DICOM Correction Proposal

STATUS	Final Text
Date of Last Update	2021/09/03
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Submission Date	2021/01/11

Correction Number	CP-2105
Log Summary: Measurement codes for UL Shear Wave	
Name of Standard PS3.6, PS3.16 2021c	

Rationale for Correction:

Ultrasound is increasingly used to make measurements of Shear Wave Speed as a way of determining the elasticity and viscosity of tissues. SR Codes are needed to support this.

Commonly, ROIs are placed on images generated using 2D-SWE (2D Shear Wave Elastography) or 3D-SWE. The mean & standard deviation is derived for pixels inside each ROI. pSWE (point SWE) is also used but only generates a point value (effectively a 1-pixel ROI).

For each ROI placed (usually between 3 and a dozen or so), values are measured/derived for:

- Shear Wave Speed (SWS)
- Elasticity – which is directly derived from the SWS and reflects tissue stiffness
- Shear Wave Dispersion Slope – which reflects viscosity as well as elasticity and is measured by some systems when assessing inflammation.

A reference ROI (for example in adjacent subcutaneous tissues) is used to normalize the other ROIs.

SWS, Elasticity, and Dispersion values from all the ROIs (except the Reference ROI) are then compiled to derive summary study statistics:

- Mean
- Median
- Standard Deviation (SD)
- Interquartile Range (IQR)
- IQR/Median

This CP provides codes to support capturing the above details in SR templates such as TID 1500. When using TID 1500, a the measured values represent the mean value for the pixels in the ROI, so Row 8 "Derivation" in TID 1419 would be set to "Mean".

A general elastography template is not defined here.

The Society of Radiologists in Ultrasound advises that measurement quality be assessed by the ratio of the interquartile range (IQR) to the median, or the ratio of the standard deviation (SD) to the mean, where IQR/M of >30% for stiffness or >15% for speed indicates reduced accuracy.

"Studies have shown that the level of variability between consecutive acquisitions, assessed by means of the IQR/M, is the most important quality criterion. When this ratio is higher than 30% (for measurements given in kilopascals), the accuracy of the technique is reduced (3,25,27). It is important to note that the IQR/M for measurements reported in kilopascals should be 30% or less, whereas that for measurements reported in meters per second (shear wave speed) should be 15% or less as the conversion of meters per second to kilopascals is nonlinear. If the IQR/M values are greater than 30% in kilopascals or 15% in meters per second, the measurement of liver stiffness should be judged as unreliable."

References:

https://doi.org/10.1148/radiol.2020192437 Update to the Society of Radiologists in Ultrasound Liver Elastography Consensus Statement – Jun 2020

https://pubs.rsna.org/doi/full/10.1148/rg.2017160116 SWE Basic Physics and Musculoskeletal Applications

Correction Wording:

Modify CID 12224 as shown

CID 12224 Ultrasound Image Modes

Resources: **HTML | FHIR JSON | FHIR XML | IHE SVS XML**
Type: **Extensible**

Version: ~~20100317~~20210903
UID: 1.2.840.10008.6.1.616

Table CID 12224. Ultrasound Image Modes

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	399064001	2D mode	G-03A2	C1302189
SCT	261197005	Doppler Color Flow	R409E2	C0475380
SCT	399155008	M mode	G-0394	C1302229
…				
DCM	**130616**	**Point Shear Wave Elastography**		
DCM	**130609**	**2D Shear Wave Elastography**		
DCM	**130610**	**3D Shear Wave Elastography**		

Add CID 12308 as shown

CID 12308 Ultrasound Shear Wave Measurements

The Units column contains the proper UCUM representation of the recommended units for the measured property.

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML
Type: Extensible
Version: 20210903
UID: 1.2.840.10008.6.1.1411

Table CID 12308. Ultrasound Shear Wave Measurements

Coding Scheme Designator	Code Value	Code Meaning	UMLS Concept Unique ID	Units
DCM	130611	Shear Wave Speed		(m/s, UCUM, “m/s”)
DCM	110830	Elasticity		(kPa, UCUM, “kPa”)
DCM	130612	Shear Wave Dispersion Slope		(m/s/kHz, UCUM, “m/s/kHz”)
DCM	130613	ROI Depth		(cm, UCUM, “cm”)
SCT	131184002	Area of defined region		(cm2, UCUM, “cm2”)

Modify CID 226 as shown

CID 226 Population Statistical Descriptors

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML
Type: Extensible
Version: 20121101
UID: 1.2.840.10008.6.1.31

Table CID 226. Population Statistical Descriptors

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	371889001	95th Percentile Value of population	R-00337	C1299358
SCT	371887004	90th Percentile Value of population	R-00338	C1276309
SCT	371917008	1 Sigma Upper Value of population	R-00346	C1299386
SCT	371920000	2 Sigma Upper Value of population	R-00387	C1299389
SCT	373098007	Mean Value of population	R-00317	C1298794
SCT	373099004	Median Value of population	R-00319	C1298795
SCT	371890005	10th Percentile Value of population	R-00377	C1299359
SCT	371888009	5th Percentile Value of population	R-00397	C1299357
SCT	371919006	1 Sigma Lower Value of population	R-00347	C1299388
SCT	371918003	2 Sigma Lower Value of population	R-00388	C1299387
DCM	121414	Standard deviation of population		
DCM	121417	2 Sigma deviation of population		
DCM	**130614**	**Interquartile Range of population**		
DCM	**130615**	**Interquartile Range to Median ratio of population**		

Note

The SNOMED meaning for R-00317 is "Mean - numeric estimation technique", but in the context of its use here, a more specific meaning has been used.

Add new codes as shown:
Definitions are provided to drive the DICOM/LOINC new code process
Some existing codes are included to compare & contrast

D DICOM Controlled Terminology Definitions (Normative)

Code Value	Code Meaning	Definition	Notes
130616	**Point Shear Wave Elastography**	**A high-speed ultrasound imaging technique that quantitatively assesses the stiffness/elasticity of tissue based on the tracking of the propagation of a shear-wave and measuring its velocity at a point.**	
130609	**2D Shear Wave Elastography**	**A high-speed ultrasound imaging technique that quantitatively assesses the stiffness/elasticity of tissue based on the tracking of the propagation of a shear-wave and measuring its velocity over a 2D area.**	
130610	**3D Shear Wave Elastography**	**A high-speed ultrasound imaging technique that quantitatively assesses the stiffness/elasticity of tissue based on the tracking of the propagation of a shear-wave and measuring its velocity over a 3D volume.**	
130611	**Shear Wave Speed**	**The velocity at which a shear-wave propagates through a substance or tissue. The shear wave speed (SWS) is correlated with the elasticity of the substance or tissue.**	
110830	Elasticity	Scalar value related to the elastic properties of the tissue.	

Code Value	Code Meaning	Definition	Notes
130612	**Shear Wave Dispersion Slope**	**The rate at which shear wave speed is attenuated with changes in the frequency of the shear wave. The dispersion slope is correlated with both the elasticity and the viscosity of the substance or tissue.**	
130613	**ROI Depth**	**Distance from the ultrasound probe surface to the geometric center of the ROI.**	
125107	Sample Volume Depth	The depth of the center of the Doppler sample volume measured from skin line along the Doppler line.	
130614	**Interquartile Range of population**	**The width of the center range within which 50% of the measured values in a reference population fall. The IQR may also be described as the first quartile value subtracted from the third quartile value, or equivalently the 25th percentile value subtracted from the 75th percentile value.**	
130615	**Interquartile Range to Median Ratio of population**	**The interquartile range value of a population divided by the median value of the same population. IQR/M, which is one way to describe the variability of a set of measurements, is sometimes used as a metric of measurement quality.**	