Digital Imaging and Communications in Medicine (DICOM)

Sup 201 - Retirement of Radiation Dose Module from Modality Performed Procedure Step

DICOM Standards Committee - Working Group 6 - Base Standard

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Scope and Field of Application

This Supplement retires the Radiation Dose Module from the Modality Performed Procedure Step SOP Class.

DICOM periodically retires various features that have not been used widely in an interoperable manner, or have been superseded by more robust services. Retirement does not require any implementations to stop using them. It does mean DICOM will no longer maintain them.

The Radiation Dose Structured Report (RDSR) is the preferred mechanism for exchanging radiation dose exposure information (introduced for XA in Sup 94 in 2005 and CT in Sup 127 in 2007), and the continuing presence of the Radiation Dose Module of the Modality Performed Procedure Step SOP Class in the standard is causing confusion (e.g., as is apparent in the recent draft ICRP report on DRLs, "http://www.icrp.org/page.asp?id=256").

The optional Radiation Dose Module of the Modality Performed Procedure Step SOP Class was published in 1998, but has not been adopted widely and neither provides a means of persistently storing nor managing the more highly structured radiation dose information that is now commonplace.

The Radiation Dose Structured Report (RDSR) mechanism has long since replaced MPPS as the mechanism for interchange of radiation dose information for all X-Ray modalities, such as CT, XA/XRF and projection radiography, including mammography.

RDSR, not MPPS, is used in the IHE Radiation Exposure Monitoring (REM) profile and is the preferred mechanism for submission to registries.

The RDSR retains the ability to describe an MPPS as the source of information, to allow the conversion from legacy equipment.

*Amend DICOM PS3.2 as follows (changes to existing text are bold and **underlined** for additions and ~~**struckthrough**~~ for removals):*

Table C.4.2-10. Supported N-SET/N-CREATE Attributes for MPPS

Attribute Name	Tag	N-Create	N-Set	Database Updates
~~**Radiation Dose**~~				
~~**Anatomic Structure, Space or Region Sequence**~~	~~**(0008,2229)**~~			
~~**>Code Value**~~	~~**(0008,0100)**~~	~~**Ɣ**~~	~~**Ɣ**~~	
~~**>Coding Scheme Designator**~~	~~**(0008,0102)**~~	~~**Ɣ**~~	~~**Ɣ**~~	
~~**>Code Meaning**~~	~~**(0008,0104)**~~	~~**Ɣ**~~	~~**Ɣ**~~	
~~**Total Time of Fluoroscopy**~~	~~**(0040,0300)**~~	~~**Ɣ**~~	~~**Ɣ**~~	~~**Stored in Procedure Techniques table**~~
~~**Total Number of Exposures**~~	~~**(0040,0301)**~~	~~**Ɣ**~~	~~**Ɣ**~~	~~**Stored in Procedure Techniques table**~~
~~**Distance Source to Detector**~~	~~**(0018,1110)**~~	~~**Ɣ**~~	~~**Ɣ**~~	~~**Stored in Procedure Techniques table**~~
~~**Distance Source to Entrance**~~	~~**(0040,0306)**~~	~~**Ɣ**~~	~~**Ɣ**~~	~~**Stored in Procedure Techniques table**~~
~~**Entrance Dose**~~	~~**(0040,0302)**~~	~~**Ɣ**~~	~~**Ɣ**~~	~~**Stored in Procedure Techniques table**~~
~~**Entrance Dose in mGy**~~	~~**(0040,8302)**~~	~~**Ɣ**~~	~~**Ɣ**~~	
~~**Exposed Area**~~	~~**(0040,0303)**~~	~~**Ɣ**~~	~~**Ɣ**~~	~~**Stored in Procedure Techniques table**~~
~~**Image Area Dose Product**~~	~~**(0018,115E)**~~	~~**Ɣ**~~	~~**Ɣ**~~	~~**Stored in Procedure Techniques table**~~
~~**Comments on Radiation Dose**~~	~~**(0040,0310)**~~	~~**Ɣ**~~	~~**Ɣ**~~	

Table C.8.1-1. Attributes in MPPS IOD Used By DICOMRis Applications

Attribute Name	Tag	Database Updates
~~**Radiation Dose**~~		
~~**Total Time of Fluoroscopy**~~	~~**(0040,0300)**~~	~~**Values are needed for these attributes so that dose exposure data can be displayed by the RisView application**~~
~~**Total Number of Exposures**~~	~~**(0040,0301)**~~	
~~**Distance Source to Detector**~~	~~**(0018,1110)**~~	
~~**Distance Source to Entrance**~~	~~**(0040,0306)**~~	
~~**Entrance Dose**~~	~~**(0040,0302)**~~	
~~**Exposed Area**~~	~~**(0040,0303)**~~	
~~**Image Area Dose Product**~~	~~**(0018,115E)**~~	

*Amend DICOM PS3.3 as follows (changes to existing text are bold and **underlined** for additions and ~~**struckthrough**~~ for removals):*

B.17 Modality Performed Procedure Step Information Object Definition

B.17.1 IOD Description

A "Modality Performed Procedure Step Information Object Definition" is an abstraction of the information that describes the activities, conditions and results of an imaging procedure performed on a modality. It contains information about the Modality Performed Procedure Step (MPPS) and its relations to other Information Entities of the DICOM real-world model as introduced in this Part.

A Modality Performed Procedure Step is related to the actual imaging procedure carried out at the modality. Other types of Performed Procedure Steps, e.g., reporting or image processing, are not covered by the Modality Performed Procedure Step IOD. The information gathered includes data about the performance of the procedure itself~~, radiation dose values to which the patient has been exposed,~~ and data for billing and material management. The Modality Performed Procedure Step IOD includes general PPS modules and image acquisition specific ones, such as Image Acquisition Results~~, Radiation Dose~~ and Billing and Material Management.

B.17.2 IOD Modules

Table B.17.2-1 lists the modules that make up the Modality Performed Procedure Step IOD.

Table B.17.2-1. Modality Performed Procedure Step IOD Modules

Module	Reference	Module Description
SOP Common	C.12.1	Contains SOP common information
Performed Procedure Step Relationship	C.4.13	References the related SOPs and IEs.
Performed Procedure Step Information	C.4.14	Includes identifying and status information as well as place and time
Image Acquisition Results	C.4.15	Identifies Series and Images related to this PPS and specific image acquisition conditions.
~~**Radiation Dose**~~	~~**C.4.16**~~	~~**Contains radiation dose information related to this Performed Procedure Step.**~~
Billing and Material Management Codes	C.4.17	Contains codes for billing and material management.

Note

The Radiation Dose Module (Retired) ~~**does not have meaning if the modality does not generate ionizing radiation or if the generator does not provide the area dose product**~~ **has been retired. See PS3.3 2017c**.

C.4.16 Radiation Dose Module (Retired)

This Module has been retired. See PS3.3 2017c.

~~**Table C.4-16 defines the Attributes that may be used to communicate information related to radiation dose values. The attributes are intended to enable the Information System to store Patient exposure to ionizing radiation for legal purposes. Though these attributes are not intended to be used to accurately calculate volume dose distribution, they may serve for some quality control purposes.**~~

~~**This module provides a means to communicate radiation dose values but DICOM does not define any requirements for the accuracy of these values, which may be defined in other professional, national or international standards.**~~

~~**The scope of the attributes contained in this module covers the entire acquisition that comprises the Modality Performed Procedure Step. Attributes that relate to single images, such as mAs or kVp, may be included in the Image IODs. It is beyond the scope of DICOM to define what attributes may be required to calculate or estimate area dose product values.**~~

Note

~~**The X-Ray Radiation Dose SR SOP Class provides a more comprehensive means of reporting radiation dose. Such a dose report may be referenced in Section C.4.15.**~~

Table C.4-16. ~~Radiation Dose Module Attributes~~

~~**Attribute Name**~~	~~**Tag**~~	~~**Attribute Description**~~
~~**Anatomic Structure, Space or Region Sequence**~~	~~**(0008,2229)**~~	~~**Anatomic structure, space or region that has been exposed to ionizing radiation.**~~ ~~**Zero or one Item shall be included in this Sequence.**~~
~~***>Include Table 8.8-1***~~		~~***No Baseline CID is defined.***~~

Attribute Name	Tag	Attribute Description
Total Time of Fluoroscopy	(0040,0300)	Total duration of X-Ray exposure during fluoroscopy in seconds (pedal time) during this Performed Procedure Step.
Total Number of Exposures	(0040,0301)	Total number of exposures made during this Performed Procedure Step. The number includes non-digital and digital exposures.
Distance Source to Detector	(0018,1110)	Distance in mm from the source to detector center. **Note** This value is traditionally referred to as Source Image Receptor Distance (SID).
Distance Source to Entrance	(0040,0306)	Distance in mm from the source to the surface of the patient closest to the source during this Performed Procedure Step. **Note** This may be an estimated value based on assumptions about the patient's body size and habitus.
Entrance Dose	(0040,0302)	Average entrance dose value measured in dGy at the surface of the patient during this Performed Procedure Step. **Note** This may be an estimated value based on assumptions about the patient's body size and habitus.
Entrance Dose in mGy	(0040,8302)	Average entrance dose value measured in mGy at the surface of the patient during this Performed Procedure Step. **Note** This may be an estimated value based on assumptions about the patient's body size and habitus.
Exposed Area	(0040,0303)	Typical dimension of the exposed area at the detector plane. If Rectangular: row dimension followed by column; if Round: diameter. Measured in mm. **Note** 1. This may be an estimated value based on assumptions about the patient's body size and habitus. 2. This attribute is used in the Section C.8.7.8 with units in cm (see Section C.8.7.8, Table C.8-33).
Image and Fluoroscopy Area Dose Product	(0018,115E)	Total area-dose-product to which the patient was exposed, accumulated over the complete Performed Procedure Step and measured in dGy*cm*cm, including fluoroscopy. **Note** 1. The sum of the area dose product of all images of a Series or a Study may not result in the total area dose product to which the patient was exposed. 2. This may be an estimated value based on assumptions about the patient's body size and habitus.
Comments on Radiation Dose	(0040,0310)	User-defined comments on any special conditions related to radiation dose encountered during this Performed Procedure Step.

Attribute Name	Tag	Attribute Description
Exposure Dose Sequence	(0040,030E)	Exposure Dose Sequence will contain Total Number of Exposures (0040,0301) items plus an item for each fluoroscopy episode not already counted as an exposure. Zero or more Items shall be included in this Sequence.
>Radiation Mode	(0018,115A)	Specifies X-Ray radiation mode. Enumerated Values: CONTINUOUS PULSED
>KVP	(0018,0060)	Peak kilo voltage output of the x-ray generator used. An average in the case of fluoroscopy (continuous radiation mode).
>X-Ray Tube Current in µA	(0018,8151)	X-Ray Tube Current in µA. An average in the case of fluoroscopy (continuous radiation mode).
>Exposure Time	(0018,1150)	Time of x-ray exposure or fluoroscopy in msec.
>Filter Type	(0018,1160)	Type of filter(s) inserted into the X-Ray beam (e.g., wedges). See Section C.8.7.10 and Section C.8.15.3.9 (for enhanced CT) for Defined Terms.
>Filter Material	(0018,7050)	The X-Ray absorbing material used in the filter. May be multi-valued. See Section C.8.7.10 and Section C.8.15.3.9 (for enhanced CT) for Defined Terms.
>Comments on Radiation Dose	(0040,0310)	User-defined comments on any special conditions related to radiation dose encountered during during the episode described by this Exposure Dose Sequence Item.

Note

1. The Anatomic Region may be deduced from attribute values available within the Modality Worklist Management SOP Class, such as Reason for Service Request, Reasons for Requested Procedure, Scheduled Procedure Step Description and Scheduled Protocol Code Sequence.

2. The Image Area Dose Product should take into account collimator position and filters, and the value for the Exposed Area should also take into account collimator position. If the equipment does not provide the Entrance Dose, it may be calculated using Area Dose Product, Exposed Area, SID and an assumed body thickness.

3. The Distance Source to Detector (0018,1110) and Exposed Area (0040,0303) are only meaningful if they remain constant for all acquisitions during this Performed Procedure Step.

C.8.7.8 X-Ray Acquisition Dose Module

Table C.8-33. X-Ray Acquisition Dose Module Attributes

Attribute Name	Tag	Type	Attribute Description
...	...	...	...

Attribute Name	Tag	Type	Attribute Description
Exposed Area	(0040,0303)	3	Typical dimension of the exposed area at the detector plane. If Rectangular: row dimension followed by column; if Round: diameter. Measured in cm. **Note** 1. The exposed area should be consistent with values specified in the Section C.8.7.3, if present. 2. This may be an estimated value based on assumptions about the patient's body size and habitus. 3. This attribute **~~is~~was previously** used in the Radiation Dose Module (Retired) with units in mm **~~(see Section C.4.16, Table C.4-16 "Radiation Dose Module Attributes")~~**. **This use has been retired. See PS3.3 2017c.**

*Amend DICOM PS3.4 as follows (changes to existing text are bold and **underlined** for additions and **~~struckthrough~~** for removals):*

F.7.2.1.1 Modality Performed Procedure Step Subset Specification

Table F.7.2-1. Modality Performed Procedure Step SOP Class N-CREATE, N-SET and Final State Attributes

Attribute Name	Tag	Req. Type N-CREATE (SCU/SCP)	Req. Type N-SET (SCU/SCP)	Requirement Type Final State (see Note 1)
...	...	...	...	
Image Acquisition Results				
...	...	...	...	
*All other Attributes of the **~~Radiation Dose Module and~~** Billing and Material Management Code Module*		3/3	3/3	

Note

1. ...
2. ...
3. Attributes (0040,1006) Placer Order Number/Procedure and (0040,1007) Filler Order Number/Procedure were previously defined in DICOM. They are now retired (see PS3.3-1998).
4. Attributes (0040,2006) and (0040,2007) were previously defined in DICOM. They are now retired (see PS3.3-1998).
5. ...
6. **The Radiation Dose Module was previously defined in DICOM. This is now retired (see PS3.3-2017c).**

F.8.2.1.1 Modality Performed Procedure Step Retrieve IOD Subset Specifications

Table F.8.2-1. Modality Performed Procedure Step Retrieve SOP Class N-GET Attributes

Attribute Name	Tag	Requirement Type (SCU/SCP)
...	...	...
Image Acquisition Results		
...	...	...

Attribute Name	Tag	Requirement Type (SCU/SCP)
*All other Attributes of the **~~Radiation Dose Module and~~** Billing and Material Management Code Module*		3/3

Note

1. Attributes (0040,1006) Placer Order Number/Procedure and (0040,1007) Filler Order Number/Procedure were previously defined in DICOM. They are now retired (see PS3.3-1998).

2. Attributes (0040,2006) and (0040,2007) were previously defined in DICOM. They are now retired (see PS3.3-1998).

3. **The Radiation Dose Module was previously defined in DICOM. This is now retired (see PS3.3-2017c).**

*Amend DICOM PS3.6 as follows (changes to existing text are bold and **underlined** for additions and **~~struckthrough~~** for removals):*

Table 6-1. Registry of DICOM Data Elements

Tag	Name	Keyword	VR	VM	
(0008,2229)	*Anatomic Structure, Space or Region Sequence*	*AnatomicStructureSpaceOrRegionSequence*	*SQ*	*1*	***RET***
(0040,0300)	*Total Time of Fluoroscopy*	*TotalTimeOfFluoroscopy*	*US*	*1*	***RET***
(0040,0301)	*Total Number of Exposures*	*TotalNumberOfExposures*	*US*	*1*	***RET***
(0040,030E)	*Exposure Dose Sequence*	*ExposureDoseSequence*	*SQ*	*1*	***RET***