DICOM Correction Proposal

STATUS	Letter Ballot
Date of Last Update	2026/01/28
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Submission Date	2025/04/16

Correction Number	CP-2558
Log Summary: Enhance Z-scores in SR Templates	
Name of Standard PS 3.16	

Rationale for Correction:

Z-scores are used to characterize a measurement in terms of a reference population, expressed as the number of standard deviations of that population the measurement is above or below the mean of that population.

It is not uncommon for the reference population to be a "relevant subset" of a baseline population obtained from a reference authority. For example, for a z-score for a fetal abdominal circumference measurement, one might use the data from the Hadlock reference authority for fetuses of the same gestational age. The gestational age is referred to as the population index.

TID 311 Measurement Statistical Properties, which is included by TID 300, can encode the numerical Z-score value with Concept = (121416, DCM, "Z-Score of measurement") in Row 1 and the reference authority (the population/data from which the Z-score is derived) in Row 4, but does not indicate the index used when a relevant subset of the reference population is selected to derive the Z-score.

Cardiac Z-scores and fetal ultrasound Z-scores are typically indexed; i.e., the measurement is compared to the subset of the reference population with the same index value as the measured entity, such as the part of the reference population with the same gestational age, femur length, biparietal distance, or body surface area.

This CP adds:

- A row in TID 311 to encode the population index.

- A CID of codes for common indexes for Ultrasound

- A CID of codes for some common reference authorities that could be used in Row 4 of TID 311, similar to what was done for CID 10040 Radiopharmaceutical Organ Dose Reference Authority https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_CID_10040.html

For reference, per DICOM:

> (121416, DCM, "Z-Score of measurement") is "Z-score of an observation value with respect a reference population, expressed as the dimensionless quantity (x-m)/s, where (x-m) is the deviation of the observation value (x) from the population mean (m), and s is the standard deviation of the population."

> (113071, DCM, "Z-score") is used in CID 7180 Abstract Multi-dimensional Image Model Component Semantic, but the definition "Values are derived by calculating the value of the Z-Score statistic from multiple image samples." is specific to that usage and is not applicable here.

TODO Someone should probably do a CP in the future to add/highlight this in Adult Echo – need the list of reference authorities and confirm the population indexes used.

Correction Wording:

Modify PS3.16 TID 5223 as shown to use $RefAuthority

TID 5223 PEDIATRIC, FETAL AND CONGENITAL CARDIAC ULTRASOUND MEASUREMENT

…

Type: Extensible
Order: Significant
Root: No

Table TID 5223. Pediatric, Fetal and Congenital Cardiac Ultrasound Measurement

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			INCLUDE	DTID 300 "Measurement"	1	M		$Measurement = $Measurement $Method = $Method $TargetSite = BCID 12280 "Cardiac Ultrasound Target Site" $TargetSiteMod = BCID 12281 "Cardiac Ultrasound Target Site Modifier" $Derivation = DCID 3838 "Diameter Derivation" **$PopulationIndex = DCID newcid1 "Ultrasound Z-Score Population Index"** **$RefAuthority = BCID newCID2 "Fetal Ultrasound Z-Score Reference Authority"**
	…							

Modify PS3.16 TID 300 shown

TID 300 MEASUREMENT

…

Table TID 300. Parameters

Parameter Name	Parameter Usage
…	
$RefAuthority	Bibliographic reference or authority for statistical properties of a reference population
$PopulationIndex	**The index concept whose value is used to select the subset reference population that is relevant to calculating the Z-score of the current measurement.**
$RangeAuthority	Bibliographic reference or authority for the normal range of the measurement
…	

Type: Extensible
Order: Significant
Root: No

Table TID 300. Measurement

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	$Measurement	1	M		UNITS = $Units
…								
8	>	HAS PROPERTIES	INCLUDE	DTID 310 "Measurement Properties"	1	U		$RefAuthority = $RefAuthority **$PopulationIndex = $PopulationIndex** $RangeAuthority = $RangeAuthority

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
…								

TID 310 MEASUREMENT STATISTICAL PROPERTIES

This Template provides the properties of a numeric measurement, including evaluations of its normality and/or significance, its relationship to a reference population, and an indication of its selection from a set of measurements.

Table TID 310. Parameters

Parameter Name	Parameter Usage
$RefAuthority	Bibliographic reference or authority for statistical properties of a reference population
$PopulationIndex	**The index concept whose value is used to select the subset reference population that is relevant to calculating the Z-score of the current measurement.**
$RangeAuthority	Bibliographic reference or authority for the normal range of the measurement

Type: **Extensible**
Order: **Significant**
Root: **No**

Table TID 310. Measurement Properties

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (121402, DCM, "Normality")	1	U		DCID 222 "Normality"
2			INCLUDE	DTID 311 "Measurement Statistical Properties"	1	U		$RefAuthority = $RefAuthority **$PopulationIndex = $PopulationIndex**
3			INCLUDE	DTID 312 "Normal Range Properties"	1	U		$RangeAuthority = $RangeAuthority
…								

TID 311 MEASUREMENT STATISTICAL PROPERTIES

This Template provides the statistical properties of a reference population for a numeric measurement, and/or the position of a measurement in such a reference population.

Table TID 311. Parameters

Parameter Name	Parameter Usage
$RefAuthority	Bibliographic reference or authority for statistical properties of a reference population
$PopulationIndex	**The index concept whose value is used to select the subset reference population that is relevant to calculating the Z-score of the current measurement.**

Type: **Extensible**
Order: **Significant**

Root: No

Table TID 311. Measurement Statistical Properties

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	DCID 221 "Measurement Range Concept"	1-n	M		
1a	**>**	**HAS CONCEPT MOD**	**CODE**	**EV (Newcode0, DCM, "Population Index")**	**1**	**UC**	**IFF Row 1 Concept Name = (121416, DCM, "Z-Score of measurement")**	**$PopulationIndex**
2			TEXT	EV (121405, DCM, "Population description")	1	U		
3			TEXT	EV (121406, DCM, "Reference Authority")	1	UC	XOR Row 4	
4			CODE	EV (121406, DCM, "Reference Authority")	1	UC	XOR Row 3	$RefAuthority

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Add newCID1 for Ultrasound Z-Score Population Index

CID NEWCID1 ULTRASOUND Z-SCORE POPULATION INDEX

Resources:	**HTML | FHIR JSON | FHIR XML | IHE SVS XML**
Keyword:	**UltrasoundZScorePopulationIndex**
FHIR Keyword:	**dicom-cid-newCID1-UltrasoundZScorePopulationIndex**
Type:	**Extensible**
Version:	**yyyymmdd**
UID:	**1.2.840.10008.6.1.newUID1**

Table CID newCID1. Ultrasound Z-Score Population Index

Coding Scheme Designator	Code Value	Code Meaning
LN	11963-6	Femur Length
LN	11820-8	Bi-Parietal Distance
LN	18185-9	Gestational Age
LN	8277-6	Body Surface Area

Add newCID2 for Fetal Ultrasound Z-Score Reference Authority

CID NEWCID2 FETAL ULTRASOUND Z-SCORE REFERENCE AUTHORITY

Resources:	**HTML | FHIR JSON | FHIR XML | IHE SVS XML**
Keyword:	**FetalUltrasoundZScoreReferenceAuthority**
FHIR Keyword:	**dicom-cid-newCID2-FetalUltrasoundZScoreReferenceAuthority**
Type:	**Extensible**
Version:	**yyyymmdd**
UID:	**1.2.840.10008.6.1.newUID2**

Table CID newCID2. Fetal Ultrasound Z-Score Reference Authority

Coding Scheme Designator	Code Value	Code Meaning
DCM	Newcode01	Schneider 2005
DCM	Newcode02	Vigneswaran 2018
DCM	Newcode03	Zidere 2021
DCM	Newcode04	Krishnan 2016
DCM	Newcode05	Pasquini 2007
DCM	Newcode06	Boston Childrens Zscore Data

Add definitions to PS 3.16 Annex D

Table D-1. DICOM Controlled Terminology Definitions

Code Value	Code Meaning	Definition	Notes
…			
Newcode01	**Schneider 2005**	**Schneider C. et al., "Development of Z-scores for fetal cardiac dimensions from echocardiography", Ultrasound Obstet Gynecol 2005; 26: 599–605. doi: 10.1002/uog.2597**	
Newcode02	**Vigneswaran 2018**	**Vigneswaran T. et al., "Reference Ranges for the Size of the Fetal Cardiac Outflow Tracts From 13 to 36 Weeks Gestation: A Single-Center Study of Over 7000 Cases". Circulation Cardiovascular imaging. 2018;11(7):e007575. doi: 10.1161/CIRCIMAGING.118.007575**	
Newcode03	**Zidere 2021**	**Zidere V. et al., "Reference ranges for the pulsed wave doppler of the fetal cardiac inflow and outflow tracts from 13 to 36 weeks gestation". Journal of the American Society of Echocardiography. 2021; Sep;34(9):1007-1016 doi: 10.1016/j.echo.2021.04.017.**	
Newcode04	**Krishnan 2016**	**Krishnan T. et al., "Predictive Models for Normal Fetal Cardiac Structures". Journal of the American Society of Echocardiography 2016 Volume 29 Number 12: 1197-1206. doi: 10.1016/j.echo.2016.08.019.**	
Newcode05	**Pasquini 2007**	**Pasquini L. et al., "Z-scores of the fetal aortic isthmus and duct: an aid to assessing arch hypoplasia". Ultrasound Obstet Gynecol. 2007 Jun;29(6):628-33. doi: 10.1002/uog.4021.**	
Newcode06	**Boston Childrens Zscore Data**	**Boston Children's Hospital z-score system data. https://zscore.chboston.org/**	