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8	Correction Number CP-1387	
9	Log Summary: Addition of Quantity Descriptors to Real World Value Maps	
10	Name of Standard	
11	PS3.3, PS3.6, PS 3.16 2014b	
12	Rationale for Correction:	
13	Real World Value Maps, whether included within images or as separate objects, provide a means of mapping stored pixel values to a numeric "real world value", though there is not actually any formal definition of what a "real world value" is, in general, or in a specific instance.	
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16	Currently, a single value for Measurement Units Code Sequence is the only means of specifying what the real world value "is".	
17	This turns out to be insufficient, since there is a distinction between the "quantity" (whether "physical", "chemical" or "biological" that the value represents, as opposed to the unit that is applicable. For example, in MR, T1 and T2 relaxation times are different physical quantities though share units of time.	
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20	Further, it may be important to specify the method of calculation. For example, cerebral blood flow will always have the same units but may be derived quite differently, even with different modalities (CT, MR).	
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22	The existing SR measurement templates have a set of coded content items that are used as concept modifiers with coded value sets to address such concerns, and it is proposed that a subset of them be included within the RWV Sequence Item to address these concerns.	
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25	Correction Wording:	

Amend DICOM PS3.3 - Real World Value Mapping Macro as follows:

C.7.6.16.2.11 Real World Value Mapping Macro

Table C.7.6.16-12 specifies the attributes of the Real World Value Mapping Functional Group Macro.

Table C.7.6.16-12. Real World Value Mapping Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Real World Value Mapping Sequence	(0040,9096)	1	The mapping of stored values to associated Real World values. One or more Items shall be included in this sequence.
>Include Table C.7.6.16-12b "Real World Value Mapping Item Macro Attributes"			Defined CID for Measurement Units Code Sequence is 82, or as specified in the macro invocation.

Table C.7.6.16-12b. Real World Value Mapping Item Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Real World Value First Value Mapped	(0040,9216)	1	Specifies the first stored value mapped for the Real Word Value Intercept (0040,9224) and Real World Value Slope (0040,9225) or Real World Value LUT (0040,9212) of this Item. See Section C.7.6.16.2.11.1 for further explanation.
Real World Value Last Value Mapped	(0040,9211)	1	Specifies the last stored value mapped for the Real Word Value Intercept (0040,9224) and Real World Value Slope (0040,9225) or Real World Value LUT (0040,9212) of this Item. See Section C.7.6.16.2.11.1 for further explanation.
Real World Value Intercept	(0040,9224)	1C	The Intercept value in relationship between stored values (SV) and the Real World values. See Section C.7.6.16.2.11.1.2 for further explanation. Required if Real World Value LUT Data (0040,9212) is not present.
Real World Value Slope	(0040,9225)	1C	The Slope value in relationship between stored values (SV) and the real world values. See Section C.7.6.16.2.11.1.2 for further explanation. Required if Real World Value LUT Data (0040,9212) is not present.
Real World Value LUT Data	(0040,9212)	1C	LUT Data in this Sequence. Required if Real World Value Intercept (0040,9224) is not present.
LUT Explanation	(0028,3003)	1	Free form text explanation of the meaning of the transformation in this Item.
LUT Label	(0040,9210)	1	Label that is used to identify the transformation of this Item.
Measurement Units Code Sequence	(0040,08EA)	1	Units of measurement. Only a single Item shall be included in this sequence. See Section C.7.6.16.2.11.1 for further explanation.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			Defined CID 82 "Units of Measure" CID 7181 "Abstract Multi-dimensional Image Model Component Units" , or as specified in the macro invocation.

Attribute Name	Tag	Type	Attribute Description
<u>Quantity Definition Sequence</u>	<u>(gggg.eee1)</u>	<u>3</u>	<u>A list of name-value pairs that describe the characteristics of the quantity represented by the Real World Value.</u> <u>One or more Items are permitted in this sequence.</u>
<u>>Include Table 10-2 "Content Item Macro Attributes Description"</u>			<u>Baseline CID for Concept Name Code Sequence is CID cc2c1 "Physical Quantity Descriptors".</u> <u>Baseline CID for Concept Code Sequence for Concept Name of (G-C1C6, SRT, "Quantity") is CID 7180 "Abstract Multi-dimensional Image Model Component Semantics".</u>

C.7.6.16.2.11.1 Real World Value Representation

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C.7.6.16.2.11.1.2 Real World Values Mapping Sequence Attributes

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The physical units for the real world values obtained from the sequence item are given by the Measurement Units Code Sequence (0040,08EA).

The quantity that the real world values represent may be described by the Quantity Definition Sequence (gggg.eee1), which consists of a list of name-value pairs, in which the coded concept name specifies what aspect of the physical quantity is being described.

Note

For example, Cerebral Blood Flow (CBF) may be described by units and quantity as follows:

- Measurement Units Code Sequence (0040,08EA) = (ml/[100]g/min, UCUM, "milliliter per 100 gram per minute")
- Quantity Definition Sequence (gggg.eee1):
 - (G-C1C6, SRT, "Quantity") = (113055, DCM, "Regional Cerebral Blood Flow")

The Quantity Definition Sequence (gggg.eee1) describes only the stored pixel values that are mapped using the Real World Values Mapping, and does not describe derived values from multiple pixels to which the Real World Values Mapping applies.

Note

I.e., the mapping is a "point" operation, and as a consequence various modifiers that might be applied to a group of pixels, such as in an ROI, should not be used. E.g., an ROI encoded in a Structured Report using TID 1419 "ROI Measurements" might be the mean or maximum value (e.g., SUVbw mean or SUVbw max), and be encoded with (121401, DCM, "Derivation") = (R-00317, SRT, "Mean") or (G-A437, SRT, "Maximum"), respectively. These would not be appropriate to use within Quantity Definition Sequence (gggg.eee1), unless the individual pixel values were themselves derived in such a manner, e.g., when multiple images are averaged together. Thus the content items used in an SR to describe an ROI might be a superset of the name-value pairs used in Quantity Definition Sequence (gggg.eee1).

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Amend DICOM PS3.6 - Data Dictionary - Section 6 - Registry of DICOM Data Elements as follows:

Table 6-1. Registry of DICOM Data Elements

Tag	Name	Keyword	VR	VM	
...	

Tag	Name	Keyword	VR	VM	
(gggg.eee1)	<u>Quantity Definition Sequence</u>	<u>QuantityDefinitionSequence</u>	<u>SQ</u>	<u>1</u>	
...	

Amend DICOM PS3.16 - Content Mapping Resource - Context Groups to add the following new Context Groups:

CID cc2c1 Physical Quantity Descriptors

Type: Extensible

Version: yyyyymmdd

Table CID cc2c1. Physical Unit Descriptors

Coding Scheme Designator	Code Value	Code Meaning
SRT	G-C1C6	Quantity
DCM	121401	Derivation
SRT	G-C036	Measurement Method

Note

The concept (G-C1C6, SRT, "Quantity"), lacking a formal definition in SNOMED, is assumed in this usage to be synonymous with the concept defined for "quantity" in Joint Committee for Guides in Metrology (JCGM), *International Vocabulary of Metrology, Basic and General Concepts and Associated Terms* (http://www.bipm.org/utis/common/documents/jcgm/JCGM_200_2012.pdf); the definition is "property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference". That document further distinguishes a "physical quantity", "chemical quantity", and "biological quantity", though no such distinction is implied here, and "quantity" is assumed to be all inclusive.