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Digital Imaging and Communications in Medicine (DICOM)

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Supplement 169: Simplified Adult Echocardiography Report

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22 DICOM Standards Committee

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70

Scope and Field

72 This supplement to the DICOM Standard introduces a simplified SR template for Adult Echocardiography measurements.

74 It provides similar content to that of TID 5200 while addressing details that were the source of interoperability issues; in particular, varying degrees and patterns of pre- and post-coordination, multiple codes for the same concept and numerous optional descriptive modifiers.

76 The new template is driven significantly by current ASE Guidelines and Standards.

OPEN ISSUES

Scope	
S1	<p>Should TID 5200 (the original) be retired when the new TID is introduced? A: We'd like to. Probably depends on how we support vendor-specific and user-defined. Should hopefully retire it. We can still ship products that are capable of sending 5200, but new products probably shouldn't bother. If we offer two Adult Echo templates, some percentage of novice vendors will choose 5200 without understanding the implications. On the other hand, if our "fallback" for non-Core measurements that can't be coded in the structured post-coordinated bucket is to suggest they be sent with 5200 then we shouldn't retire it. Maybe they can use generic Comprehensive SR.</p>
S5	<p>Have other international groups published "Core Set" papers we should include? Committee members have reviewed JASE (Japan) guidelines, and Japan has been a signatory of at least one of the ASE papers. Feedback from other groups would be welcome.</p>
S10	<p>What kind of a process should WG12 have (if any) to monitor and react to updates from ASE?</p>
S13	<p>How/Should vendor education be addressed? The new template makes finer distinctions than the old template. To reduce the validation load on the consuming systems, confidence is needed that the producing system is in fact taking the distinctions into account. E.g. Systole, vs End Systole, vs Atrial Systole. So if the pre-coordinated code means exactly End Systole, then don't use the pre-coordinated code if the system measures at mid-systole.</p>
S16	<p>Should TID 5202 Stress Echo be in scope for this template? It's related to 5204 (which is included here), but TID5202 was not included in the original 5200. If included, would need to decide if Stress Stage is pre-coordinated for all or some measurements or if it is better recorded at a higher level in the object and create separate objects for different stages</p>

S18	<p>Should the Core Spreadsheet be maintained? If so, what format is most effective?</p> <p>The sorting and filtering and parsing is very handy. Copying the table into Word would be unwieldy and would lose useful functionality. OTOH, in XML it might be quite useful. Currently it is a Google/Excel Spreadsheet</p>
Structure	
Coding	
C14	<p>What needs to be captured about the package/pre-processing before the measurement?</p> <p>E.g. the presence of special speckle tracking or proprietary segmentation</p>
C16	<p>How should different BSA calculation methods be handled?</p> <p>A: Propose that Core Set will code DuBois.</p> <p>This means that other methods are handled as vendor/user-defined measurements using the post-coordinated template. (Keeping in mind that the receiver can presumably compute alternate indexing as long as the value used for the encoded measurements is provided)</p> <p>ALTERNATIVE PROPOSAL</p> <p>All Core Set measurements that index against BSA (and all post-coordinated measurements that reference (LN, 8277-6, Body Surface Area) as their index divisor) use the value recorded for BSA in the Patient Characteristics TID 3602. TID 3602 could be extended to encode the BSA calculation method used (e.g. DuBois, Haycock or others from CID 3663).</p>
C22	<p>Should it be mandatory to record image coordinates for every measurement?</p>
C24	<p>Should ratios and indexes be modelled in the post-coordinated structure?</p> <p>The supplement includes a proposed mechanism using a “Measurement Divisor” modifier and several Measurement Types that encode a simple numerator/denominator relationship between two values.</p> <p>Many Echo Measurements are ratios or indexed values. This mechanism would likely address a lot of vendor and user-defined variations (e.g. wishing to index against BMI instead of BSA, or taking a ratio of two values)</p>

C26	<p>What should systems with no or unreliable code libraries do for post-coordinated codes?</p> <p>The first row of the Post-Coordinated Measurement Template (TID 3QY) holds a fully pre-coordinated code that can be used by receivers to database the measurement and avoid re-analyzing the modifiers on each encounter.</p> <p>Since the code is required to be present, how should the sender behave if it is unwilling or unable to maintain the table of pre-coordinated codes for post-coordinated measurements?</p> <p>Alternatives for a lazy/rebooted system include:</p> <p>A) create a new UID for every such measurement, every time B) use a specific code for such measurements e.g. (999,DCM,"DONOTTRACK") C) prohibit use of TID 3QY and require they use TID 3QZ (Adhoc) instead</p> <p>A) is the approach in the current text. However it seems to be a valid code, encouraging receivers to database a proliferating set of values even though the sender knows that the receiver will never see them again</p> <p>B) explicitly communicates that this measurement cannot be longitudinally coordinated, but dumb receivers might try to collect them together</p> <p>C) avoids implying that the measurement can be track, but then prevents the cart from sending potentially useful modifier information.</p>
C27	<p>Should this SR follow the parsing rules of TID5200?</p> <p>In principle, it would allow existing receivers to handle the new objects with very little modification (although the new data would be better behaved)</p> <p>The current template attempts to do this by including an extra layer of nested containers for each measurement group in TID 5QQQ and by duplicating the Finding Site to record the section subjects.</p>
C28	<p>What view-independent names should we use for the three axes of the ventricles?</p> <p>As a volume, a ventricle in some sense has a "length", a "width", and a "depth", or if you prefer, an x, y and z dimension.</p> <p>Length seems like a good name for the base-to-apex dimension of a ventricle. If we consider it to have an oval cross-section (taken roughly perpendicular to the length), do we call the dimensions of the oval the major axis and minor axis, or is that confusing? "Internal Dimension" seems rather non-descriptive and seems to mean different things in different contexts.</p>

CLOSED ISSUES

Scope	

<p>S2</p>	<p>Is it necessary/practical to guarantee convertibility from Old-to-New SOP? A: Guarantee, no.</p> <p>We are trying to make sure that the new SOP is reasonably powerful so conversion may be reasonably tractable. But guaranteeing convertibility would prevent making new information mandatory which would also restrict harmonization with newer templates. Note however that a system that can't fill in a value could omit the measurement from the converted new SOP. Systems will likely be capable of outputting both old and new SOPs. Recipients can choose/negotiate for the one they want.</p>
<p>S3</p>	<p>Should Cardiovascular History be reiterated in the Echo SR? A: No.</p> <p>If the worklist provides it, it might be OK to suggest it be copied, but otherwise, the Cart is not likely to have access to this information unless the tech does manual data entry, in which case, it's not clear that the cart console is the best place/GUI to be typing it in. It would be better done by a clerical person on another system (e.g. the HIS, the RIS or the CVIS). Note that Indications have been included. Perhaps the same logic applies to those.</p>
<p>S4</p>	<p>What is in the core list of measurements? A: The full set of concepts from the ASE papers, as collated in the ASE Core spreadsheet. (about 200 currently) plus additional measurements proposed by vendors and found to be reasonably "common".</p> <p>No new papers have come out recently so the original work stands (spanning 1989ish to 2012ish)</p>
<p>S6</p>	<p>What do processing and reporting systems on the consuming side need? A: See Annex XY (Use Cases) We think we've covered them.</p>

<p>S7</p>	<p>How much do we support “vendor-specific” measurements (beyond core)? A: See Pre-coordinated and Adhoc templates.</p> <p>Common measurements can be added to the Core Set. “Well-behaved” measurements can go in the Post-Coordinated Measurement container. That handles a large number of typical variations. By using the Core spreadsheet to model the core set, we have a good set of “basis axes” for the Post-Coordinated Measurement container. The CIDs corresponding to the concepts most likely to need extensions (Basic Echo Anatomic Sites, Echo Measurement Properties, Echocardiography Measurement Methods, Echocardiography Image View) have been made extensible. Anatomy is expected to occasionally add new or more fine-grained anatomy. Method allows new methods including details.</p> <p>Lastly, the Adhoc sub-template can handle any measurements that don’t need to be databased.</p> <p>No specific examples were raised that would require solutions such as:</p> <ul style="list-style-type: none"> - Adding a “freeform” container with few rules <ul style="list-style-type: none"> o Which would allow “lazy implementers” to put everything in the freeform section or otherwise abuse the tools. - Adding an “Additional Modifier Code Sequence” to the Post-Coordinated template or allowing the Post-coordinated template to be extended <ul style="list-style-type: none"> o Which would allow the variability/complexity that hamper 5200 to start coming back in. - Telling vendors to make a Private SOP Class. <ul style="list-style-type: none"> o Which would lack interoperability - Telling vendors to keep using 5200 <ul style="list-style-type: none"> o Which would not be making progress <p>There is of course a tradeoff between interoperability/simplicity and being able to use this for ANY measurement (particularly codes that are “ambiguous” but are 1-1 coordinated between sites and vendors)</p>
<p>S8</p>	<p>Can the vendor-specific strategy also be used for user-defined measurements? A: Yes, That’s the intent.</p> <p>Really it’s about x-defined measurements and x may be a vendor or a user. Maybe the vendor presets are just too hard to navigate. Note that part of the problem is that these may not be well modelled. User/Vendor “just wants a label and a number” but then later they want intelligent handling of the data they have handicapped.</p>

S11	<p>Should SCOORD3D be addressed in this supplement? A: No.</p> <p>It's not simple. SCOORD3D brings a lot of complexity (see TID 1411) to address fully abstracted 3D references. Most measurement references can be handled with 2D SCOORD references to particular frames which permit references to points in a 3D space. If there are strong driving use cases SCOORD3D can be added as a separate piece of work.</p>
S12	<p>Should advanced equations be modelled? A: No.</p> <p>Too complex and open ended.</p>
S14	<p>Should the vanilla template retain a few congenital codes? A: Yes.</p> <p>Want to allow a vanilla workup to record a few of these measurements without invoking the more sophisticated Fet/Ped/Con template which supports a more complete workup. Forcing them to switch to the FPC template could be problematic since some sites don't expect that and won't have it configured. The current list in the spreadsheet is sufficient.</p>
S15	<p>Should we try to unify/converge units for a given measurement across modalities? A: No.</p> <p>Outside scope for this supplement (although it might be good if someone tackles it).</p>
S17	<p>Is TEE out of scope? A: Not necessarily.</p> <p>Having View="don't care" for most measurements means TEE is not excluded and that is good. Check if there are TEE issues for ones where View is not mdc.</p>
Structure	
St1	<p>Create a new SOP Class? A: Yes.</p> <p>We will create a template and will give it a new UID. This allows negotiation for the new template (and allows systems to reject the new template if they don't support it). The contents still parse and process as SR (i.e. dsrdump still works, parsers don't need to be changed, etc.) Of course the template can still be sent inside a generic SR SOP Class.</p>
St2	<p>Should the list of Core Measurements be included directly in TID rows, or dereference through CID tables? A: De-reference through CID. Propose new syntax to allow a Units column in the CID.</p> <p>Although TIDs might allow making some measurements conditional on other measurements, we don't do much of this and CIDs are much more readable for implementers.</p>

St3	<p>Should the TID Row Order be Significant or Insignificant? A: Assume insignificant until a need is found for it to be significant.</p> <p>Order significant would be a harder for producer but might be easier for consumers.</p>
St4	<p>Should the Image Library container be MC based on use of REFER in the children? A: No. Remove the Image Library and require images to be referenced directly.</p> <p>The library is complex for the parser. Better to point directly to the specific image instance in the measurement.</p>
St5	<p>Within the container (Pre-Coord; Post-Coord), should measurements be sorted by code? A: No.</p> <p>Although it would be a predictable/non-random order that would be simple to implement and it would group multiple instances of the same measurement together, but parsers have to handle any order anyway, and it's a simple run through to sift for what you need.</p>
<p>Coding</p>	
C1	<p>Should the code meanings use uniform terminology or colloquial terminology? A: Use uniform but don't be pedantic.</p> <p>Colloquial is somewhat random which might lead to coding errors. Use uniform terms unless they get too unwieldy. In any case, Apps can display them in the GUI/report any way they like.</p>
C2	<p>Bias toward pre-coordination or post-coordination?</p> <ol style="list-style-type: none"> 1. Pre-coordination. <ul style="list-style-type: none"> • Make it mandatory • Do not include modifiers <p>[Structure/Location/Finding Site] [Observable][Flow Direction?] [Cardiac Phase] [Method] etc See Google Doc.</p> <p>Would it be bad to allow lots of modifiers that reiterate semantics in the pre-coordinated code to allow "dumb" applications to handle new codes in some way (e.g. add to the For example some measurements will have "View not specified" since we don't care and don't want codes for all the different variants. <Do we allow a measurement to add a detail like view to a NOS code></p> <p>But maybe we say that user measurements are completely post-coordinated and all modifiers are mandatory. But what process is this facilitating, and would it be better just to do the Conformance statement.</p> <p>Might want to have a user-defined-measurement flag (beyond the private coding scheme?) And we might want to put the vendor and user defined measurements in another group/container.</p> <p>Note that we will have to enforce some level of discipline on the user when creating/configuring new measurements.</p>

C3	<p>How can reasonable consistency of units be achieved?</p> <p>A: Stick to what is stated in ASE, but flag & discuss deviations from the following:</p> <ul style="list-style-type: none"> • Distance in cm • Area in cm² (except BSA in m²) • Velocity in cm/s • Time in ms • Volume in ml • Mass in g • Flow in ml/s <p>Systems are welcome to do conversions when displaying measurements to users if some sites/users have preferences that differ from the standard.</p>
C4	<p>Should \$DerivationParameter, \$Equation, or \$Table be encoded?</p> <p>A: No.</p> <p>They add complexity. Few creators use them. Few consumers support them (or else they get derailed when they are provided).</p> <p>For the core set the equation is pre-coordinated in the measurement. For user-defined measurements, it seems unlikely that consumers would parse/recomputed the value even if the equation was included in-band, rather than just documenting it out of band. Arguably, equations could be stuffed in the Code Meaning of the \$Method (which is done in a couple of places in Part 16), since the only real user might be the clinician wanting to know what equation was used, but usually they are named, not expressed.</p> <p>Anyone with a concrete Echo use case for these should present it. (They are used somewhat in OB for the GA calculations)</p>
C5	<p>Should \$Quotation be encoded?</p> <p>A: No.</p> <p>It adds complexity. Few creators use it. Few consumers support it (or else they get derailed when they are provided).</p> <p>Anyone with a concrete Echo use case for these should present it.</p>
C6	<p>Should \$Equivalent Meaning of Concept Name be encoded?</p> <p>A: Yes.</p> <p>This enables pre-coordinated codes for vendor & user defined measurements, allowing them to be handled (once the modifiers are parsed) in the same way as the pre-coordinated core set of measurements.</p>
C7	<p>Should \$Laterality and \$Topographical Modifier be encoded?</p> <p>A: No.</p> <p>Don't need them for Cardiology (although vascular does). Left/right chambers are not laterality. Proximal/Distal/etc is not relevant.</p> <p>Anyone with a concrete Echo use case for these should present it.</p>

C8	<p>Should \$Measurement Properties be encoded? A: No.</p> <p>It adds complexity (normality codes, level of significance, statistical properties, ranges, range authorities). Few if any creators use it. Few consumers support it (or else they get derailed when they are provided). Anyone with a concrete Echo use case for these should present it. The Selection Method concept is useful though. It will be retained.</p>
C9	<p>Do Cardiac Phase/Cycle semantics refer to Mechanical or Electrical; Chamber or Organ? A: Default is Mechanical, Chamber. Use adjectives to address others.</p> <p>If the chamber is not indicated, Cardiac Phases is synonymous with Left Ventricle Phase. So if not clarified Systole refers to Left Ventricle Systole. Note also that End Systole refers to a point in time, Systole refers to a duration of time spanning Systole. Although some code meanings may still refer to Systolic {X}, the definition or post-coordinated terms will be clear that it is measurement X taken over the duration of Systole, or measurement X taken at the time point of End Systole.</p>
C10	<p>Should missing codes be added in LOINC, SNOMED or DICOM? A: Add pre-coordinated measurement codes to LOINC, post-coordinated anatomic concepts to SNOMED.</p> <p>For now, use DICOM Supp placeholder codes.</p>
C11	<p>How should values that have to be estimated by the operator/clinician be addressed? A: Add a Measurement Type of “Estimated”</p> <p>Should perhaps mandate that if there are derived/calculated values, then all input values must be included in the SR as well so it will be recorded if some inputs are estimated.</p>
C12	<p>Do Flow Direction semantics refer to the viewpoint of the probe or anatomy? A: Anatomy is most clinically useful (see CID 12221).</p> <p>While the probe knows towards/away, the app must help figure out the anatomic.</p>
C13	<p>Do we need a modifier for Hand Grip and Valsalva? A: No. Capture in the Method modifier..</p> <p>Really only significant for Mitral E Velocity so far. If you need it, code it into your method.</p>

<p>C15</p>	<p>Should TID 5201 or TID 3602 be used for Patient Characteristics</p> <p>A: 3602.</p> <p>Although 5201 was used in the original 5200 Adult Echo, 3602 is used by Fetal/Ped/Congenital Echo since it is more complete and has more mandatory elements. Also, 3602 is a superset of 5201 and 5201 is Extensible so it is not really a deviation.</p> <p>(Note that technically a cart shouldn't send 3602 without requiring the tech to input a height weight.)</p>
<p>C17</p>	<p>What does Finding Site mean (in Post-Coordinated measurements)?</p> <p>A: The nominal location where the measurement was taken. It may or may not be the subject of the measurement. The latter is coded in Finding Observation Type.</p> <p>For example, Doppler can measure the velocity of both blood and tissue. A Finding Site=Mitral Valve and Finding Observation Type= Hemodynamic Measurements with Flow Direction=Antegrade Flow means a measurement of the velocity of the antegrade blood flow taken at the mitral valve.</p> <p>Note there are a few ambiguous cases: the Pulmonary Pressure is the site of the mmHg finding value, but a measurement sample was taken elsewhere to compute that finding.</p>
<p>C18</p>	<p>Should we allow modifiers on Finding Site?</p> <p>A: No. Use a more specific pre-coordinated Finding Site instead.</p> <p>It is irrelevant in Pre-coordinated. It is seldom used in post-coordinated. Simplest is to use more specific Finding Sites when needed.</p> <p>If we allow an "Unconstrained bucket" then modifiers of everything could be allowed.</p> <p>The main drivers for modifiers would be to allow tagging particular segments of a vessel or specific parts of a Mitral Valve Leaflet. Modifiers could, however, open a can of worms for receiving systems in terms of unexpected pairings.</p>
<p>C19</p>	<p>Should \$Units be constrained for Post-Coordinated Measurements?</p> <p>A: Yes.</p> <p>It is important to be predictable.</p> <p>On the other hand, allowing variation would let the sender be configured to drive a dumb receiver to meet the users preferences.</p>

<p>C20</p>	<p>Should we introduce “Not significant” codes for some CIDs</p> <p>A: No.</p> <p>Although it allows the TID row to be mandatory so receivers don’t have to deal with variation and allows the sender to affirmatively indicate that the value is not significant in the current context, DICOM dislikes codes for such concepts.</p> <p>This corresponds to the “mdc code” (multiple values possible, don’t care what it actually is) entries in the Core Set analysis. For example, for the Mitral Valve Vmax measurement the Image View is Not Significant (mdc).</p>
<p>C21</p>	<p>How can a consumer identify/strip out derived values (and choose to re-derive)?</p> <p>A: Use Measurement Type</p> <p>But it would be important to configure the sender to send all the needed elements to do the re-derivation.</p>
<p>C23</p>	<p>Should we allow senders to freely add modifiers?</p> <p>A: No.</p> <p>Especially no modifiers on core measurements.</p> <p>Prohibit senders from sending it (rather than allowing senders to code it and receivers to ignore it). Most importantly, we don’t want transmission to fail because the receiver has trouble handling it.</p>
<p>C25</p>	<p>Is it OK to use private coding schemes for Concept Name codes (e.g. in the Post-Coordinated Template)?</p> <p>A: Yes.</p> <p>Note that receivers are still obliged to parse and render such items, for example by using string in the corresponding Code Meaning.</p>

82

Changes to NEMA Standards Publication PS 3.2-2011

84

Digital Imaging and Communications in Medicine (DICOM)

Part 2: Conformance

86

Add new SOP Class in Table A.1-2

88

Table A.1-2
UID VALUES

UID Value	UID NAME	Category
...		
<u>1.2.840.10008.5.1.4.1.1.88.XX</u>	<u>Simplified Adult Echo SR Storage</u>	<u>Transfer</u>
...		

90

Add Section:

92

Describe documentation of vendor specific measurements. For example, the format could require that you document the view, the mode, the method, etc, etc, etc

94

<<Would be nice if database systems could read in an XML/JSON representation to facilitate the mapping process>><<Don't want to hold up the supplement for that though>>

96

98

Changes to NEMA Standards Publication PS 3.3-2011

100

Digital Imaging and Communications in Medicine (DICOM)

Part 3: Information Object Definitions

102

Add Section A.35.X for new SOP Class:

A.35.X Simplified Adult Echo SR Information Object Definition

104

A.35.X.1 Simplified Adult Echo SR Information Object Description

106

The Simplified Adult Echo SR IOD is used to convey measurements collected in association with an adult echocardiography procedure.

108

A.35.X.2 Simplified Adult Echo SR IOD Entity-Relationship Model

110

The E-R Model in Section A.1.2 of this Part applies to the Simplified Adult Echo SR IOD. Table A.35.X-1 specifies the Modules of the Simplified Adult Echo SR IOD.

A.35.X.3 Simplified Adult Echo SR IOD Module Table

112

**Table A.35.X-1
SIMPLIFIED ADULT ECHO SR IOD MODULES**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	SR Document Series	C.17.1	M
	Clinical Trial Series	C.7.3.2	U
Frame of Reference	Synchronization	C.7.4.2	C – shall be present if system time is synchronized to an external reference. May be present otherwise.
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
Document	SR Document General	C.17.2	M
	SR Document Content	C.17.3	M
	SOP Common	C.12.1	M

114

A.35.X.3.1.1 Template

116 The document may be constructed from Baseline TID 5QQQ “Simplified Echo Procedure Report” (defined in PS3.16) invoked at the root node.

118 **A.35.X.3.1.2 Value Type**

Value Type (0040,A040) in the Content Sequence (0040,A730) of the SR Document Content Module is
120 constrained to the following Enumerated Values (see Table C.17-7 for Value Type definitions):

- 122 TEXT
- CODE
- NUM
- 124 DATETIME
- UIDREF
- 126 PNAME
- CONTAINER
- 128

A.35.X.3.1.3 Relationship Constraints

130 Relationships between content items in the content of this IOD may be conveyed by-value. Table A.35.X-2
specifies the relationship constraints of this IOD. See Table C.17.3-2 for Relationship Type definitions.

132

Table A.35.X-2

134

RELATIONSHIP CONTENT CONSTRAINTS FOR SIMPLIFIED ADULT ECHO SR IOD

Source Value Type	Relationship Type (Enumerated Values)	Target Value Type
CONTAINER	CONTAINS	TEXT, CODE, NUM, DATETIME, UIDREF, PNAME, CONTAINER
TEXT, CODE, NUM	HAS OBS CONTEXT	TEXT, CODE, NUM, DATETIME, UIDREF, PNAME, COMPOSITE
CONTAINER	HAS ACQ CONTEXT	TEXT, CODE, NUM, DATETIME, UIDREF, PNAME, CONTAINER.
Any type	HAS CONCEPT MOD	TEXT, CODE
TEXT, CODE, NUM	HAS PROPERTIES	TEXT, CODE, NUM, DATETIME, UIDREF, PNAME, CONTAINER.
TEXT, CODE, NUM	INFERRED FROM	TEXT, CODE, NUM, DATETIME, UIDREF, CONTAINER.

136 **A.35.X.3.1.4 Time Constraints**

All times are assumed to be in UTC unless otherwise specified in the Synchronization Module.

138

Changes to NEMA Standards Publication PS 3.6-2011

140

Digital Imaging and Communications in Medicine (DICOM)

Part 6: Data Dictionary

142

Add the following UID Value to Part 6 Annex A Table A-1:

144

**Annex A Registry of DICOM unique identifiers (UID)
(Normative)**

146

**Table A-1
UID VALUES**

UID Value	UID NAME	UID TYPE	Part
...
<u>1.2.840.10008.5.1.4.1.1.88.XX</u>	<u>Simplified Adult Echo SR Storage</u>	<u>SOP Class</u>	<u>PS 3.4</u>

148

Add the following UID Value to Part 6 Annex A Table A-3:

150

**Table A-3
CONTEXT GROUP UID VALUES**

Context UID	Context Identifier	Context Group Name
...
<u>1.2.840.10008.6.1.XX1</u>	<u>newcid1</u>	<u>Measurement Selection Reason</u>
<u>1.2.840.10008.6.1.XX2</u>	<u>newcid2</u>	<u>Echo Finding Observation Types</u>
<u>1.2.840.10008.6.1.XX3</u>	<u>newcid3</u>	<u>Echo Measurement Types</u>
<u>1.2.840.10008.6.1.XX4</u>	<u>newcid4</u>	<u>Echo Measured Properties</u>
<u>1.2.840.10008.6.1.XX5</u>	<u>newcid5</u>	<u>Basic Echo Anatomic Sites</u>
<u>1.2.840.10008.6.1.XX6</u>	<u>newcid6</u>	<u>Echo Flow Directions</u>
<u>1.2.840.10008.6.1.XX7</u>	<u>newcid7</u>	<u>Cardiac Phases and Time Points</u>
<u>1.2.840.10008.6.1.XX0</u>	<u>newcid0</u>	<u>Core Echo Measurements</u>

152

154

Changes to NEMA Standards Publication PS 3.16-2011

156

Digital Imaging and Communications in Medicine (DICOM)

Part 16: Content Mapping Resource

158

Section 6.1.9 is included unmodified for reference:

160 **6.1.9 Value Set Constraint**

162 Value Set Constraints, if any, are specified in this field as defined or enumerated coded entries, or as baseline or defined context groups.

164 The Value Set Constraint column may specify a default value for the Content Item if the Content Item is not present, either as a fixed value, or by reference to another Content Item, or by reference to an Attribute from the dataset other than within the Content Sequence (0040,A730).

166 **6.1.9.1 NUM Units Constraint**

168 Constraints on units of measurement, if any, are specified in the Value Set Constraint field if and only if the Value Type is NUM. The constraints are specified either as defined or enumerated coded entries, or as baseline or defined context groups.

170

Modify Section 6.2.3.1 as shown:

172 **6.2.3.1 Template Parameters**

174 A Template that is included by another Template may include parameters that are replaced by values defined in the invoking Template. Parameters may be used to specify coded concepts or Context Groups in the Concept Name, Condition, or Value Set Constraint fields of a Template.

176 An included Template that accepts parameters shall be introduced by a table listing those parameters of the form:

Parameter Name	Parameter Usage

178

Parameters are indicated by a name beginning with the character "\$".

180 The invoking Template may specify the value of the parameters in the included Template by name in the Value Set Constraint field of the INCLUDE row. The parameter in the included Template shall be replaced
182 by the specified parameter value. Specification of a parameter value shall be of one of the following forms:

Notation	Definition
\$parametername = EV or DT (CV, CSD, "CM")	The parameter passed to the template is the specified coded term.
\$parametername = (CV, CSD, "CM")	The parameter passed to the template is the specified coded term, used as a parameter in a Condition field of the included Template.
\$parametername = BCID or DCID (CID) CNAME	The parameter passed to the template is the Context Group.
\$parametername = MemberOf {BCID or DCID (CID) CNAME}	The parameter passed to the template is a single coded term from the Context Group in curly braces.
<u>\$parametername = columnname@BCID or DCID (CID) CNAME</u>	<u>The parameter passed to the template is the auxiliary column titled columnname of the specified Context Group.</u> <u>If the same CID is referenced for multiple parameters, the same row of the Context Group shall be used for all parameter values.</u>

184 The specification of a parameter value is valid only for the directly included template. Therefore, it needs to
 186 be explicitly respecified in templates intermediate between the originally specifying Template and the
 188 target Template. The intermediate Template may use the same parameter name as used by the Template
 it invokes; in such a case, the intermediate Template would invoke the subsidiary Template with a
 specification in the Value Set Constraint field such as:

\$parametername = \$parametername

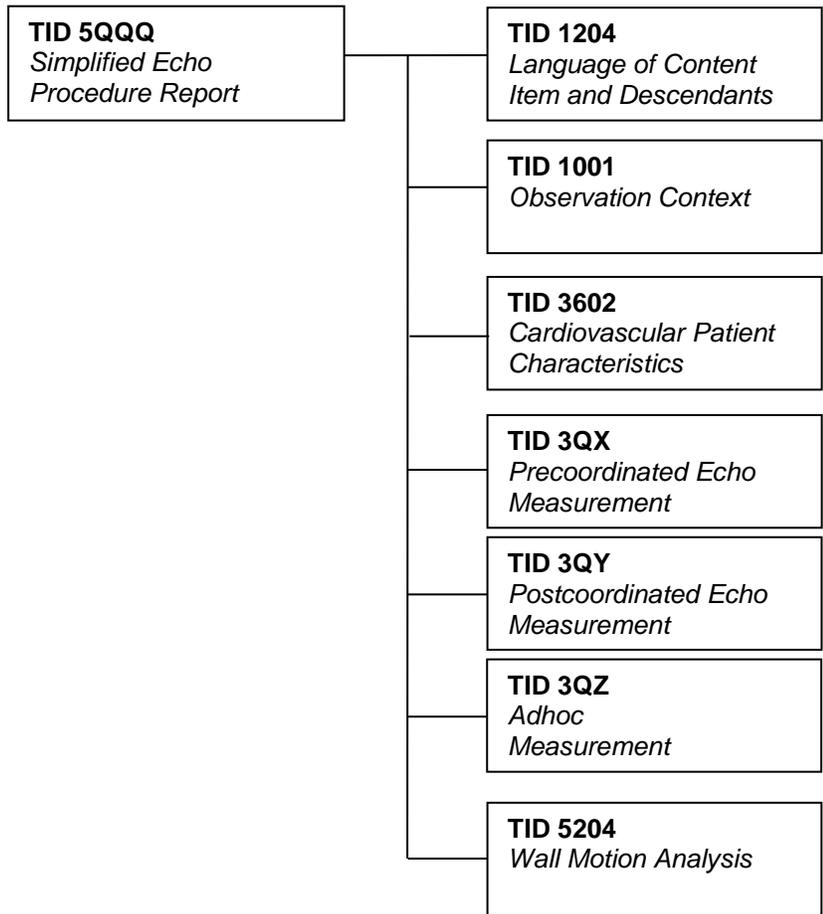
190 Note: In this case, the left hand instance of \$parametername is the name in the subsidiary template, and the
 right hand instance is the (parameterized) value passed into the current template.

192 The invoking template is not required to specify all parameters of included templates. If not specified, the
 value set (term or context group) for that parameter is unconstrained. An unconstrained value in a
 194 Condition will cause the condition to fail.

196 **Add new Section to Annex A following Echocardiography Procedure Report Templates**

SIMPLIFIED ADULT ECHOCARDIOGRAPHY TEMPLATES

198 The templates that comprise the Simplified Adult Echocardiography Report are interconnected as in Figure
 A-x.1



200

Figure A.x-1: Echocardiography Procedure Report Template Structure

202 **TID 5QQQ Simplified Echo Procedure Report**

204 This template forms the top of a content tree that allows an ultrasound device to describe the results of an adult echocardiography imaging procedure.

206 The template is instantiated at the root node. It can also be included in other templates that need to incorporate echocardiography findings into another report as quoted evidence.

208 This template does not include an Image Library. Image Content Items in the Echo Measurement templates (for example to indicate Source of Measurement) shall be included with by-value relationships, not with by-reference relationships.

210 Measurements in this template (except for the Wall Motion Analysis) are collected into one of three containers, each with a specific sub-template and constraints appropriate to the purpose of the container.

212 • **Pre-coordinated Measurements**

- are fully standardized measurements (many taken from the ASE practice guidelines).
 - Each has a single pre-coordinated standard code that fully captures the semantics of the measurement.
- 214

- 216 ○ The only modifiers permitted are to indicate coordinates where the measurement was
218 taken, provide a brief display label, and indicate which of a set of repeated measurements
is the preferred value. Other modifiers are not permitted.
- 220 ● **Post-coordinated Measurements**
 - 220 ○ are non-standardized measurements that are performed with enough regularity to merit
222 the control and configuration to capture the full semantics of the measurement. For
example these measurements may include those configured on the cart by the vendor or
224 user site. Some of these may be variants of the Pre-coordinated Measurements.
 - 224 ○ A set of mandatory and conditional modifiers with controlled vocabularies capture the
essential semantics in a uniform way.
 - 226 ○ A single pre-coordinated code is also provided so that when the same type of
228 measurement is encountered in the future, it is not necessary to parse and evaluate the
full constellation of modifier values. Since this measurement has not been fully
230 standardized, the pre-coordinated code may use a private coding scheme (e.g. from the
vendor or user site)
 - 232 ● **Adhoc Measurements**
 - 232 ○ are non-standardized measurements that do not merit the effort to track or configure all
234 the details necessary to populate the set of modifiers required for a post-coordinated
measurement.
 - 234 ○ The measurement code describes the elementary property measured.
 - 236 ○ Modifiers provide a brief display label and indicate coordinates where the measurement
was taken. Other modifiers are not permitted.
- 238 For an example of this encoding and a discussion of the benefits and use cases, see Annex XY.

240

TID 5QQQ – Simplified Echo Procedure Report
Type: Non-Extensible Order: Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (125200, DCM, "Adult Echocardiography Procedure Report")	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	DTID (1204) Language of Content Item and Descendants	1	U		
3	>	HAS OBS CONTEXT	INCLUDE	DTID (1001) Observation Context	1	M		
4	>		CONTAINER	DT (121064, DCM, "Current Procedure Descriptions")	1	U		
5	>>		CODE	DT (125203, DCM, "Acquisition Protocol")	1-n	M		BCID (12001) Ultrasound Protocol Types
6	>		CONTAINER	EV (121109, DCM, "Indications for Procedure")	1	U		
7	>>		CODE	EV (121071, DCM, "Finding")	1-n	U		DCID (12246) Cardiac Ultrasound Indication for Study
8	>>		TEXT	EV (121071, DCM, "Finding")	1	U		
9	>		INCLUDE	DTID (3602) Cardiovascular Patient Characteristics	1	U		
10	>		CONTAINER	EV (121070, DCM, "Findings")	1	M		
11	>>	HAS CONCEPT MOD	CODE	EV (G-C0E3, SRT, "Finding Site")	1	M		EV (newcode001, DCM, "Pre-coordinated Measurements")
12	>>		CONTAINER	DT (125007, DCM, "Measurement Group")	1	M		
13	>>>		INCLUDE	DTID (3QX) Pre-coordinated	1-n	M		\$Measurement = DCID (newcid0) Core

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
				Echo Measurement				Echo Measurements \$Units = Units@DCID (newcid0) Core Echo Measurements \$Preferred = DCID (newcid1) Measurement Selection Reasons
14	>		CONTAINER	EV (121070, DCM, "Findings")	1	M		
15	>>	HAS CONCEPT MOD	CODE	\$SectionSubject = EV (G-C0E3, SRT, "Finding Site")	1	M		EV (newcode002, DCM, "Post-coordinated Measurements")
16	>>		CONTAINER	DT (125007, DCM, "Measurement Group")	1	M		
17	>>>		INCLUDE	DTID (3QY) Post-coordinated Echo Measurement	1-n	U		\$Property = DCID (newcid4) Echo Measurement Properties \$Preferred = DCID (newcid1) Measurement Selection Reasons
18	>		CONTAINER	EV (121070, DCM, "Findings")	1	M		
19	>>	HAS CONCEPT MOD	CODE	EV (G-C0E3, SRT, "Finding Site")	1	M		EV (newcode002, DCM, "Adhoc Measurements")
20	>>		CONTAINER	DT (125007, DCM, "Measurement Group")	1	M		
21	>>		INCLUDE	DTID (3QZ) Adhoc Measurement	1-n	U		\$Measurement = DCID (newcid4) Echo Measurement Properties
22	>		INCLUDE	DTID (5204) Wall Motion Analysis	1-n	U		\$Procedure = DT (P5-B3121, SRT, "Echocardiography for Determining Ventricular Contraction")

242

Content Item Descriptions

Row 8	A text string containing one or more sentences describing one or more indications, possibly with additional comments from the physician or tech.
Row 11	TID (5200) introduced the Finding Site concept at this level to carry the \$SectionSubject, e.g. "Doppler Measurements" or "Aorta" or "Cardiac Shunt Study" while then allowing each individual measurement inside the section to have its own Finding Site which is the actual Finding Site of the measurement. TID (5QQQ) maintains this row (and the one above and below it) to preserve consistency of structure for existing parsers of TID (5200) and to collect the three families of measurements.
Row 13	These are measurements from a standardized list of pre-coordinated codes. See CID newcid0. Measurements which do not correspond to the full semantics of one of the pre-coordinated codes in CID newcid0 can likely be encoded in Row 17 instead. Multiple instances of the same measurement code may be present in the container. Each instance represents a different sample or derivation. This template makes no requirement that any or all samples be sent. For example, a mean value of all the samples of a given measurement could be sent without sending all or any of the samples from which the mean was calculated. Device configuration and/or operator interactions determine what measurements are sent.
Row 17	These are measurements that can be encoded using a standardized structure of post-coordinated codes. Measurements which correspond to the full semantics of one of the pre-coordinated codes in CID newcid0 should be encoded in Row 13 instead.

	<p>\$Measurement shall be provided, but is not constrained to a CID.</p> <p>Multiple instances of the same measurement code may be present in the container. Each instance represents a different sample or derivation.</p> <p>This template makes no requirement that any or all samples be sent. For example, a mean value of all the samples of a given measurement could be sent without sending all or any of the samples from which the mean was calculated. Device configuration and/or operator interactions determine what measurements are sent.</p>
Row 21	<p>These are adhoc measurements encoded with minimal semantics.</p> <p>Row 13 can be used to encode measurements with more complete semantics.</p> <p>\$Units shall be provided, but is not constrained to a CID.</p> <p>Device configuration and/or operator interactions determine what measurements are sent.</p>

244

TID 3QX Pre-coordinated Echo Measurement

246 This template codes numeric echo measurements where most of the details about the nature of the measurement have been pre-coordinated in the measurement code. In contrast, see TID 3QY Post-coordinated Echo Measurement.

248

The pre-coordinated measurement code and units are provided when this Template is included from a parent Template.

250

TID 3QX Parameters

Parameter Name	Parameter Usage
\$Measurement	Coded term or Context Group for Concept Name of measurement
\$Units	Units of Measurement
\$Preferred	Flag the preferred value by indicating the reason it was selected as preferred.

252

TID 3QX Pre-coordinated Echo Measurement

Type: Non-Extensible Order: Significant

254

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	\$Measurement	1	M		Units = \$Units
2	>	HAS PROPERTIES	CODE	EV (121404, DCM, "Selection Status")	1	MC	IFF this measurement has been selected as the single preferred value for the measured concept.	\$Preferred
3	>	HAS CONCEPT MOD	CODE	EV (121401, DCM, "Derivation")	1	MC	IFF this measurement is not a sample.	EV (R-0031,SRT, "Mean")
4	>		INCLUDE	DTID (320) Image or Spatial Coordinates	1-n	U		\$Purpose = EV (121112, DCM, "Source of measurement")
5	>		INCLUDE	DTID (321) Waveform or Temporal Coordinates	1-n	U		\$Purpose = EV (121112, DCM, "Source of measurement")
6	>	HAS PROPERTIES	TEXT	(newcode008,DCM,"Short Label")	1	U		

256

Content Item Descriptions

Row 2	Communicates the reason that this value was selected as the preferred value for the measured concept. This row shall not be present for more than one value of a given Measurement Concept Name. E.g. multiple measurements of (11706-9,LN,"Aortic Valve Peak Systolic Flow") may be present, but only one may be selected as preferred.
Row 3	Describes the method used to derive this measurement value from other measurement values. If Row 3 is not present, then this measurement is simply a sample. This row shall not be present for more than one value of a given Measurement Concept Name. Note: A measurement value that is a mean value of other measurements and was also selected as the preferred value because it is the mean will have both Row 2 and Row 3 present.
Row 6	This may be used to label the measurement value when space is limited on the screen or report page. E.g. a Short Label of "LVIDD" might be provided for a measurement of the left ventricle internal diameter at end diastole. Note: Short Labels are not standardized and may omit details of the measurement, thus it is ill advised to use them for purposes such as matching.

258

TID 3QY Post-coordinated Echo Measurement

260 This template codes numeric echo measurements where most of the details about the nature of the measurement have been post-coordinated in modifiers and acquisition context. In contrast, see TID 3QX
262 Pre-coordinated Echo Measurement.

This template is intended to be used for User-defined and Vendor-defined Echo Measurements.

264 Several modifier rows are conditional and are omitted when the modifier concept is not significant for the measurement encoded in the item. When these modifiers are included by the sender, it indicates that the
266 modifier concept is significant and receivers will generally treat the measurements differently than similar measurements sent that omit that modifier. Senders should be sure that is their intent.

268 Note that the codes in the CIDs listed below were sufficient to accurately encode all the best practice echo measurements recommended by the ASE. If, however, a new code is needed to record a specific User-
270 defined or Vendor-defined measurement, most of the CIDs are extensible.

If such measurements cannot be encoded with the following structure, an implementation may choose to
272 code the measurement in TID 3QZ, or to use TID 5200 instead of TID 5QQQ.

TID 3QY Parameters

Parameter Name	Parameter Usage
\$Measurement	Coded term or Context Group for Concept Name of measurement
\$Property	Property being measured
\$Units	Units of Measurement
\$Preferred	Flag the preferred value by indicating the reason it was selected as preferred.

274

\$Units is expected to match the Units column of CID (newcid4) for the corresponding \$Property, except
276 when the measurement type is (newcode111,DCM, "Indexed"), (newcode112, DCM, "Ratio") or
278 (newcode113,DCM, "Fraction"). Pay special attention to the description of Row 17. This allows parsers to handle Post-coordinated measurements the same as they would handle TID 3QX when they are familiar with the \$Measurement code.

280

TID 3QY

Post-coordinated Echo Measurement

282

Type: Non-Extensible Order: Significant

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	\$Measurement	1	M		Units = \$Units
2	>	HAS PROPERTIES	CODE	EV (121050,DCM,"Equivalent Meaning of Concept Name")	1-n	U		
3	>	HAS PROPERTIES	CODE	EV (121404, DCM, "Selection Status")	1	MC	IFF this measurement has been selected as the single preferred value for the measured concept.	\$Preferred
4	>	HAS CONCEPT MOD	CODE	EV (121401, DCM, "Derivation")	1	MC	IFF this measurement is not a sample.	EV (R-0031,SRT, "Mean")
5	>		INCLUDE	DTID (320) Image or Spatial Coordinates	1-n	U		\$Purpose = EV (121112, DCM, "Source of measurement")
6	>		INCLUDE	DTID (321) Waveform or Temporal Coordinates	1-n	U		\$Purpose = EV (121112, DCM, "Source of measurement")
7	>	HAS CONCEPT MOD	CODE	EV (newcode004, DCM, "Measurement Type")	1	M		DCID (newcid3) Echo Measurement Types
8	>	HAS CONCEPT MOD	CODE	EV (G-C0E3, SRT, "Finding Site")	1	M		DCID (newcid5) Basic Echo Anatomic Sites
9	>	HAS CONCEPT MOD	CODE	EV (newcode003, DCM, "Finding Observation Type")	1	M		DCID (newcid2) Echo Finding Observation Types
10	>	HAS CONCEPT MOD	CODE	EV (newcode005, DCM, "Measured Property")	1	M		Property = \$Property
11	>	HAS CONCEPT MOD	CODE	EV (G-C048, SRT, "Flow Direction")	1	MC	IFF Row 9 is (PA-50030,SRT, "Hemodynamic Measurements") and the Flow Direction is significant for this measurement.	DCID (newcid6) Echo Flow Directions
12	>	HAS CONCEPT MOD	CODE	EV (G-C036, SRT, "Measurement Method")	1	MC	IFF the Measurement Method is significant for this measurement.	DCID (12227) Echocardiography Measurement Methods
13	>	HAS ACQ CONTEXT	CODE	EV (G-0373, SRT, "Image Mode")	1	MC	IFF the Image Mode is significant for this measurement.	DCID (12224) Ultrasound Image Modes
14	>	HAS ACQ CONTEXT	CODE	EV (111031, DCM, "Image View")	1	MC	IFF the Image View is significant for this measurement.	DCID (12226) Echocardiography Image View
15	>	HAS CONCEPT MOD	CODE	EV (R-4089A, SRT, "Cardiac Cycle Point")	1	MC	IFF the Cardiac Cycle Point is significant for this measurement.	DCID (newcid7) Cardiac Phases and Time Points
16	>	HAS CONCEPT MOD	CODE	EV (R-40899, SRT, "Respiratory Cycle Point")	1	MC	IFF the Respiratory Cycle Point is significant for this measurement.	DCID (12234) Respiration State
17	>	HAS CONCEPT MOD	CODE	EV (newcode007, DCM, "Measurement Divisor")	1	MC	IFF the value of Row 7 is (newcode111,DCM,	

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
							"Indexed" or (newcode112, DCM, "Ratio") or (newcode113,DCM, "Fraction")	
18	>	HAS PROPERTIES	TEXT	(newcode008,DCM,"Short Label")	1	U		

284 Content Item Descriptions

Row 1	<p>A fully pre-coordinated code that incorporates all the semantics of this measurement.</p> <p>The code is intended to allow parsers to recognize post-coordinated measurements that have been previously encountered, thus facilitating incorporation of the measurement into databases, report templates, registries, etc. Typically these codes will be from a vendor or site specific coding scheme, e.g. 99ACME. Sending the same code consistently in different reports will depend on the recording system maintaining a stable list of these pre-coordinated codes. Such a list might be configured or internally generated and managed.</p> <p>This shall be populated by the recording system. If the recording system does not maintain a persistent table of such codes as new post-coordinated measurements are produced and used again later, a new UID shall be generated each time.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1. Two measurements with the same pre-coordinated code have, by definition, the same semantics 2. Two measurements with the same constellation of modifier values may have different pre-coordinated codes because they have semantics that differ in a way not captured in the modifiers and values 3. Two measurements with the same constellation of modifier values and the same semantics may have different pre-coordinated codes because they <ul style="list-style-type: none"> - come from carts of different vendors who don't share the same code table - come from carts of the same vendor, but the carts don't share the same code table - come from the same cart, but it's code table has been modified - come from the same cart, but it does not maintain a code table
Row 2	<p>One or more <u>additional</u> fully pre-coordinated codes which are semantically equivalent to the code in Row 1. This may be used to communicate known mappings, such as to national registry codes or other vendors codes.</p>
Row 3	<p>The reason that this value was selected as the preferred value for the measured concept.</p> <p>This row shall not be present for more than one value of a given measured concept. E.g. multiple measurements of (11706-9,LN,"Aortic Valve Peak Systolic Flow") may be present, but only one may be selected as preferred.</p>
Row 8	<p>The finding site reflects the anatomical location where the measurement is taken.</p> <p>CID (newcid5) contains the codes which proved to be sufficient for mapping the full set of ASE standard measurements. It is recommended to use these locations unless a more detailed location is truly necessary.</p>
Row 9	<p>The finding observation type indicates the type of observation made at the finding site to produce the measurement.</p> <p>In many cases, for example Aortic Root Diameter, the structure of the finding site is being observed. In other cases, for example Mitral Valve Regurgitant Flow Peak Velocity, the finding site is the mitral valve, the hemodynamic flow (not the valve structure) is being observed, the measured property is the peak velocity, and the flow direction is retrograde.</p>
Row 17	<p>The pre-coordinated code for the measurement that has been used as the denominator of this measurement. Only applies to measurements of type Indexed, Ratio or Fraction.</p> <p>The measurement referenced as the Measurement Divisor shall be present in the instance in which it is used. When Row 17 is present, any values in Rows 5-6, 8-16 shall reflect the numerator of the measurement rather than the Index, Ratio or Fraction as a whole. The rest of the rows, including the pre-coordinated measurement value,</p>

	the pre-coordinated measurement code, the units and the short label, reflect the Index, Ratio or Fraction as a whole. E.g. in the case of an Indexed measurement, the value recorded in Row 1 has already been divided by the Index referenced in Row 17, and the Units in Row 1 match the indexed value, not the numerator Property described in Row 10.
Row 18	This may be used to label the measurement value when space is limited on the screen or report page. E.g. a Short Label of "LVIDD" might be provided for a measurement of the left ventricle internal diameter at end diastole. Note: Short Labels are not standardized and may omit details of the measurement, thus it is ill advised to use them for purposes such as matching.

286

TID 3QZ Adhoc Measurement

288 This Template codes numeric echo measurements where most of the details about the nature of the measurement are not communicated. The measurement is identified in terms of the property measured, 290 such as Length, Diameter, Area, Velocity etc. and some measurement context may established by reference to spatial coordinates on an image or a waveform. A displayable label is included but there is no 292 managed code identifying the measurement.

The template is intended to be used to include adhoc, one-time measurements whose need is determined 294 during imaging exam or reviewing session. In contrast, measurements that are taken in an ad hoc fashion but are selected from the set of pre-coordinated or post-coordinated measurements that are configured on 296 the cart should be coded using TID 3QX Pre-coordinated Echo Measurement or TID 3QY Post-coordinated Echo Measurement.

298

TID 3QZ Parameters

Parameter Name	Parameter Usage
\$Property	Property being measured
\$Units	Units of Measurement

300

TID 3QZ

Adhoc Measurement

Type: Non-Extensible

Order: Significant

302

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	\$Property	1	M		Units = \$Units
2	>		INCLUDE	DTID (320) Image or Spatial Coordinates	1-n	U		\$Purpose = EV (121112, DCM, "Source of measurement")
3	>		INCLUDE	DTID (321) Waveform or Temporal Coordinates	1-n	U		\$Purpose = EV (121112, DCM, "Source of measurement")
4	>	HAS PROPERTIES	TEXT	(newcode008,DCM,"Short Label")	1	M		

304

Content Item Descriptions

Row 4	This may be used to label the measurement value when space is limited on the screen or report page. E.g. a Short Label of "LVIDD" might be provided for a measurement of the left ventricle internal diameter at end diastole.
-------	--

	Note: Short Labels are not standardized and may omit details of the measurement, thus it is ill advised to use them for purposes such as matching.
--	--

306

308

Add the following CID's to Part 16 Annex B:

310 **CID newcid1 Measurement Selection Reasons**

312 **Context ID newcid1**
Measurement Selection Reasons
Type: Extensible Version: yyymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	G-A437	Maximum – this sample was selected because it was the maximum
SRT	R-404FB	Minimum – this sample was selected because it was the minimum
DCM	121411	Most Recent Value Chosen – this sample was selected because it was the most recent
DCM	121410	User chosen value – this value was selected because the user preferred it
DCM	121412	Mean - this value was selected because it was the mean

314

CID newcid2 Echo Finding Observation Types

316 **Context ID newcid2**
Echo Finding Observation Types
Type: Non-Extensible Version: yyymmdd

318

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	newcode100	Structure of the Finding Site
DCM	newcode101	Behavior of the Finding Site
SRT	PA-50030	Hemodynamic Measurements

320 **CID newcid3 Echo Measurement Types**

322 **Context ID newcid3**
Echo Measurement Types
Type: Non-Extensible Version: yyymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	newcode110	Direct
DCM	newcode111	Indexed
DCM	newcode112	Ratio

DCM	newcode113	Fraction
DCM	newcode114	Calculated
DCM	newcode115	Estimated

324

CID newcid4 Echo Measured Properties

326

Context ID newcid4

Echo Measured Properties

328

Type: Extensible Version: yyyyymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	Units
LN	20168-1	Acceleration Time	(ms, UCUM, "millisecond")
LN	59130-5	Alias Velocity	(m/s, UCUM, "meter per second")
SRT	G-A166	Area	(cm ² , UCUM, "square centimeter")
SRT	F-31000	Blood Pressure	(mm[Hg], UCUM, "mmHg")
SRT	F-32070	Cardiac Ejection Fraction	(%, UCUM, "%")
LN	20217-6	Deceleration Time	(ms, UCUM, "millisecond")
SRT	M-02550	Diameter	(cm, UCUM, "centimeter")
LN	59120-6	dP/dt by US	(mm[Hg]/s, UCUM, "mmHg/s")
		Duration	(ms, UCUM, "millisecond")
		Dyssynchrony Index	(ms, UCUM, "millisecond")
		Effective Orifice Area	(cm ² , UCUM, "square centimeter")
LN	59093-5	Epicardial Area	(cm ² , UCUM, "square centimeter")
		Excursion Distance	(cm, UCUM, "centimeter")
LN	59132-1	Fractional Shortening	(%, UCUM, "%")
SRT	G-A22A	Length	(cm, UCUM, "centimeter")
SRT	G-D701	Mass	(g, UCUM, "gram")
		Maximum Orifice Area	(cm ² , UCUM, "square centimeter")
SRT	F-31150	Mean Blood Pressure	(mm[Hg], UCUM, "mmHg")
LN	20256-4	Mean Gradient [Pressure] by Doppler	(mm[Hg], UCUM, "mmHg")
LN	20352-1	Mean Blood Velocity	(m/s, UCUM, "meter per second")
SRT	G-A194	Minor Axis	(cm, UCUM, "centimeter")

LN	59099-2	Myocardial Performance Index (Tei)	(1, UCUM, "no units")
LN	20247-3	Peak Gradient [Pressure]	(mm[Hg], UCUM, "mmHg")
LN	34141-2	Peak Instantaneous Flow Rate	(ml/s, UCUM, "milliliter per second")
		Peak Blood Pressure	(mm[Hg], UCUM, "mmHg")
LN	11726-7	Peak Blood Velocity	(m/s, UCUM, "meter per second")
		Peak Tissue Velocity	(cm/s, UCUM, "centimeter per second")
		PISA Radius	(cm, UCUM, "centimeter")
LN	59085-1	Pre-Ejection Period	(ms, UCUM, "millisecond")
LN	20280-4	Pressure Half Time	(ms, UCUM, "millisecond")
SRT	G-0390	Regurgitant Fraction	(%, UCUM, "%")
		Regurgitation Jet Area	(cm ² , UCUM, "square centimeter")
		Regurgitation Jet Width	(cm, UCUM, "centimeter")
LN	59090-1	Internal Dimension	(cm, UCUM, "centimeter")
LN	59089-3	Thickness	(cm, UCUM, "centimeter")
SRT	F-32120	Stroke Volume	(ml, UCUM, "milliliter")
SRT	F-02692	Vascular Resistance	(dyn.s/cm ⁵ , UCUM, "dynes.s/cm ⁵ ")
LN	20354-7	Velocity Time Integral	(cm, UCUM, "centimeter")
		Vena Contracta Width	(cm, UCUM, "centimeter")
SRT	G-D705	Volume	(ml, UCUM, "milliliter")
LN	33878-0	Volume Flow Rate	(ml/s, UCUM, "milliliter per second")

330 **CID newcid5 Basic Echo Anatomic Sites**

332 **Context ID newcid5 Basic Echo Anatomic Sites**

Type: Extensible Version: yyyyymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	T-42110	Aortic Root
SRT	T-42102	Aortic Sinotubular Junction
SRT	T-35400	Aortic Valve
SRT	T-35410	Aortic Valve Ring
SRT	T-42100	Ascending Aorta
SRT	T-48710	Inferior vena cava

SRT	T-32410	Interventricular septum
SRT	G-0392	Lateral Mitral Annulus
SRT	T-32300	Left Atrium
SRT	T-44400	Left Pulmonary Artery
SRT	T-32600	Left Ventricle
SRT	T-32619	Left ventricle basal anterior segment
SRT	R-1007A	Left ventricle basal anterolateral segment
SRT	R-10075	Left ventricle basal anteroseptal segment
SRT	T-32615	Left ventricle basal inferior segment
SRT	R-10079	Left ventricle basal inferolateral segment
SRT	R-10076	Left ventricle basal inferoseptal segment
SRT	T-32617	Left ventricle mid anterior segment
SRT	R-1007C	Left ventricle mid anterolateral segment
SRT	R-10077	Left ventricle mid anteroseptal segment
SRT	T-32616	Left ventricle mid inferior segment
SRT	R-1007B	Left ventricle mid inferolateral segment aka Left Ventricle Posterior Wall
SRT	R-10078	Left ventricle mid inferoseptal segment
SRT	T-32620	Left Ventricle Myocardium
SRT	T-32650	Left Ventricle Outflow Tract
SRT	G-0391	Medial Mitral Annulus
SRT	T-35310	Mitral Annulus
SRT	T-35300	Mitral Valve
SRT	T-44000	Pulmonary Artery
SRT	T-4858F	Pulmonary Vein
SRT	T-35210	Pulmonic Ring
SRT	T-35200	Pulmonic Valve
SRT	T-32200	Right Atrium
SRT	T-44200	Right Pulmonary Artery
SRT	T-32500	Right Ventricle
	????	Right Ventricle (SRT, T-32500) + Anterior Wall
SRT	T-32503	Right Ventricle Midventricular Segment
SRT	T-32550	Right Ventricle Outflow Tract
	????	Right Ventricle Outflow Tract (SRT, T-32550) + Distal (or at Pulmonic Valve)
	????	Right Ventricle Outflow Tract (SRT, T-32550) + Proximal (or subvalvular)
SRT	T-32504	Right Ventricle Basal Segment
SRT	T-35110	Tricuspid Annulus

SRT	T-35100	Tricuspid Valve
SRT	T-44100	Trunk of pulmonary artery

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CID newcid6 Echo Flow Directions

336

**Context ID newcid6
Echo Flow Directions**

338

Type: Extensible Version: yyyyymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	R-42047	Antegrade Direction
SRT	R-42E61	Retrograde Direction

340 CID newcid7 Cardiac Phases and Time Points

342 The following codes are intended for use in a post-coordinated context. For example, the E-wave refers to the period of diastolic rapid inflow as experienced at the post-coordinated finding site, such as the mitral valve or the tricuspid valve.

344 The table is organized in time sequence based on the start of the coded period.

346 As indicated in Annex G, the e-prime period used for tissue velocity measurements is synonymous with the E-wave period used for blood velocity measurements.

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**Context ID newcid7
Cardiac Phases and Time Points**

Type: Extensible Version: 20100317

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
		Electromechanical Delay
LN	59085-1	Pre-ejection Period
SRT	F-32020	Systole
SRT	R-40B12	Ventricular Isovolumic Contraction
SRT	R-40B11	S-wave / Ventricular Ejection
SRT	R-FAB5B	End Systole
SRT	F-32010	Diastole
SRT	R-40B10	Ventricular Isovolumic Relaxation
		D-wave (Atrial Diastolic Filling)
SRT	R-40B1C	E-wave / Diastolic Rapid Inflow
SRT	R-40B21	Diastasis
SRT	F-32030	A-Wave / Atrial Systole
		AR-wave
SRT	F-32011	End Diastole

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	newcode131	Full Cardiac Cycle

350

CID newcid0 Core Echo Measurements

352

**Context ID newcid0
 Core Echo Measurements**

354

Type: Non-Extensible Version: yyyyymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)	Units
		Aortic Annulus Diameter	(cm, UCUM, "centimeter")
		Aortic Regurgitation Aliasing Velocity	(cm/s, UCUM, "centimeter per second")
		Aortic Regurgitation Effective Regurgitation Orifice Area	(cm ² , UCUM, "square centimeter")
		Aortic Regurgitation Flow	(ml/s, UCUM, "milliliter per second")
		Aortic Regurgitation Fraction	(%, UCUM, "%")
		Aortic Regurgitation Jet Area/LVOT Area %	(%, UCUM, "%")
		Aortic Regurgitation Jet Width/LVOT Width %	(%, UCUM, "%")
		Aortic Regurgitation PISA Radius	(cm, UCUM, "centimeter")
		Aortic Regurgitation Vena Contracta	(cm, UCUM, "centimeter")
		Aortic Regurgitation Volume (Continuity VTI)	(ml, UCUM, "milliliter")
		Aortic Regurgitation Volume (PISA)	(ml, UCUM, "milliliter")
		Aortic Regurgitation VTI	(cm, UCUM, "centimeter")
		Aortic root diameter	(cm, UCUM, "centimeter")
		Aortic root diameter / BSA	(cm/m ² , UCUM, "centimeter per square meter")
		Aortic Sinotubular junction dimension	(cm, UCUM, "centimeter")
		Aortic Valve Area (Continuity Vmax) / BSA	(cm ² /m ² , UCUM, "square centimeter per square meter")
		Aortic Valve Area (Continuity VTI) / BSA	(cm ² /m ² , UCUM, "square centimeter per square meter")
		Aortic Valve Mean (Blood?) Velocity	(cm/s, UCUM, "centimeter per second")

LN	18063-8	Aortic valve Mean systole gradient [Pressure] by US.doppler derived simplified Bernoulli	(mm[Hg], UCUM, "mmHg")
LN	18094-3	Aortic Valve Orifice [Area] US.Continuity.VMAX+Diameter	(cm ² , UCUM, "square centimeter")
LN	18092-7	Aortic Valve Orifice [Area] US.Continuity.VTI+Diameter	(cm ² , UCUM, "square centimeter")
		Aortic Valve Peak Instantaneous Gradient	(mm[Hg], UCUM, "mmHg")
LN	11706-9	Aortic Valve Peak Systolic Flow	(m/s, UCUM, "meter per second")
LN	20173-1	Aortic Valve Regurgitation Jet Peak Diastolic Flow	(cm/s, UCUM, "centimeter per second")
LN	20249-9	Aortic Valve Regurgitation Jet Peak Gradient [Pressure]	(mm[Hg], UCUM, "mmHg")
LN	18105-7	Aortic Valve Regurgitation Jet Pressure Half Time	(ms, UCUM, "millisecond")
LN	18169-3	Aortic Valve Velocity-Time Integral (no flow direction in these VTI codes)	(cm, UCUM, "centimeter")
		Ascending Aorta Dimension	(cm, UCUM, "centimeter")
		Average e-prime Vmax and E:e-prime ratio	({ratio}, UCUM, "ratio")
		Basal anterior time to S Vmax (Ts-basal anterior)	(ms, UCUM, "millisecond")
		Basal anteroseptal time to S Vmax (TS-basal anteroseptal)	(ms, UCUM, "millisecond")
		Basal inferior time to S Vmax (Ts-basal inferior)	(ms, UCUM, "millisecond")
		Basal lateral time to S Vmax (Ts-basal lateral)	(ms, UCUM, "millisecond")
		Basal posterior time to S Vmax (Ts-basal posterior)	(ms, UCUM, "millisecond")
		Basal septal time to S Vmax (Ts-basal septal)	(ms, UCUM, "millisecond")
LN	18006-7	Inferior Vena Cava Diameter	(cm, UCUM, "centimeter")
		Interventricular mechanical delay (IVMD)	(ms, UCUM, "millisecond")
LN	29430-6	Interventricular Septum Thickness Diastole by US 2D	(cm, UCUM, "centimeter")
LN	29431-4	Interventricular Septum Thickness Diastole by US.M-mode	(cm, UCUM, "centimeter")
LN	29432-2	Interventricular Septum Thickness Systole by US 2D	(cm, UCUM, "centimeter")

LN	29433-0	Interventricular Septum Thickness Systole by US.M-mode	(cm, UCUM, "centimeter")
		IVS time to peak displacement	(ms, UCUM, "millisecond")
		Lateral (Mitral Annulus?) e-prime Vmax	(cm/s, UCUM, "centimeter per second")
		Lateral E:e-prime ratio	(ratio, UCUM, "ratio")
LN	29468-6	Left atrial Diameter anterior-posterior systole by US 2D	(cm, UCUM, "centimeter")
LN	18024-0	Left atrial Diameter anterior-posterior systole by US M-Mode	(cm, UCUM, "centimeter")
		Left atrial end systolic area 2C	(cm ² , UCUM, "square centimeter")
		Left atrial end systolic area 4C	(cm ² , UCUM, "square centimeter")
		Left atrial end systolic volume biplane (area-length)	(ml, UCUM, "milliliter")
		Left atrial end systolic volume biplane (area-length) / BSA	(ml/m ² , UCUM, "milliliter per square meter")
		Left atrial end systolic volume biplane (MOD)	(ml, UCUM, "milliliter")
		Left atrial end systolic volume biplane (MOD) / BSA	(ml/m ² , UCUM, "milliliter per square meter")
		Left atrial end systolic volume single plane 2C (MOD)	(ml, UCUM, "milliliter")
		Left atrial end systolic volume single plane 4C (MOD)	(ml, UCUM, "milliliter")
		Left atrial systolic diameter (AP) 2D / BSA	(cm/m ² , UCUM, "centimeter per square meter")
		Left atrial systolic diameter (AP) MM / BSA	(cm/m ² , UCUM, "centimeter per square meter")
		Left atrial systolic length 2C	(cm, UCUM, "centimeter")
		Left atrial systolic length 4C	(cm, UCUM, "centimeter")
LN	18019-0	Left Pulmonary Artery Diameter	(cm, UCUM, "centimeter")
LN	29442-1	Left Ventricular Posterior Wall Thickness Diastole by US 2D	(cm, UCUM, "centimeter")
LN	29443-9	Left Ventricular Posterior Wall Thickness Diastole by US.M-mode	(cm, UCUM, "centimeter")
LN	29444-7	Left Ventricular Posterior Wall Thickness Systole by US 2D	(cm, UCUM, "centimeter")
LN	29445-4	Left Ventricular Posterior Wall Thickness Systole by US.M-mode	(cm, UCUM, "centimeter")

LN	18047-1	Left ventricular Ejection fraction by US 2D modified biplane	(%, UCUM, "%")
LN	18049-7	Left ventricular Ejection fraction by US.M-mode.Teichholz	(%, UCUM, "%")
		Left ventricular end diastolic volume (3D)	(ml, UCUM, "milliliter")
		Left ventricular end diastolic volume biplane (MOD)	(ml, UCUM, "milliliter")
		Left ventricular end diastolic volume biplane (MOD) / BSA	(ml/m2, UCUM, "milliliter per square meter")
		Left ventricular end diastolic volume single plane 2C (MOD)	(ml, UCUM, "milliliter")
		Left ventricular end diastolic volume single plane 4C (MOD)	(ml, UCUM, "milliliter")
		Left ventricular end systolic volume (3D)	(ml, UCUM, "milliliter")
		Left ventricular end systolic volume biplane (MOD)	(ml, UCUM, "milliliter")
		Left ventricular end systolic volume biplane (MOD) / BSA	(ml/m2, UCUM, "milliliter per square meter")
		Left ventricular end systolic volume single plane 2C (MOD)	(ml, UCUM, "milliliter")
		Left ventricular end systolic volume single plane 4C (MOD)	(ml, UCUM, "milliliter")
		Left ventricular endocardial area SAX PM level	(cm2, UCUM, "square centimeter")
		Left ventricular epicardial area SAX PM level	(cm2, UCUM, "square centimeter")
		Left ventricular fractional shortening (of minor axis) (MM)	(%, UCUM, "%")
LN	29434-8	Left ventricular Fractional shortening minor axis by US 2D	(%, UCUM, "%")
		Left ventricular internal diastolic dimension - 2D	(cm, UCUM, "centimeter")
		Left ventricular internal diastolic dimension - MM	(cm, UCUM, "centimeter")
		Left ventricular internal diastolic dimension / BSA	(cm/m2, UCUM, "centimeter per square meter")
		Left ventricular internal diastolic dimension / BSA	(cm/m2, UCUM, "centimeter per square meter")
		Left ventricular internal systolic dimension - 2D	(cm, UCUM, "centimeter")
		Left ventricular internal systolic dimension - MM	(cm, UCUM, "centimeter")

		Left ventricular internal systolic dimension / BSA	(cm/m ² , UCUM, "centimeter per square meter")
		Left ventricular internal systolic dimension / BSA	(cm/m ² , UCUM, "centimeter per square meter")
		Left Ventricular Isovolumic Relaxation Time by Doppler	(ms, UCUM, "millisecond")
		Left Ventricular Isovolumic Relaxation Time by TDI	(ms, UCUM, "millisecond")
		Left ventricular length 4C	(cm, UCUM, "centimeter")
		Left ventricular mass (area-length)	(g, UCUM, "gram")
		Left ventricular mass (area-length) / BSA	(g/m ² , UCUM, "gram per square meter")
		Left ventricular mass (area-length) / height ^{2.7}	g/m ^{2.7}
		Left ventricular mass (dimension method) 2D	(g, UCUM, "gram")
		Left ventricular mass (dimension method) 2D / BSA	(g/m ² , UCUM, "gram per square meter")
		Left ventricular mass (dimension method) 2D / height ^{2.7}	g/m ^{2.7}
		Left ventricular mass (dimension method) MM	(g, UCUM, "gram")
		Left ventricular mass (dimension method) MM / BSA	(g/m ² , UCUM, "gram per square meter")
		Left ventricular mass (dimension method) MM / height ^{2.7}	g/m ^{2.7}
		Left ventricular mass (truncated ellipse)	(g, UCUM, "gram")
		Left ventricular mass (truncated ellipse) / BSA	(g/m ² , UCUM, "gram per square meter")
		Left ventricular mass (truncated ellipse) / height ^{2.7}	g/m ^{2.7}
		Left ventricular outflow tract dimension (2D)	(cm, UCUM, "centimeter")
LN	18164-4	Left ventricular outflow tract Peak systolic flow by US.doppler	(cm/s, UCUM, "centimeter per second")
LN	18170-1	Left ventricular outflow tract Velocity-time integral by US.doppler	(cm, UCUM, "centimeter")
LN	18068-7	Left ventricular Pre ejection period by US	(ms, UCUM, "millisecond")
		Left ventricular relative wall thickness (2 * LVPWd / LVIDd)	(ratio), UCUM, "ratio")

LN	20333-1	Left Ventricular Stroke Volume by 2D Mitral Valve Flow Area Calculated	(ml, UCUM, "milliliter")
LN	8769-2	Left ventricular Stroke volume by US.Doppler	(ml, UCUM, "milliliter")
		LV Ejection fraction (Teichholz) 2D	(%, UCUM, "%")
		LV Ejection fraction 3D	(%, UCUM, "%")
		LV Ejection fraction single plane 2C (MOD)	(%, UCUM, "%")
		LV Ejection fraction single plane 4C (MOD)	(%, UCUM, "%")
		LV Stroke volume 3D	(ml, UCUM, "milliliter")
		LVPW time to peak displacement	(ms, UCUM, "millisecond")
LN	18020-8	Main Pulmonary Artery Diameter	(cm, UCUM, "centimeter")
SRT	G-038A	Main Pulmonary Artery Peak Velocity	(cm/s, UCUM, "centimeter per second")
		Mid anterior time to S Vmax (Ts-mid anterior)	(ms, UCUM, "millisecond")
		Mid anteroseptal time to S Vmax (Ts-mid anteroseptal)	(ms, UCUM, "millisecond")
		Mid inferior time to S Vmax (Ts-mid inferior)	(ms, UCUM, "millisecond")
		Mid lateral time to S Vmax (Ts-mid lateral)	(ms, UCUM, "millisecond")
		Mid posterior time to S Vmax (Ts-mid posterior)	(ms, UCUM, "millisecond")
		Mid septal time to S Vmax (Ts-mid septal)	(ms, UCUM, "millisecond")
		Mitral annulus diastolic diameter - A2C	(cm, UCUM, "centimeter")
		Mitral annulus diastolic diameter - A4C	(cm, UCUM, "centimeter")
		Mitral annulus diastolic diameter - PLAX	(cm, UCUM, "centimeter")
		Mitral Regurgitation Aliasing Velocity	(cm/s, UCUM, "centimeter per second")
LN	18035-6	Mitral Regurgitation dP/dT derived from Mitral Regurgitation Velocity	(mm[Hg]/s, UCUM, "mmHg/s")
		Mitral Regurgitation Flow (PISA)	(ml/s, UCUM, "milliliter per second")
		Mitral Regurgitation Fraction (Continuity VTI)	(%, UCUM, "%")
		Mitral Regurgitation Fraction (PISA)	(%, UCUM, "%")
		Mitral Regurgitation PISA Radius	(cm, UCUM, "centimeter")
		Mitral Regurgitation Vena Contracta Width	(cm, UCUM, "centimeter")

		Mitral Regurgitation Volume (Continuity VTI)	(ml, UCUM, "milliliter")
		Mitral Valve "A"wave duration/Pulmonary Vein "A" wave duration	(ratio, UCUM, "ratio")
LN	29470-2	Mitral Valve Annulus Velocity Time Integral	(cm, UCUM, "centimeter")
		Mitral Valve Area (Continuity VTI)	(cm ² , UCUM, "square centimeter")
		Mitral Valve Area (PISA)	(cm ² , UCUM, "square centimeter")
		Mitral Valve Area (Planimetry)	(cm ² , UCUM, "square centimeter")
		Mitral Valve Area (Pressure Half-Time)	(cm ² , UCUM, "square centimeter")
SRT	G-0385	Mitral Valve A-Wave Duration	(ms, UCUM, "millisecond")
LN	17978-8	Mitral Valve A-Wave Peak Velocity	(cm/s, UCUM, "centimeter per second")
LN	18001-8	Mitral Valve Deceleration Pressure Half Time	(ms, UCUM, "millisecond")
		Mitral Valve Deceleration Time	(ms, UCUM, "millisecond")
LN	29448-8	Mitral valve Effective regurgitant orifice [Area] by Ultrasound.doppler.PISA	(cm ² , UCUM, "square centimeter")
LN	18037-2	Mitral Valve E-Wave Peak Velocity	(cm/s, UCUM, "centimeter per second")
		Mitral Valve Flow Propagation velocity (Vp)	(cm/s, UCUM, "centimeter per second")
LN	20277-0	Mitral Valve Maximum Blood Flow Velocity	(cm/s, UCUM, "centimeter per second")
LN	18059-6	Mitral Valve Mean Gradient [Pressure]	(mm[Hg], UCUM, "mmHg")
LN	18038-0	Mitral Valve Peak E-Wave/Peak A-Wave	(ratio, UCUM, "ratio")
LN	18057-0	Mitral Valve Peak Gradient [Pressure]	(mm[Hg], UCUM, "mmHg")
LN	20268-9	Mitral valve regurgitant jet Peak systolic flow by US.doppler	(cm/s, UCUM, "centimeter per second")
LN	20250-7	Mitral Valve Regurgitation Jet Peak Gradient	(mm[Hg], UCUM, "mmHg")
LN	29449-6	Mitral Valve Regurgitation Volume (PISA)	(ml, UCUM, "milliliter")
LN	18172-7	Mitral Valve Velocity Time Integral	(cm, UCUM, "centimeter")

		Peak time delay between anterior-inferior wall	(ms, UCUM, "millisecond")
		Peak time delay between anteroseptal-posterior wall	(ms, UCUM, "millisecond")
		Peak time delay between septal-lateral wall	(ms, UCUM, "millisecond")
LN	8393-1	Pulmonary Artery End diastolic blood pressure	(mm[Hg], UCUM, "mmHg")
LN	8414-5	Pulmonary Artery Mean Blood Pressure	(mm[Hg], UCUM, "mmHg")
LN	8440-0	Pulmonary Artery Systolic blood pressure	(mm[Hg], UCUM, "mmHg")
LN	8828-6	Pulmonary Vascular Resistance	(dyn.s/cm5, UCUM, "dynes.s/cm5")
SRT	G-038B	Pulmonary Vein A-Wave Duration	(ms, UCUM, "millisecond")
LN	29451-2	Pulmonary Vein Diastolic Peak Velocity	(cm/s, UCUM, "centimeter per second")
LN	29453-8	Pulmonary Vein Maximum A Wave Reversal by US Doppler	(cm/s, UCUM, "centimeter per second")
LN	29450-4	Pulmonary Vein Systolic Peak Velocity	(cm/s, UCUM, "centimeter per second")
LN	29452-0	Pulmonary Vein Systolic to Diastolic Ratio	(ratio), UCUM, "ratio")
LN	29462-9	Pulmonary-to-Systemic Shunt Flow Ratio	(ratio), UCUM, "ratio")
		Pulmonic Annulus Diameter	(cm, UCUM, "centimeter")
		Pulmonic Regurgitation End-Diastolic Peak Gradient	(mm[Hg], UCUM, "mmHg")
		Pulmonic Regurgitation End-Diastolic Velocity	(cm/s, UCUM, "centimeter per second")
		Pulmonic Regurgitation Vmax	(cm/s, UCUM, "centimeter per second")
LN	17982-0	Pulmonic valve Acceleration by US.doppler	(ms, UCUM, "millisecond")
LN	18042-2	Pulmonic Valve Ejection Time	(ms, UCUM, "millisecond")
LN	18162-8	Pulmonic valve Maximum blood flow by US.doppler	(cm/s, UCUM, "centimeter per second")
LN	18058-8	Pulmonic valve Peak gradient [Pressure] by US.doppler	(mm[Hg], UCUM, "mmHg")
LN	18174-3	Pulmonic valve Velocity-time integral by US.doppler	(cm, UCUM, "centimeter")

LN	17988-7	Right atrial Apical 4 chamber Systolic {Area} by US 2D	(cm ² , UCUM, "square centimeter")
		Right atrial major axis dimension 4C	(cm, UCUM, "centimeter")
		Right atrial minor axis dimension 4C	(cm, UCUM, "centimeter")
		Right atrial minor axis dimension 4C / BSA	(cm/m ² , UCUM, "centimeter per square meter")
LN	8070-3	Right Atrium Systolic Pressure	(mm[Hg], UCUM, "mmHg")
LN	18021-6	Right Pulmonary Artery Diameter	(cm, UCUM, "centimeter")
		Right ventricular basal dimension 4C	(cm, UCUM, "centimeter")
		Right ventricular base-to-apex length 4C	(cm, UCUM, "centimeter")
		Right ventricular diastolic area 4C	(cm ² , UCUM, "square centimeter")
		Right Ventricular Ejection Time	(ms, UCUM, "millisecond")
		Right ventricular fractional area change	(%, UCUM, "%")
		Right ventricular free wall thickness 2D	(cm, UCUM, "centimeter")
		Right ventricular free wall thickness MM	(cm, UCUM, "centimeter")
SRT	G-0381	Right Ventricular Index of Myocardial Performance	(1, UCUM, "no units")
		Right ventricular isovolumic contraction time	(ms, UCUM, "millisecond")
		Right Ventricular Isovolumic Relaxation Time	(ms, UCUM, "millisecond")
		Right ventricular mid-cavity dimension 4C	(cm, UCUM, "centimeter")
		Right ventricular outflow tract diameter at pulmonic valve (RVOT-Distal)	(cm, UCUM, "centimeter")
		Right ventricular outflow tract diameter at subvalvular level (RVOT-Proximal)	(cm, UCUM, "centimeter")
LN	18171-9	Right ventricular outflow tract Velocity-time integral by US.doppler	(cm, UCUM, "centimeter")
SRT	G-0380	Right Ventricular Peak Systolic Pressure	(mm[Hg], UCUM, "mmHg")
LN	20301-8	Right ventricular Pre ejection period by US	(ms, UCUM, "millisecond")
		Right ventricular systolic area 4C	(cm ² , UCUM, "square centimeter")
		Septal E:e-prime ratio - really means E:septal e-prime ratio	({ratio}, UCUM, "ratio")
		Septal e-prime Vmax	(cm/s, UCUM, "centimeter per second")

		Septal to posterior wall motion delay (SPWMD)	(ms, UCUM, "millisecond")
		Tricuspid Annular Plane Systolic Excursion (TAPSE)	(cm, UCUM, "centimeter")
		Tricuspid Annulus Diameter	(cm, UCUM, "centimeter")
		Tricuspid Regurgitation PISA Radius	(cm, UCUM, "centimeter")
		Tricuspid Regurgitation Vena Contracta Width	(cm, UCUM, "centimeter")
		Tricuspid Valve a-prime Vmax	(cm/s, UCUM, "centimeter per second")
LN	18030-7	Tricuspid Valve A-Wave Peak Velocity	(cm/s, UCUM, "centimeter per second")
SRT	G-0389	Tricuspid Valve Closure to Opening Time	(ms, UCUM, "millisecond")
LN	18000-0	Tricuspid Valve Deceleration Time	(ms, UCUM, "millisecond")
LN	18056-2	Tricuspid Valve Diastolic Mean Gradient	(mm[Hg], UCUM, "mmHg")
LN	18055-4	Tricuspid Valve Diastolic Peak Gradient	(mm[Hg], UCUM, "mmHg")
LN	18032-3	Tricuspid Valve Diastolic Pressure Half-Time	(ms, UCUM, "millisecond")
LN	18175-0	Tricuspid Valve Diastolic Velocity Time Integral	(cm, UCUM, "centimeter")
		Tricuspid Valve E:e-prime Vmax Ratio	{ratio}, UCUM, "ratio"
		Tricuspid Valve e-prime Vmax	(cm/s, UCUM, "centimeter per second")
		Tricuspid Valve e-prime:a-prime Vmax Ratio	{ratio}, UCUM, "ratio"
LN	18161-0	Tricuspid Valve Maximum Blood Flow	(cm/s, UCUM, "centimeter per second")
LN	18031-5	Tricuspid Valve Peak E-Wave	(cm/s, UCUM, "centimeter per second")
LN	18039-8	Tricuspid Valve Peak E-Wave/Peak A-Wave	{ratio}, UCUM, "ratio"
LN	18034-9	Tricuspid Valve Regurgitation Jet dP/dT Systole	(mm[Hg]/s, UCUM, "mmHg/s")
LN	18065-3	Tricuspid Valve Regurgitation Jet Maximum Systolic Gradient	(mm[Hg], UCUM, "mmHg")
LN	18166-9	Tricuspid Valve Regurgitation Jet Peak Systolic Flow (is it clear Flow means distance over time, not volume or volume over time?)	(cm/s, UCUM, "centimeter per second")

		Tricuspid Valve s-prime Vmax	(cm/s, UCUM, "centimeter per second")
		Ts-SD (Dyssynchrony Index)	(ms, UCUM, "millisecond")

356

358 **Modify the following CID's in Part 16 Annex B:**

360 **CID 12227 Echocardiography Measurement Method**

362 **Context ID 12227**
Echocardiography Measurement Method
Type: Extensible Version: 20030918

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
<i>Include CID 12228 "Echocardiography Volume Methods"</i>		
<i>Include CID 12229 "Echocardiography Area Methods"</i>		
<i>Include CID 12230 "Gradient Methods"</i>		
<i>Include CID 12231 "Volume Flow Methods"</i>		
<i>Include CID 12232 "Myocardium Mass Methods"</i>		
<u>DCM</u>	<u>newcode141</u>	<u>Directly measured</u>

364

366

Add the following Definitions to Annex D

368

DICOM Code Definitions (Coding Scheme Designator “DCM” Coding Scheme Version “01”)

Code Value	Code Meaning	Definition
	...	
newcode001	Pre-coordinated Measurements	Measurements that are described by a single pre-coordinated code.
newcode002	Post-coordinated Measurements	Measurements that are described by a collection of (generally atomic) post-coordinated codes.
newcode003	Finding Observation Type	The type of observation made at the finding site, e.g. whether it is an observation of the structure of the finding site, an observation of the behavior of the finding site, or an observation of the blood flow at the finding site.
newcode004	Measurement Type	The type of derivation used to obtain the measurement value. E.g. whether it is taken directly, formed as a ratio, normalized against an index, or calculated using a more elaborate equation.
newcode005	Measured Property	The property that is being measured. Examples include mass, diameter, peak blood velocity.
newcode007	Measurement Divisor	The measurement which is the denominator of a measurement that is divided. This applies to measurements such as ratios or indexed values.
newcode008	Short Label	A brief label, suitable for display on a screen or report. (Not suitable for matching).
newcode100	Structure of the Finding Site	The subject of a measurement is the physical structure of the Finding Site, such as the mass or diameter.
newcode101	Behavior of the Finding Site	The subject of a measurement is the behavior of the Finding Site, such as the velocity or duration of motion.
newcode110	Direct	The measurement is taken directly using a caliper or tool of some sort. Examples include the distance between points on an image, the time between points on an m-mode trace, the velocity value in a pixel in a Doppler image, the area in a contour placed on an image, the area under a velocity curve.
newcode111	Indexed	The measurement is divided by an index value (such as Body Mass Index).
newcode112	Ratio	The measurement is a ratio of two values.
newcode113	Fraction	The measurement is expressed as a fraction of another measurement.

newcode114	Calculated	The measurement is calculated by incorporating one or more measured values into an equation.
newcode115	Estimated	The measurement is entered by a human operator.
newcode131	Full Cardiac Cycle	An entire cardiac cycle. E.g. from End Systole of one heartbeat to End Systole of the next heartbeat.
newcode141	Directly measured	The measurement is a direct output of the measurement tool.
	Fully pre-coordinated terms: <Where should these definitions live if not DCM codes? In LOINC?>	Definition Template: The <measured property> of the <finding site/observation type> measured/calculated at/during <cardiac cycle point> in <mode/view> using the <method> and divided by the <divisor>. The measurement may have been taken using any <leftovers>.
	Aortic Valve Annulus Diameter	The diameter of the Aortic Valve Annulus measured at End Systole in 2D mode. The measurement may have been taken using any view or method.
	Aortic Valve Flow VTI	The Velocity Time Integral of the Aortic Valve Flow measured during Systole in Doppler mode. The measurement may have been taken using any view or method.
	Aortic Valve Flow Peak Velocity	The Peak Velocity of the Aortic Valve Flow measured during Systole in Doppler mode. The measurement may have been taken using any view or method.
	Aortic Valve Flow Mean Velocity	The Mean Velocity of the Aortic Valve Flow measured during Systole in Doppler mode. The measurement may have been taken using any view or method.
	Aortic Valve Peak Instantaneous Gradient	The Peak Instantaneous Pressure Gradient across the Aortic Valve measured during Systole in Doppler mode using the Simplified Bernoulli method.
	Aortic Valve Mean Gradient	The Mean Pressure Gradient across the Aortic Valve measured during Systole in Doppler mode using the Simplified Bernoulli method.
	Aortic Valve Regurgitant Flow VTI	The Velocity Time Integral of the Aortic Valve Regurgitant Flow measured during Diastole in Doppler mode. The measurement may have been taken using any view or method.

	Aortic Valve Regurgitant Flow Volume by PISA	The Volume of the Aortic Valve Regurgitant Flow measured during Diastole in Doppler mode using the PISA method. The measurement may have been taken using any view.
	Aortic Valve Regurgitant Flow Jet Area to LVOT Area	The Ratio of the Aortic Valve Regurgitant Flow Jet Area to the LVOT Area measured during Diastole (?) in Doppler mode. The measurement may have been taken using any view.
	Aortic Valve Regurgitant Flow Effective Orifice Area	The Effective Orifice Area of the Aortic Valve Regurgitant Flow measured during Diastole in Doppler mode using the volume derived from the PISA method? The measurement may have been taken using any view.
	Aortic Valve Regurgitant Fraction	The Ratio of the Aortic Valve Regurgitant Volume to the Aortic Valve Stroke Volume measured in Doppler mode. The measurement may have been taken using any view.
	Aortic Valve Area by Continuity VTI / BSA	An indexed value representing the Area of the Aortic Valve measured in Doppler mode using the Continuity VTI method, normalized to the Body Surface Area.
	Pulmonary Vein Flow S-wave Peak Velocity	The Peak Velocity of the Pulmonary Vein Flow measured during Systole in pulsed Doppler mode. The measurement may have been taken using any view or method and in any of the Pulmonary Veins.
	Pulmonary Vein Flow A-wave Duration	The Duration of the Pulmonary Vein Flow measured during Atrial Systole in pulsed Doppler mode. The measurement may have been taken using any view or method and in any of the Pulmonary Veins.
	Delta D	The difference in duration between the duration of the Pulmonary Vein Flow measured during Atrial Systole in pulsed Doppler mode, and the duration of the Mitral Valve Flow measured during Atrial Systole in pulsed Doppler mode. The measurement may have been taken using any view or method and in any of the Pulmonary Veins.

370 **Modify Definitions in Annex D as shown:**

DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

Code Value	Code Meaning	Definition

372

374 **Add Synonyms to Annex G as shown:**
Note: Annex G is for synonyms, Annex H is for abbreviating code meanings to the 64 character limit.

376 **Annex G English Code Meanings of Selected Codes (Normative)**

Coding Scheme Designator	Code Value	Code Meaning
LN	20280-4	Pressure Half Time
		Pressure Half Time by US.calculated
LN	59089-3	Thickness
		ROI Thickness by US
LN	59090-1	Internal Dimension
		ROI Internal Dimension by US
LN	20247-3	Peak Gradient [Pressure]
		Peak Gradient [Pressure] by US.calculated
LN	20256-4	Mean Gradient [Pressure]
		Mean Gradient [Pressure] by Doppler
SRT	R-1007B	Left ventricle mid inferolateral segment
		Left Ventricle Posterior Wall
SRT	R-40B11	Ventricular Ejection
		S-wave
		s-prime
SRT	R-40B1C	Diastolic Rapid Inflow
		E-wave
		e-prime
SRT	F-32030	Atrial Systole
		A-wave
		a-prime

378

380

382

Changes to NEMA Standards Publication PS 3.17-2011

Digital Imaging and Communications in Medicine (DICOM)

384

Part 17: Explanatory Information

386 **Add Annex XY**

388

ANNEX XY: Populating the Simplified Echo Procedure Report Template (Informative)

390 This Annex provides guidance to understand and populate the Simplified Echo Procedure Report (TID
391 5QQQ) and its sub-templates. For implementers familiar with the Echocardiography Procedure Report
392 (TID 5200), which is largely replaced by TID 5QQQ, some relationships and differences are also
explained.

Structure Overview

394 Measurements in this template (except for the Wall Motion Analysis) are collected into one of three
containers, each with a specific sub-template and constraints appropriate to the purpose of the container.

- 396 • **Pre-coordinated Measurements**
 - 398 ○ are fully standardized measurements (many taken from the ASE practice guidelines).
 - 400 ○ Each has a single pre-coordinated standard code that fully captures the semantics of the
402 measurement.
 - The only modifiers permitted are to indicate coordinates where the measurement was
taken, provide a brief display label, and indicate which of a set of repeated measurements
is the preferred value. Other modifiers are not permitted.
- 404 • **Post-coordinated Measurements**
 - 406 ○ are non-standardized measurements that are performed with enough regularity to merit
configuration and capturing the full semantics of the measurement. For example these
408 measurements may include those configured on the cart by the vendor or user site. Some
of these may be variants of the Pre-coordinated Measurements.
 - 410 ○ A set of mandatory and conditional modifiers with controlled vocabularies capture the
essential semantics in a uniform way.
 - 412 ○ A single pre-coordinated code is also provided so that when the same type of
measurement is encountered in the future, it is not necessary to parse and evaluate the
full constellation of modifier values. Since this measurement has not been fully

414 standardized, the pre-coordinated code may use a private coding scheme (e.g. from the
vendor or user site)

- **Adhoc Measurements**

416 ○ are non-standardized measurements that do not merit the effort to track or configure all
418 the details necessary to populate the set of modifiers required for a post-coordinated
measurement.

○ The measurement code describes the elementary property measured.

420 ○ Modifiers provide a brief display label and indicate coordinates where the measurement
was taken. Other modifiers are not permitted.

422

Use Cases

424 Use Case 1: Store and Extract Specific Measurement

The user wishes to perform measurements on the Cart, store them to the PACS and later have a specific
426 measurement (say ABC) automatically displayed in the overlay or automatically inserted into a report page
on the review system. This does not require the receiver to understand any of the semantics of the
428 measurement.

Configuration:

430 The cart is configured to encode a particular measurement using a specific pre-coordinated code (and
code meaning).

432 In the case of measurements from the Core Set, it is a well-known pre-coordinated code (i.e. the code is in
CID newcid0), the full semantics are well-known and the measurement will be recorded in TID 3QX. Likely
434 most, if not all, of the Core Set measurements come pre-configured on the cart.

In the case of vendor-specific or site-specific measurements, it is a pre-coordinated code managed by the
436 site or the vendor which is entered and persisted on the cart. Since the code is not well-known, the
measurement will be recorded in TID 3QY along with the modifiers describing its semantics.

438 The receiver (i.e. the PACS display package or the reporting package) is configured to associate the
specific pre-coordinated code with a location on the overlay or a slot in the report.

440 The form of the user interface for these capabilities is up to the implementer.

Operation:

442 The user takes measurements on the Cart, including measurement ABC. All these measurements are
recorded in the Simplified Adult Echo SR object. If multiple instance of measurement ABC are included,
444 one of them may be flagged by the cart by setting the Selection Status for that instance to the reason it
was selected as the preferred value.

446 The Cart stores the SR object to the PACS.

The PACS or the reporting package retrieves the SR object and scans the contents looking for
448 measurements with the pre-coordinated code for measurement ABC. If multiple instances are found, the
receiver takes the one for which the Selection Status has been set.

450 The receiver renders the measurement value to the display or report, annotating it with the recorded Units,
Code Meaning, and/or Short Label as appropriate.

452 Note that in this use case the receiver handles the measurement in a mechanical way. As long as the
454 measurement can be unambiguously identified, the semantics do not need to be understood by the
receiver.

Use Case 2: Store and Process Measurements

456 The user wishes to perform measurements on the Cart, store them to the PACS and later perform
processing of some or all of the measurements on a CVIS or other system. Processing may include
458 incorporating measurements into a database, performing trend analysis, plotting graphs, driving decision
support, etc. One measurement taken at end systole may be compared to the “same” measurement that
460 is taken at end diastole, etc. Measurements at the same Finding Site might be collected together.

Configuration:

462 As in Use Case 1, the cart is configured to encode a each measurement using a specific pre-coordinated
code (and code meaning).

464 Again, measurements from the Core Set use a well-known pre-coordinated code and are recorded in TID
3QX while vendor-specific or site-specific measurements use locally managed codes and are recorded in
466 TID 3QY along with the modifiers describing its semantics.

Operation:

468 The user again takes measurements on the Cart which are recorded in the Simplified Adult Echo SR
object and if multiple instance of a measurement are included, one of them may be flagged by the cart by
470 setting the Selection Status for that instance to the reason it was selected as the preferred value.

The Cart stores the SR object to the PACS.

472 The receiving database or processing system retrieves the SR object and parses the contents. The
contents of TID 3QX have known semantics and are processed accordingly.

474 On first encounter, measurements in TID 3QY will likely have unfamiliar pre-coordinated codes.
Depending on the sophistication of the receiver, parsing the modifiers may provide sufficient information
476 for the receiver to automatically handle the new measurement. If not, the measurement can be put in an
exception queue for a human operator to review the values of the modifiers and decide how the
478 measurement should be handled. In between those two possibilities, the receiver may be able to compare
the modifier values of known measurements and provide the operator with a partially categorized
480 measurement.

In any case, once the semantics of the measurement are understood by the receiver, the corresponding
482 pre-coordinated code can be logged so that future encounters with that measurement can be handled in
an automated fashion.

484 The receiver may also make use of the Selection Status values or may database all the provided
measurement values or allow the human to select from the provided set.

486 Note that in this use case the receiver handles the measurements based on the semantics associated with
the measurement.

488

Differences of note between TID 5200 and TID 5QQQ

490 **Report Sections:** In TID 5200, containers and headings were used to facilitate the layout of
printed/displayed reports by collecting measurements into groups based on concepts like anatomical

492 region. Further, TID 5200 permitted carts to add new sections freely, TID 5QQQ does not. Section usage
493 was a source of problematic variability for receivers of TID 5200. TID 5QQQ constrains this. When such
494 groupings are useful, for example when printing reports, it makes more sense to configure it in one place
(in the receiving database/reporting system) rather than configuring such groupings independently (and
496 possibly inconsistently) on each ultrasound device in a department. Receivers may choose group
measurements based on Finding Site or some other logic as they see fit. This avoids the problem of trying
498 to keep many carts in sync. SR objects are considered acquisition data/evidence. When the findings are
transcoded into CDA reports, sections will likely be introduced in the CDA as appropriate.

500 **Finding Observation Type (Attribute):** The Finding Site is the location at which the measurement was
taken. While some measurements will be an observation of the structure of the finding site itself, other
502 measurements will be an observation of something like flow, in which case the Finding Site is simply the
location, not the actual thing being observed/measured. To clarify this distinction, Finding Observation
504 Type was introduced. For example, when the measurement is a peak velocity and the Finding Site is a
valve, to distinguish between a measurement of the velocity of the blood through the valve, and a
506 measurement of the velocity of the valve tissue, the Finding Observation Type would be set to "Structure of
Finding Site" or "Hemodynamic Measurement" respectively.

508

Usage Guidance

510 **Finding Site:** Modifiers are not permitted on the Finding Site in TID 3QY. Such modifiers allowed for
different ways of encoding the same concept. TID 3QY requires the use of a single anatomical code that
512 fully pre-coordinates the location details of the measurement. CID newcid5 (Basic Echo Anatomic Sites)
have proven to be sufficient to encode the ASE Core Set of measurements. Implementers are strongly
514 recommended to using codes from that list unless there is a truly significant location detail that needs to be
captured. For example, to identify a specific segment of the atrial wall, or a specific leaf of a valve as the
516 location of the measurement.

Measured Property: The codes in CID newcid4 (Echo Measured Properties) have also proven to be
518 sufficient to encode the ASE Core Set of measurements. It is expected that the majority of vendor-specific
or site-specific measurements can also be encoded using these properties, but it is understandable that
520 some additional codes may be needed. When introducing new codes, be careful not to introduce
elements of the other modifiers, such as Finding Site or Cardiac Cycle Point, into the Measured Property.
522 For example, do not introduce a property for Diastolic Atrial Length to be used for the left and right atria.
For such a measurement, the Property=Length, Cardiac Cycle Point=End Diastole and Finding Site=Left
524 Atrium or Right Atrium respectively.

Image View: Implementers may use codes for image views beyond those listed in DCID 12226
526 (Echocardiography Image View) as needed, but note that Image View is only recorded if it is significant to
the interpretation of the measurement. Inclusion of the Image View will likely isolate the measurement
528 from other measurements of the same feature taken in different views.

Cardiac Cycle Point: Note that (SRT, F-32020, "Systole") is used here to refer to the entire duration of
530 ventricular systole, while (SRT, R-FAB5B, "End Systole") is used to refer to the point in time where the
aortic valve closes (or in the case of the right ventricle, the pulmonary valve). So a Vmax measurement for
532 systole, would mean the maximum velocity over the period of systole, and a Vmax measurement for end
systole, would mean the maximum velocity at the time point of end systole.

534 **Measurement Method:** Allows distinguishing between two measurements that tell you the same thing, but
are obtained/derived in a different way. As with the Image View, this is only recorded if it is significant to
536 the interpretation of the measurement.

538 **Selection Status:** This is used to flag the preferred value when multiple instances of the same
measurement are recorded in the SR object. Using this to communicate the value preferred by the
operator or the cart is very useful for receivers that lack the logic to make a selection themselves. Of
540 course in cases where there is no need or value in sending multiple instances of the same measurement,
the issue can be avoided by only sending a single instance of any given measurement in the SR object.

542

Example Coding

544 <Insert example text from Earl and Ruth>

546

Add Annex YY

548 **ANNEX YY: Types of Measurement Specifications (Informative)**

YY.1 OVERVIEW

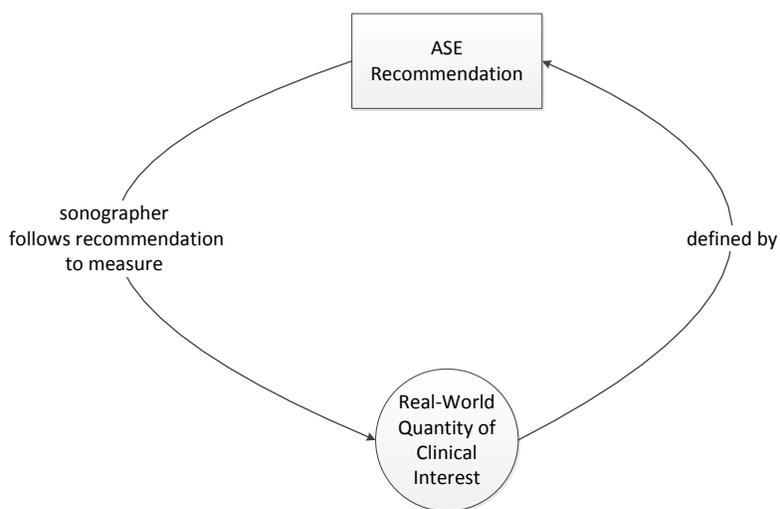
550 Real-world quantities of clinical interest are exchanged in DICOM Structured Reports. These real-world
quantities are identified using concept codes of two different types:

- 552 • Standard measurements that are *defined* by professional organizations such as the American
554 Society of Echocardiography (ASE), *codified* by vocabulary standards such as the Logical
Observation Identifiers Names and Codes (LOINC) or Systematized Nomenclature of Medicine –
Clinical Terms (SNOMED-CT) standards, and *packaged* in a DICOM Structured Report template.
- 556 • Non-Standard measurements that are implemented by a medical equipment vendor or clinical
institution and codified using a private or standard Coding Scheme.
- 558 • Adhoc measurements are those measurements that are generally acquired one time to quantify
560 some atypical anatomy or pathology that may be observed during an exam. These measurements
are not codified, but rather are described by the image itself and possibly by a label assigned at
the time the measurement is taken.

562 This paper discusses the requirements for identifying measurements of both types in such a manner that
they are accurately acquired and correctly interpreted by medical practitioners.

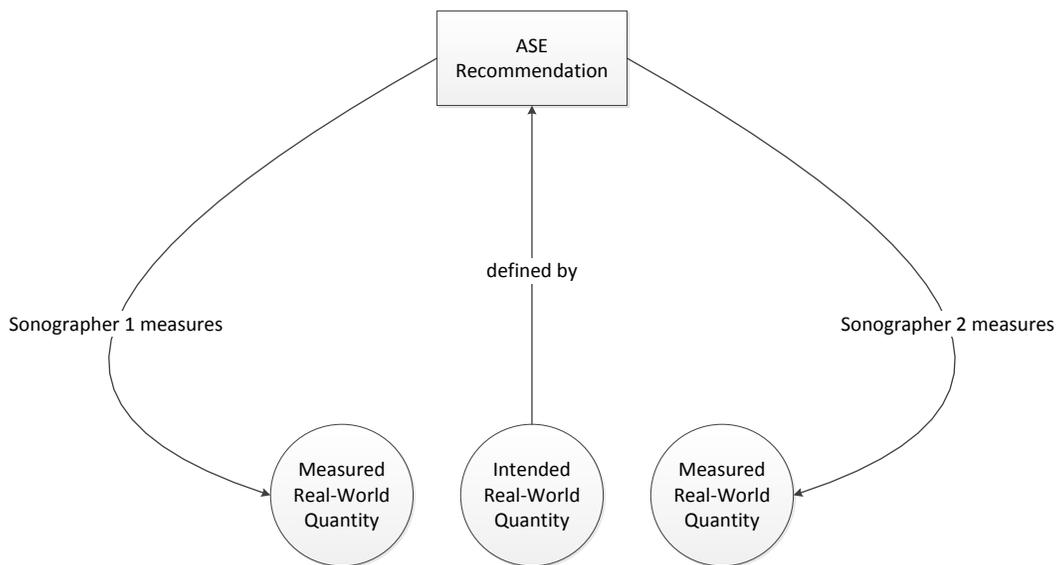
564 **YY.2 SPECIFICATION OF STANDARD MEASUREMENTS**

Clinical organizations publish recommendations for standardized measurements that comprise a
566 necessary and sufficient quantification of particular anatomy and physiology useful in obtaining a clinical
diagnosis. For each measurement recommendation, the measurement definition is specific enough so that
568 any trained medical practitioner would know exactly how to acquire the measurement. Thus, there would
be a 1:1 correspondence between the intended measurement recommendation and the practitioner's
570 understanding of the intended measurement and the technique used to measure it (anatomy and
physiology, image view, cardiac/respiratory phase, and position/orientation of measurement calipers). This
572 is illustrated in Figure 1:



574 **Figure 1: Matching Intended Quantity with Measurement Definition**

576 The goal is for each recommended measurement to be fully specified such that every medical practitioner
578 making the measurement on a given patient at a given time achieves the same result. However, if the
578 recommendation were to be unclear or ambiguous, different qualified medical practitioners would achieve
578 different results measuring the same quantity on the same patient, as illustrated in Figure 2:



580 **Figure 2: Result of Unclear or Ambiguous Measurement Definition**

582 There are a number of characteristics that should be included in a measurement recommendation in order
582 to ensure that all practitioners making that measurement achieve the same results in making the
582 measurement. Some characteristics are

- 584 • Anatomy being measured, specified to appropriate level of detail
- 586 • Reference points (e.g., "OFD is measurement in the same plane as BPD from the outer table of the proximal skull with the cranial bones perpendicular to the US beam to the inner table of the distal skull")
- 588 • Type of measurement (distance, area, volume, velocity, time, VTI, etc.)
- Sampling method (average of several samples, peak value of several samples, etc.)

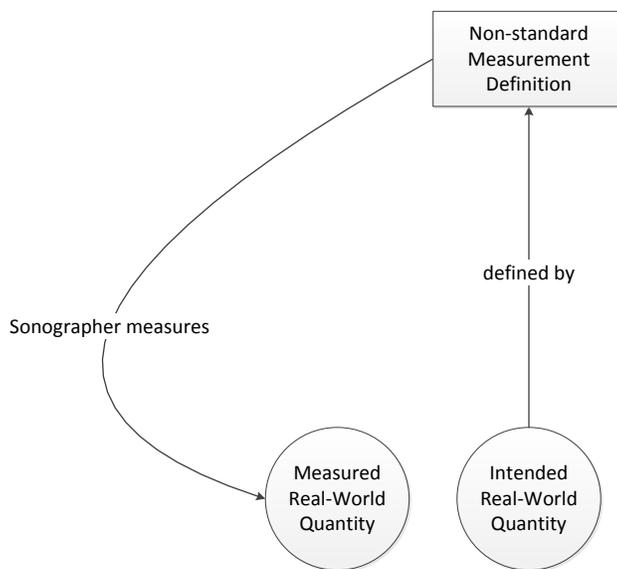
- 590
- Image view in which the measurement is made
 - Cardiac and/or respiratory phase

592 The measurement definition should specify these characteristics in order that the definition is clear and unambiguous. Since the characteristics are published as part of the Standard measurement definition document, a pre-coordinated measurement code is sufficient to specify the measurement in a structured report.

596 Because of the detail in the definition of each standard measurement, it is sufficient to represent such measurements with a pre-coordinated measurement code and a minimum of circumstantial modifiers.
598 This approach is being followed by PS 3.16 TID 3QX, for example.

YY.3 SPECIFICATION OF NON-STANDARD MEASUREMENTS

600 Non-Standard Measurements that are defined by a particular vendor or clinical institution, and are not widely understood by users of other vendors' equipment or practitioners in other clinical institutions. A system producing such measurements cannot expect a consuming application to implicitly understand the measurement and its characteristics. Further, such measurements may not be fully understood by the medical practitioners who are acquiring the measurements so there is some risk that the measurement acquired may not match the real-world quantity intended by the measurement definition as illustrated by Figure 3:



608 **Figure 3: Inadequate Definition of Non-Standard Measurement**

610 It is important for all non-standard measurement definitions to include all the characteristics of the measurement as would have been specified for Standard (baseline) measurement definitions, such as:

- Anatomy being measured, specified to appropriate level of detail
- 612 • Reference points (e.g., "OFD is measurement in the same plane as BPD from the outer table of the proximal skull with the cranial bones perpendicular to the US beam to the inner table of the distal skull")
- 614 • Type of measurement (distance, area, volume, velocity, time, VTI, etc.)
- 616 • Sampling method (average of several samples, peak value of several samples, etc.)
- Image view in which the measurement is made
- 618 • Cardiac and/or respiratory phase

Fully-specifying the characteristics of such measurements is important for several reasons:

- 620 1. Ensuring medical practitioners correctly measure the intended real-world quantity
622 2. Aiding consumer applications in correctly interpreting the non-standard measurement and
mapping the non-standard measurement to the most appropriate internally-supported
624 3. Aid in determining whether non-standard measurements from different sources are in fact
equivalent measurements and could thus be described by a single Standard measurement
626 definition.

Each of these reasons is elaborated upon in the sections to follow. This is the justification for representing
628 such non-standard measurements using both post-coordinated concepts and a pre-coordinated concept
code for the measurement, such as is done in PS 3.16 TID 3QY.

630 **YY.3.1 Acquiring the Intended Real-World Quantity**

A medical practitioner can be expected to correctly acquire the real-world quantity intended by the non-
632 standard measurement definition only if it is completely specified. This includes explicitly specifying all the
essential clinical characteristics as are described for Standard (baseline) measurements. While the
634 resultant measurement value can be described by a pre-coordinated concept code, the characteristics of
the intended real-world quantity must be defined and known.

636 **YY.3.2 Interpreting the Non-Standard Measurement**

It isn't enough that the characteristics of the intended real-world measurement be known by the acquisition
638 system and user; they also must be conveyed with the measurement value and pre-coordinated concept
code since a consumer application may not be familiar with the non-standard concept code. This means
640 that all such non-standard measurements must include mandatory post-coordinated descriptors for each
relevant characteristic along with the pre-coordinated concept code.

642 The presence of such post-coordinated descriptors aids the consumer application in

- 644 1. Mapping the non-standard measurement to an appropriate internally-supported measurement.
Including the post-coordinated descriptors greatly simplifies the task of determining measurement
equivalence.
- 646 2. Organizing the display of the non-standard measurement values in a report. It is clinically useful to
structure written reports in a hierarchical manner by displaying all measurements that pertain to
648 the same anatomical structure or physiological condition together.
- 650 3. Interpreting similar anatomical measurements differently depending on such characteristics as
acquisition image mode (e.g., 2D vs. M-mode image). Since the clinical interpretation may depend
on this information, it should be explicitly included along with the measurement concept code/code
652 meaning.
- 654 4. Analyzing accumulated report data (trending, data mining, and big data analytics)

Note that some of these benefits are reduced if the context groups specified for each standard modifier are
656 extended with custom modifier codes. A user should take great care when considering the extension of
the standard context groups to minimize the proliferation of modifier codes.

The presence of the pre-coordinated code in addition to the post-coordinated descriptors allows
658 subsequent receipt of the same measurement to utilize the mapping that was performed as described
above.

660 **YY.3.3 Determining Equivalence of Measurements from Different Sources**

It is customary for individual vendors to provide tools to acquire measurements that aren't currently defined
662 in a Standard measurement template. In the normal evolution of the Standard, standard measurement
sets are periodically updated to reflect the state of medical practice. Often, individual vendors and/or
664 clinical users are first to implement the acquisition of new measurements.

666 Some measurements may be defined and used within a particular clinical institution. For maximum
interoperability, if there exists a Standard or vendor-defined measurement concept code for that
668 measurement, the Standard or vendor-defined concept code should be used instead of creating a custom
measurement code unique to that institution.

670 Determining whether two or more different measurement definitions pertain to the same real-world quantity
is a non-trivial task. It requires clinical experts to carefully examining alternative measurement definitions
672 to determine if two or more definitions are equivalent. This task is greatly simplified if the distinct
characteristics of the non-standard measurement are explicitly stated and conveyed. If two measurements
674 differ in one or more critical characteristics then it can concluded that the two measurement definitions
describe different real-world quantities. Only those measurements that share all the critical clinical
characteristics need to be careful examined by clinical experts to see if they are equivalent.

676 It may be determined that two measurements that share all specified clinical characteristics are actually
distinct real-world quantities. If this occurs, it may be an indication that not all relevant clinical
678 characteristics have been isolated and codified. In this case, the convention for defining the measurement
should be extended to include the unspecified clinical characteristic.

680 **YY.4 SPECIFICATION OF ADHOC (ONE-TIME) MEASUREMENTS**

In the case of a measurement that is only being performed once, there is little value in incurring the
682 overhead to specify all measurement characteristics and assigning a code to the measurement as it will
never be used again. Rather, the image in which the measurement was performed provides sufficient
684 clinical context for the measurement. Association of the measurement with the source image is provided
by the use of SCOORD image references in the Structured Report. A short display label is also used to
686 complete the specification of the measurement.

If a user finds that the same quantity is being measured repeatedly as an adhoc measurement, a non-
688 standard measurement definition should be created for the measurement as described in Section YY.3.