five registries include DIR, NMD, CTC, ICE, and GRID.



*For more information please contact:*

---

*Laura Coombs, PhD*

*lcoombs@acr.org*

*(703) 715-4383*

*or*

*Mythreyi Chatfield, PhD*

*mchatfield@acr.org*

*(703) 715-4394*