Status	Letter Ballot
Date of Last Update	2016/01/18
Person Assigned	David Clunie mailto:dclunie@dclunie.com
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Submission Date	2015/09/09

Correction Number CP-1535
Log Summary: Additional SUVlbm formulas
Name of Standard PS3.3, PS3.16
Rationale for Correction: Larger patients are not accurately described by the conventional (James) LBM formula, and an alternative formula has been defined with more robust characteristics across a larger range of patient sizes. Add appropriate codes for the additional formula both for the SUV Type attribute used in images and the corresponding concepts used in real World Value Maps and Structured Reports, and link the enumerated values for SUV Type to the PS3.16 concept definitions. Also correct the order of curly braces unit annotations (annotations need to follow, not precede, the units if not unity). Also change the reference to CID 84 to CID 85,. since SUV units have been factored out of PET units into their own context group. The existing Enumerated Value for LBM by the James method is not renamed due to the potential impact on the installed base.
Correction Wording:

Amend PS 3.3:

C.8.9.1 PET Series Module

Table C.8-60 contains IOD Attributes that describe a PET Series.

Table C.8-60. PET Series Module Attributes

Attribute Name	Tag	Type	Attribute Description
...	...	...	...
SUV Type	(0054,1006)	3	Type of Standardized Uptake Value (SUV). **Enumerated Values:** **BSA** body surface area **BW** body weight **LBM** lean body mass **by James method** **LBMJANMA** **lean body mass by Janmahasatian method** **IBW** ideal body weight If absent, and the Units (0054,1001) are GML, then the type of SUV shall be assumed to be BW. **Note** The type of SUV cannot reliably be deduced from the units alone, i.e., SUVbw, SUVibw and SUVlbm **(James or Janmahasatian)**all have units of GML.
...	...	...	..

Note

The formulas for the determination of SUVbw, SUVbsa, SUVlbm**(James)** and SUVibw are defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction. Radiology, 1999* at http://radiology.rsna.org/content/213/2/521. **The Janmahasatian LBM formula is defined in *Janmahasatian et al. Quantification of Lean Bodyweight. Clin Pharmacokinet. 2005 Oct 1;44(10):1051–65.* at http://dx.doi.org/10.2165/00003088-200544100-00004 and its role in SUVlbm(Janma) calculation is discussed in *Tahari et al. Optimum Lean Body Formulation for Correction of Standardized Uptake Value in PET Imaging. Journal of Nuclear Medicine. 2014 Sep 1;55(9):1481–4.* at http://jnm.snmjournals.org/content/55/9/1481.** See also **~~CID 84 "PET Units"~~ CID 85 "SUV Units"** .

Amend DICOM PS 3.16:

CID 84 PET Units

Type: **Extensible**
Version: **20141110**

Table CID 84. PET Units

Coding Scheme Designator	Code Value	Code Meaning
Include CID 85 "SUV Units"		
UCUM	{counts}	Counts
UCUM	{counts}/s	Counts per second
UCUM	{propcounts}	Proportional to counts
UCUM	{propcounts}/s	Proportional to counts per second

Coding Scheme Designator	Code Value	Code Meaning
UCUM	cm2	Centimeter**2
UCUM	%	Percent
UCUM	Bq/ml	Becquerels/milliliter
UCUM	mg/min/ml	Milligrams/minute/milliliter
UCUM	umol/min/ml	Micromole/minute/milliliter
UCUM	ml/min/g	Milliliter/minute/gram
UCUM	ml/g	Milliliter/gram
UCUM	/cm	/Centimeter
UCUM	umol/ml	Micromole/milliliter

CID 85 SUV Units

Type: **Extensible**
Version: **20141110**

Table CID 85. SUV Units

Coding Scheme Designator	Code Value	Code Meaning
UCUM	~~**{SUVbw}**~~g/ml**{SUVbw}**	Standardized Uptake Value body weight
UCUM	~~**{SUVlbm}**~~g/ml**{SUVlbm}**	Standardized Uptake Value lean body mass **(James)**
UCUM	**g/ml{SUVlbm(Janma)}**	**Standardized Uptake Value lean body mass (Janma)**
UCUM	~~**{SUVbsa}**~~cm2/ml**{SUVbsa}**	Standardized Uptake Value body surface area
UCUM	~~**{SUVibw}**~~g/ml**{SUVibw}**	Standardized Uptake Value ideal body weight

Note

The formulas for the determination of SUVbw, SUVbsa, SUVlbm**(James)** and SUVibw are defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction. Radiology, 1999* at http://radiology.rsna.org/content/213/2/521. **The Janmahasatian LBM formula is defined in *Janmahasatian et al. Quantification of Lean Bodyweight. Clin Pharmacokinet. 2005 Oct 1;44(10):1051–65.* at http://dx.doi.org/10.2165/00003088-200544100-00004 and its role in SUVlbm(Janma) calculation is discussed in *Tahari et al. Optimum Lean Body Formulation for Correction of Standardized Uptake Value in PET Imaging. Journal of Nuclear Medicine. 2014 Sep 1;55(9):1481–4.* at http://jnm.snmjournals.org/content/55/9/1481.**

The patient size correction factors are summarized here, where weight is in kg and height is in cm:

SUVbw: males & females: weight

SUVlbm**(James)**: males: 1.10 * weight - 120 * (weight/height) ^2

females: 1.07 * weight - 148 * (weight/height) ^2

SUVlbm(Janma): males: 9.27E3 * weight / (6.68E3 + 216 * weight / (height^2))

females: 9.27E3 * weight / (8.78E3 + 244 * weight / (height^2))

SUVbsa: males & females: weight^ 0.425 * height^0.725 * 0.007184

SUVibw: males: 48.0 + 1.06 * (height - 152)

females: 45.5 + 0.91 * (height - 152)

CID 7180 Abstract Multi-dimensional Image Model Component Semantics

Type: **Extensible**
Version: **20141110**

Table CID 7180. Abstract Multi-dimensional Image Model Component Semantics

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-CT Concept ID	UMLS Concept Unique ID
...	...	...		
DCM	126400	Standardized Uptake Value		
DCM	126401	SUVbw		
DCM	126402	SUVlbm		
DCM	**126405**	**SUVlbm(Janma)**		
DCM	126403	SUVbsa		
DCM	126404	SUVibw		

Amend DICOM PS3.16 concept definitions:

Table D-1. DICOM Controlled Terminology Definitions

Code Value	Code Meaning	Definition	Notes
126400	Standardized Uptake Value	A ratio of locally measured radioactivity concentration versus the injected radioactivity distibuted evenly throughout the whole body. This general concept encompasses all specific methods of calculating the whole body volume of distribution, such as using body weight, lean body mass, body surface area, etc.	
126401	SUVbw	Standardized Uptake Value calculated using body weight. The patient size correction factor for males and females is body weight. Defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction.*Radiology, 1999 at http://radiology.rsna.org/content/213/2/521	
126402	SUVlbm	Standardized Uptake Value calculated using lean body mass **by James method**. The patient size correction factor for males is 1.10 * weight - 120 * (weight/height) ^2, and for females is 1.07 * weight - 148 * (weight/height) ^2. Defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction.*Radiology, 1999 at http://radiology.rsna.org/content/213/2/521	
126403	SUVbsa	Standardized Uptake Value calculated using body surface area. The patient size correction factor for males and females is weight^ 0.425 * height^0.725 * 0.007184. Defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction.*Radiology, 1999 at http://radiology.rsna.org/content/213/2/521	
126404	SUVibw	Standardized Uptake Value calculated using ideal body weight. The patient size correction factor for males is 48.0 + 1.06 * (height - 152) and for females is 45.5 + 0.91 * (height - 152). Defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction.*Radiology, 1999 at http://radiology.rsna.org/content/213/2/521	

Code Value	Code Meaning	Definition	Notes
126405	**SUVlbm(Janma)**	**Standardized Uptake Value calculated using lean body mass by Janmahasatian method. The patient size correction factor for males is 9.27E3 * weight / (6.68E3 + 216 * weight / (height^2)) and for females is 9.27E3 * weight / (8.78E3 + 244 * weight / (height^2)).** **Defined in *Janmahasatian et al. Quantification of Lean Bodyweight. Clin Pharmacokinet. 2005 Oct 1;44(10):1051–65.* at http://dx.doi.org/10.2165/00003088-200544100-00004 and its role in SUVlbm(Janma) calculation is discussed in *Tahari et al. Optimum Lean Body Formulation for Correction of Standardized Uptake Value in PET Imaging. Journal of Nuclear Medicine. 2014 Sep 1;55(9):1481–4.* at http://jnm.snmjournals.org/content/55/9/1481.**	
126410	SUV body weight calculation method	Method of calculating Standardized Uptake Value using body weight. The patient size correction factor for males and females is body weight. Defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction.*Radiology, 1999 at http://radiology.rsna.org/content/213/2/521	
126411	SUV lean body mass calculation method	**James m**~~M~~ethod of calculating Standardized Uptake Value using lean body mass. The patient size correction factor for males is 1.10 * weight - 120 * (weight/height) ^2, and for females is 1.07 * weight - 148 * (weight/height) ^2. Defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction.*Radiology, 1999 at http://radiology.rsna.org/content/213/2/521	
126412	SUV body surface area calculation method	Method of calculating Standardized Uptake Value using body surface area. The patient size correction factor for males and females is weight^ 0.425 * height^0.725 * 0.007184. Defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction.*Radiology, 1999 at http://radiology.rsna.org/content/213/2/521	
126413	SUV ideal body weight calculation method	Method of calculating Standardized Uptake Value using ideal body weight. The patient size correction factor for males is 48.0 + 1.06 * (height - 152) and for females is 45.5 + 0.91 * (height - 152). Defined in Sugawara et al. *Reevaluation of the Standardized Uptake Value for FDG: Variations with Body Weight and Methods for Correction.*Radiology, 1999 at http://radiology.rsna.org/content/213/2/521	
126414	**SUV lean body mass calculation Janmahasatian method**	**Janmahasatian method of calculating Standardized Uptake Value using lean body mass. The patient size correction factor for males is 9.27E3 * weight / (6.68E3 + 216 * weight / (height^2)) and for females is 9.27E3 * weight / (8.78E3 + 244 * weight / (height^2)).** **Defined in *Janmahasatian et al. Quantification of Lean Bodyweight. Clin Pharmacokinet. 2005 Oct 1;44(10):1051–65.* at http://dx.doi.org/10.2165/00003088-200544100-00004 and its role in SUVlbm(Janma) calculation is discussed in *Tahari et al. Optimum Lean Body Formulation for Correction of Standardized Uptake Value in PET Imaging. Journal of Nuclear Medicine. 2014 Sep 1;55(9):1481–4.* at http://jnm.snmjournals.org/content/55/9/1481.**	