Supplement 247: Eyecare Measurement Templates

DICOM WORKING GROUP 9
OPHTHALMOLOGY

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Purpose

- Add templates, context groups, and coded vocabulary for key eyecare measurements
- Ophthalmic study reports typically produced as Encapsulated PDF
  - Need to record key measurements as discrete data for clinical summary (e.g., in EHR)
- Focus on key clinical measurements for patient care, not a comprehensive list of measurements (e.g., for research)

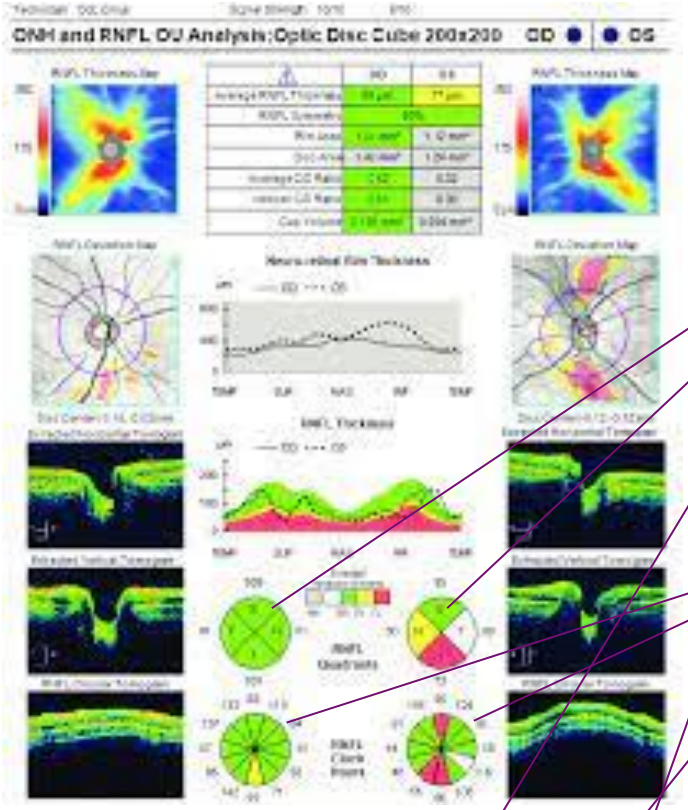
Prior work

- IHE Eyecare - Key Measurements in DICOM Encapsulated PDF, for Trial Implementation (2019)
  [https://www.ihe.net/uploadedFiles/Documents/Eye_Care/IHE_EyeCare_Suppl_Key_Measurement_PDF.pdf]
  - Content option under Unified Eye Care Workflow
  - Templates for SR-like content in Encapsulated PDF
- AAO recommendation of discrete data exchange (in association with displayable PDF) (2021) [https://www.aaojournal.org/article/S0161-6420(21)00164-0/fulltext]
- HL7 FHIR® Implementation Guide: Ophthalmology Retinal ("Eyes on FHIR") work in progress
  [https://build.fhir.org/ig/HL7/fhir-eyecare-ig/branches/master/index.html]

Sup247 Approach

- Templates defined for use in either SR or SR-like content in Encapsulated PDF
- Separate template for each category of measurement
  - Visual Field
  - Retinal Nerve Fiber Layer
  - Ganglion Cell Layer
  - Ophthalmic Image ROI
  - Optic Disc
  - Macula Thickness
  - Endothelial Cell Count

Example: Retinal nerve fiber layer



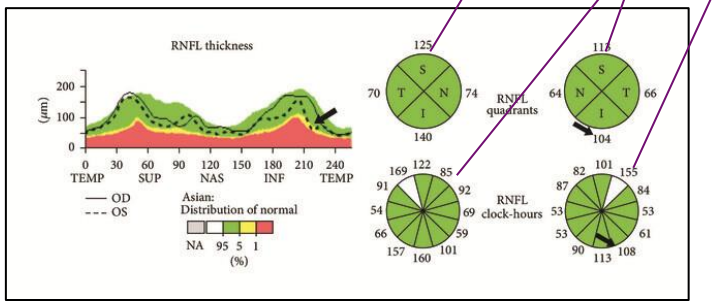


Table CID 42x3 RNFL Key Measurements

Coding Scheme Designator	Code Value	Code Meaning
DCM	nnn400	Retinal nerve fiber layer average thickness
DCM	nnn401	Retinal nerve fiber layer inferior thickness
DCM	nnn402	Retinal nerve fiber layer superior thickness
DCM	nnn403	Retinal nerve fiber layer temporal thickness
DCM	nnn404	Retinal nerve fiber layer nasal thickness
DCM	nnn411	RNFL clockface position 1 thickness
DCM	nnn412	RNFL clockface position 2 thickness
DCM	nnn413	RNFL clockface position 3 thickness
DCM	nnn414	RNFL clockface position 4 thickness
DCM	nnn415	RNFL clockface position 5 thickness
DCM	nnn416	RNFL clockface position 6 thickness
DCM	nnn417	RNFL clockface position 7 thickness
DCM	nnn418	RNFL clockface position 8 thickness
DCM	nnn419	RNFL clockface position 8 thickness
DCM	nnn420	RNFL clockface position 10 thickness
DCM	nnn421	RNFL clockface position 11 thickness
DCM	nnn422	RNFL clockface position 12 thickness
DCM	nnn406	Retinal ROI width

Example: Macular Thickness

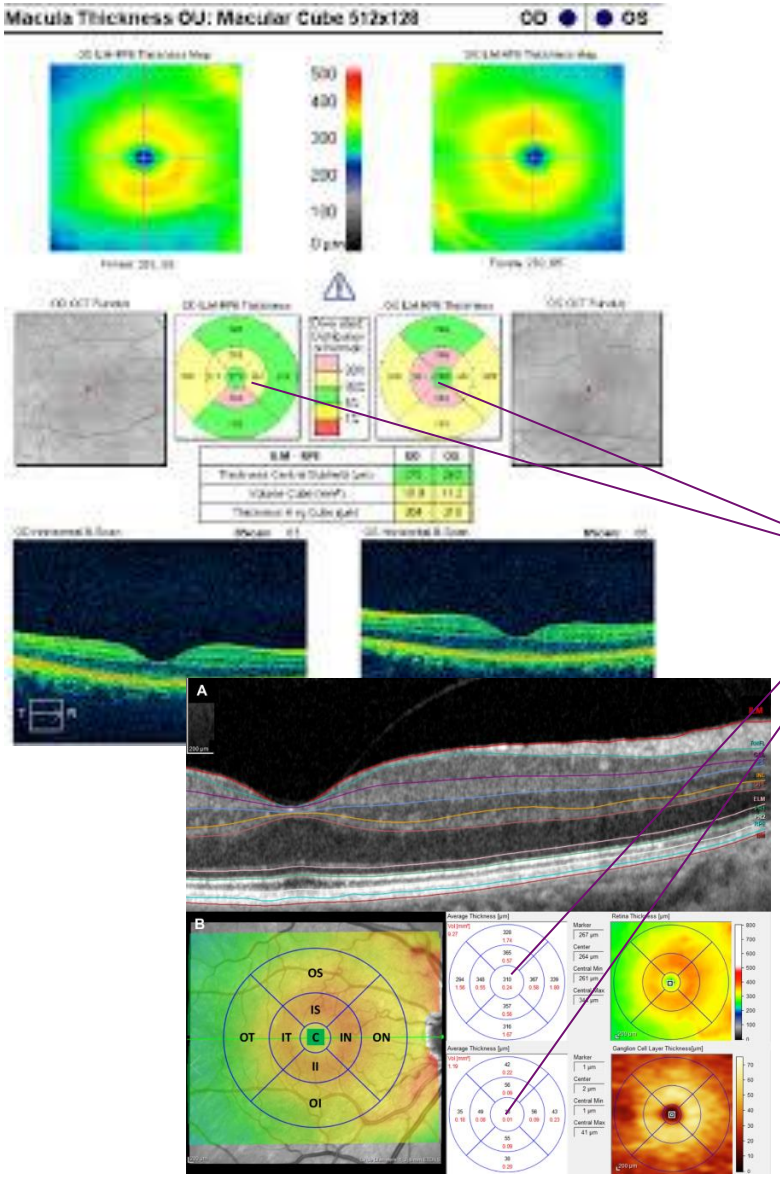


Table CID 42x4 Macular Thickness Key Measurements

Coding Scheme Designator	Code Value	Code Meaning
LN	57108-3	Macular grid.center point thickness by OCT
LN	57109-1	Macular grid.center subfield thickness by OCT
LN	57110-9	Macular grid.inner superior subfield thickness by OCT
LN	57111-7	Macular grid.inner nasal subfield thickness by OCT
LN	57112-5	Macular grid.inner inferior subfield thickness by OCT
LN	57113-3	Macular grid.inner temporal subfield thickness by OCT
LN	57114-1	Macular grid.outer superior subfield thickness by OCT
LN	57115-8	Macular grid.outer nasal subfield thickness by OCT
LN	57116-6	Macular grid.outer inferior subfield thickness by OCT
LN	57117-4	Macular grid.outer temporal subfield thickness by OCT
LN	57118-2	Macular grid.total volume by OCT
DCM	nnn250	Average macular thickness

Key Measurements are Mandatory

Table TID 60x1. Ophthalmology Measurements Group

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	CONTAINER	EV (125007, DCM, "Measurement Group")	1	M		
8	>	CONTAINS	INCLUDE	DTID 300 "Measurement"	**1-n**	**MC**	IFF Template is invoked with a non-empty $Measurement parameter (see Content Item Description)	$Measurement = $Measurement
9	>	CONTAINS	INCLUDE	DTID 300 "Measurement"	1-n	U		$Measurement = $OptMeasure

Row 8	Mandatory numeric findings of the measurement group. **Each Concept specified in the Value Set Constraints (i.e., as specified in the invoking Template $Measurement parameter) shall be encoded in a NUM Content Item, thus if there are eight concepts in the specified Context Group, eight NUM Content Items in accordance with TID 300 shall be present**. Note that the NUM Content Item allows an absent value with an associated reason code per CID 42, e.g., (114007, DCM, "Measurement not attempted"). TID 300 Measurement defines an optional capability to specify properties of a measurement via TID 310 Measurement Properties. TID 310 supports properties such as normality, statistical properties (through subsidiary TID 311), normal ranges (subsidiary TID 312), level of significance and more. Normality flags are highly useful and commonly provided by implementations.
Row 9	Optional numeric measurements of the measurement group.

Example invocation of measurement group

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (nnn101, DCM, "Optic Disc Key Measurements")	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	DTID 1204 "Language of Content Item and Descendants"	1	U		
3	>	HAS OBS CONTEXT	INCLUDE	DTID 1002 "Observer Context"	1-n	U		
4	>	HAS OBS CONTEXT	INCLUDE	DTID 4019 Algorithm Identification	1	U		
5	>	CONTAINS	INCLUDE	DTID 60x1 "Ophthalmology Measurements Group"	1-n	M		$Measurement = DCID 42x2 Optic Disc Key Measurements

Table CID 42x2 Optic Disc Key Measurements

Coding Scheme Designator	Code Value	Code Meaning	Units of Measure
DCM	nnn300	Cup to disc area ratio	({ratio}, UCUM, "ratio")
DCM	nnn301	Cup to disc ratio vertical	({ratio}, UCUM, "ratio")
DCM	nnn302	Cup to disc ratio horizontal	({ratio}, UCUM, "ratio")
DCM	nnn303	Neuroretinal rim area	(mm2, UCUM, "mm2")
DCM	nnn304	Optic cup area	(mm2, UCUM, "mm2")
DCM	nnn305	Optic disc area	(mm2, UCUM, "mm2")
DCM	nnn306	Optic cup volume	(mm3, UCUM, "mm3")

New Ratio Template

- Visual Field key measurements require ratios, e.g., false positives over number of trials, represented as numerator and denominator (not decimal fraction)
- New general Ratio Template defined for a measurement with explicit numerator and denominator values, otherwise similar to TID 300
- Allows transcoding to FHIR Ratio datatype