



Integrating
the Healthcare
Enterprise

Integrating the Healthcare Enterprise International – IHE Eye Care

Webinar Series July 2017

- Peter Scherer, CIO ifa Group of Companies (IGOC)
 - IHE Eye Care Co-Chair Technical Committee
- Donald Van Syckle, DVS Consulting, Inc.
 - IHE Eye Care Planning Committee and Technical Committee Consultant

A short introduction to IHE

- IHE is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information.
- In 1997, a consortium of radiologists and information technology experts formed IHE, or "Integrating the Healthcare Enterprise."
- IHE created and operates a process through which interoperability of health care IT systems can be improved. The group gathers case requirements, identifies available standards, and develops technical guidelines that manufacturers can implement.
- The core philosophy of IHE is to identify and evaluate existing standards and define commonly agreed rules how to use these standards to fulfill specific healthcare use cases (workflow requests) the so called 'Integration Profiles'.
- IHE is sponsored by the Healthcare Information and Management Systems Society (HIMSS) and the Radiological Society of North America (RSNA).

The IHE Eye Care Domain

- In 2005 the American Academy of Ophthalmology (AAO) recognized the benefits of IHE and became the sponsor of IHE Eye Care. This enables clinicians and vendors to adapt IHE specific to the needs of the eye care business.
- The AAO recommends clinicians use eye care vendors that implement IHE Integration Profiles as this greatly reduces the efforts of system to system information exchange.
- IHE Eye Care provides the venue for vendors to test their products. This is a multiple vendor event, where multiple companies work together to test against real-world scenarios encountered in an eye care clinic. This AAO sponsored event is called the IHE Eye Care Connectathon.
- The AAO also holds an “interoperability showcase” in which vendors assemble to demonstrate the interoperability of their products to eye care healthcare professionals.

Today the IHE Eye Care Definitions are using mainly 4 well known Health Care IT standards:

HL7 (Health Level 7) V2.x

HL7 V2.x is used to communicate administrative and non-imaging data such as patient demographics, appointment schedules, and more

DICOM (Digital Imaging and Communications in Medicine) V3

DICOM V3 is used to store and communicate imaging data for eye care devices such as a fundus camera, slit lamp, visual field, OCT and more

HL7 V3 CDA

HL7 V3 CDA is the base of many C-CDA document templates describing multiple aspects of a patient history, such as a patient's eye care exam or a patient's eye care summary. The documents are used to communicate health care information beyond the local health care network.

Japan Ophthalmic Instruments Association (JOIA)

XML file based specification enabling the exchange of refractive measurements from devices such as autorefractors, keratometers, lensometers, etc.

Basics (continued)

- IHE is a framework or architecture for achieving a useful clinical workflow involving all kind of IT systems used in the healthcare environment.
- IHE EyeCare abstracts real world use cases to **Integration Profiles**.
- **Actors** are used to abstract tasks that are involved in a use case.
- **Transactions** are used to abstract the communication between the **Actors** to fulfill the workflow of the use case. There are Mandatory and Optional Transactions for each Actor.
- This results in a matrix defining the functionalities and communication abilities between two or more vendor products that interact within eye care healthcare organizations providing a seamless workflow to the healthcare professional.

IHE Eye Care definitions

- **IHE Eye Care defines these Integration Profiles:**
Unified Eye Care Workflow, Eye Care Charge Posting, Eye Care Evidence Document, Eye Care Displayable Report
- **IHE Eye Care defines these Actors:**
Acquisition Modality, Acquisition Modality Importer, Appointment Consumer, Appointment Scheduler, Charge Processor, Content Consumer, Content Creator, Department System Scheduler/Order Filler, Evidence Creator, Image Display, Image Manager/Image Archive, Image Storage/Display, Patient Registration Consumer, Patient Registration Source, Performed Procedure Step Manager, Refractive Measurement Source, Refractive Measurement Consumer, Refractive Measurement Source Importer
- **IHE EyeCare defines these Transactions:**
Appointment Scheduling Management, Eye Care Charge Posted, Modality Images/Evidence Key Objects Stored, Modality Images/Evidence Stored, Modality Procedure Step Completed, Modality Procedure Step In Progress, Patient Demographics Update, Patient Registration, Procedure Scheduled, Query Images, Query Modality Worklist, Retrieve Images, Refractive Measurements with Valid Patient ID, Refractive Measurements without Patient ID

Profiles & Technical Frameworks

Unified Eye Care Workflow

- Automated Workflow in your practice
- Patient Safety in Mind - *input patient information once*
- Products such as Practice Management Systems (PMS), Electronic Medical Record Systems (EMRs), Image Management (PACS), Image Display Workstation and eye care Imaging Devices
- Expanded to include EMR to refractive device measurement integration
 - Japan Ophthalmic Instruments Association (JOIA)
XML-based refractive measurements
- Standards used
 - HL7 v2.5.1 messages, DICOM SOP Classes and JOIA XML streams
- ***All other workflows Retired***
 - Advanced Eye Care Workflow - ***Retired***
 - Basic Eye Care Workflow - ***Retired***
 - Core Eye Care Workflow - ***Retired***

Pick the workflow configuration that fits your practice

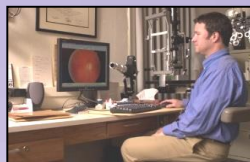
Real World Model I

EHR provides DICOM patient list to devices & uses Image Management System (PACS) to archive images and reports

Patient Management System



Image Display



Patient
Demographics
&
Appointments

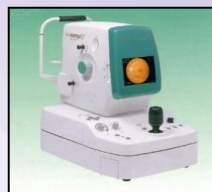


Post Charges
(Optional)



Electronic Health Record

Orders/Worklist
(Demographics)



Eye Care Device

Storage



Image Management System
(PACS)

Advanced
Image Display



- *Patient Demo & Appointments Based Upon HL7 v2.5.1*
- *Device Patient List (Worklist) and Images/Reports (DICOM)*
- *Advanced Image Display (DICOM)*

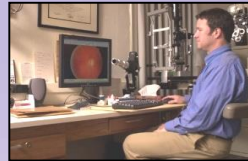
Real World Model I

EHR provides DICOM patient list to devices & uses Image Management System (PACS) to archive images and reports

Patient Management System



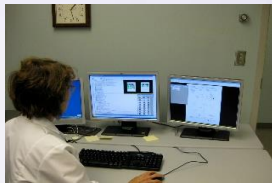
Image Display



Patient
Demographics
&
Appointments

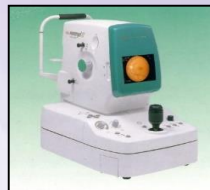


Post Charges
(Optional)



Electronic Health Record

Orders/Worklist
(Demographics)



Eye Care Device

Storage



Image Management System
(PACS)

Advanced
Image Display



- *Patient Demo & Appointments Based Upon HL7 v2.5.1*
- *Device Patient List (Worklist) and Images/Reports (DICOM)*
- *Advanced Image Display (DICOM)*

Real World Model II

EHR provides DICOM patient list to devices & stores/displays key DICOM images and reports (no PACS)

Patient Management System



**Patient
Demographics
& Appointments**



**Post Charges
(Optional)**



Electronic Health Record

Orders/Worklist

**Storage of Key
Images/Reports
(No PACS)**

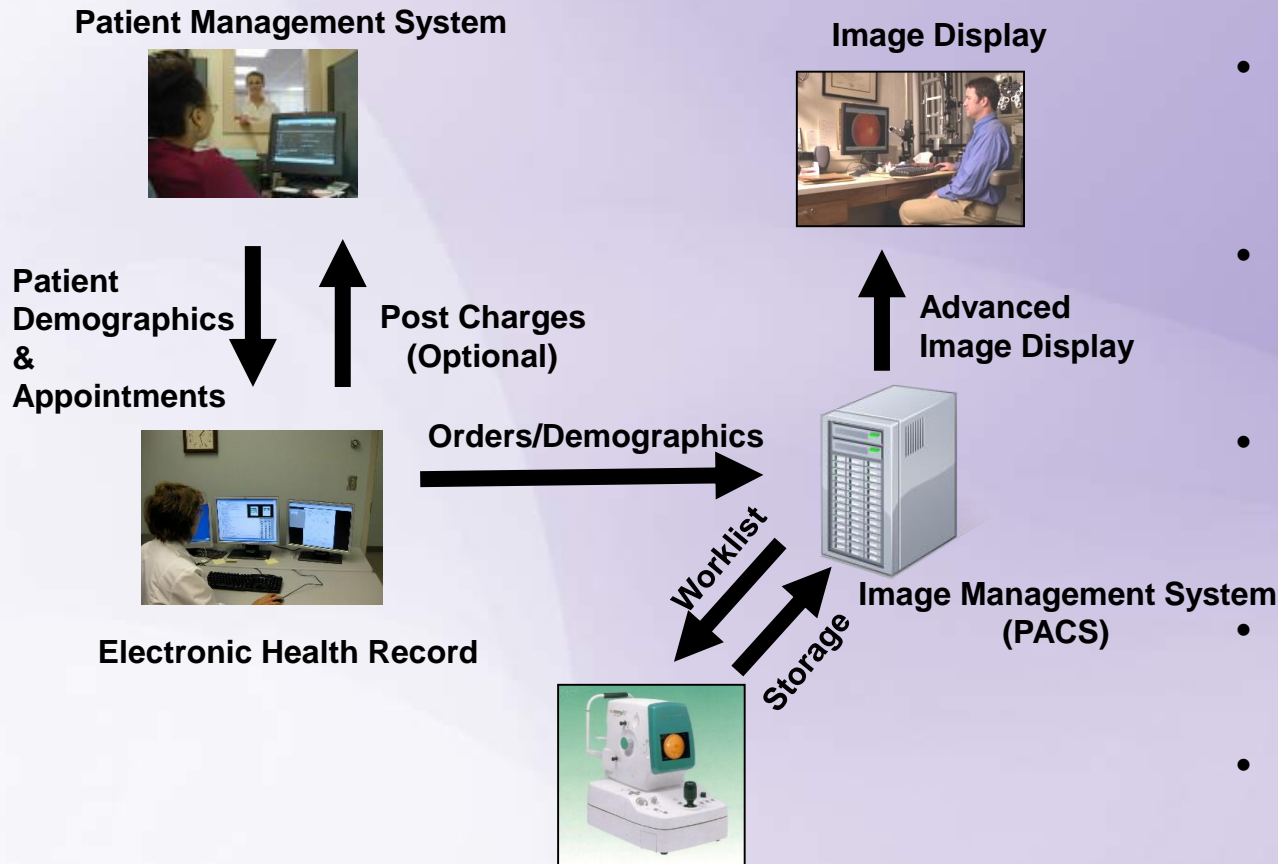


Eye Care Device

- *Patient Demo & Appointments Based Upon HL7 v2.5.1*
- *Device Patient List (Worklist) and Images/Reports (DICOM)*
- *Storage & Display of Key Images on EHR*
- *Devices and Users responsible for safekeeping of images*

Real World Model III

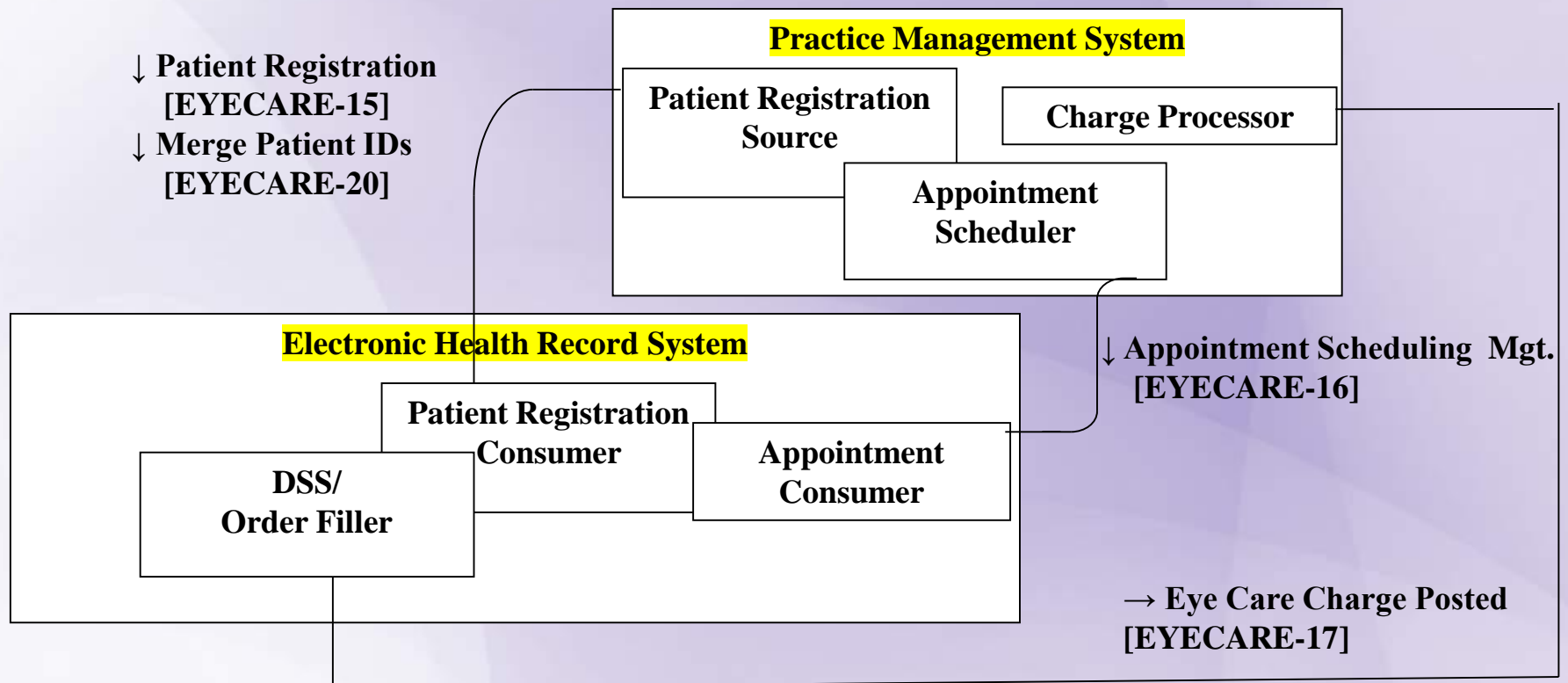
EHR does NOT support DICOM features (HL7 only) & integrates with PACS that supports DICOM patient list to devices and archival of images/reports



- *Patient Demo & Appointments Based Upon HL7 v2.5.1*
- *EHR sends Patient and Order info to PACS (HL7)*
- *PACS provides patient list to devices (DICOM MWL)*
- *PACS archives images/reports (DICOM)*
- *Advanced Image Display (DICOM)*

Profiles & Technical Frameworks

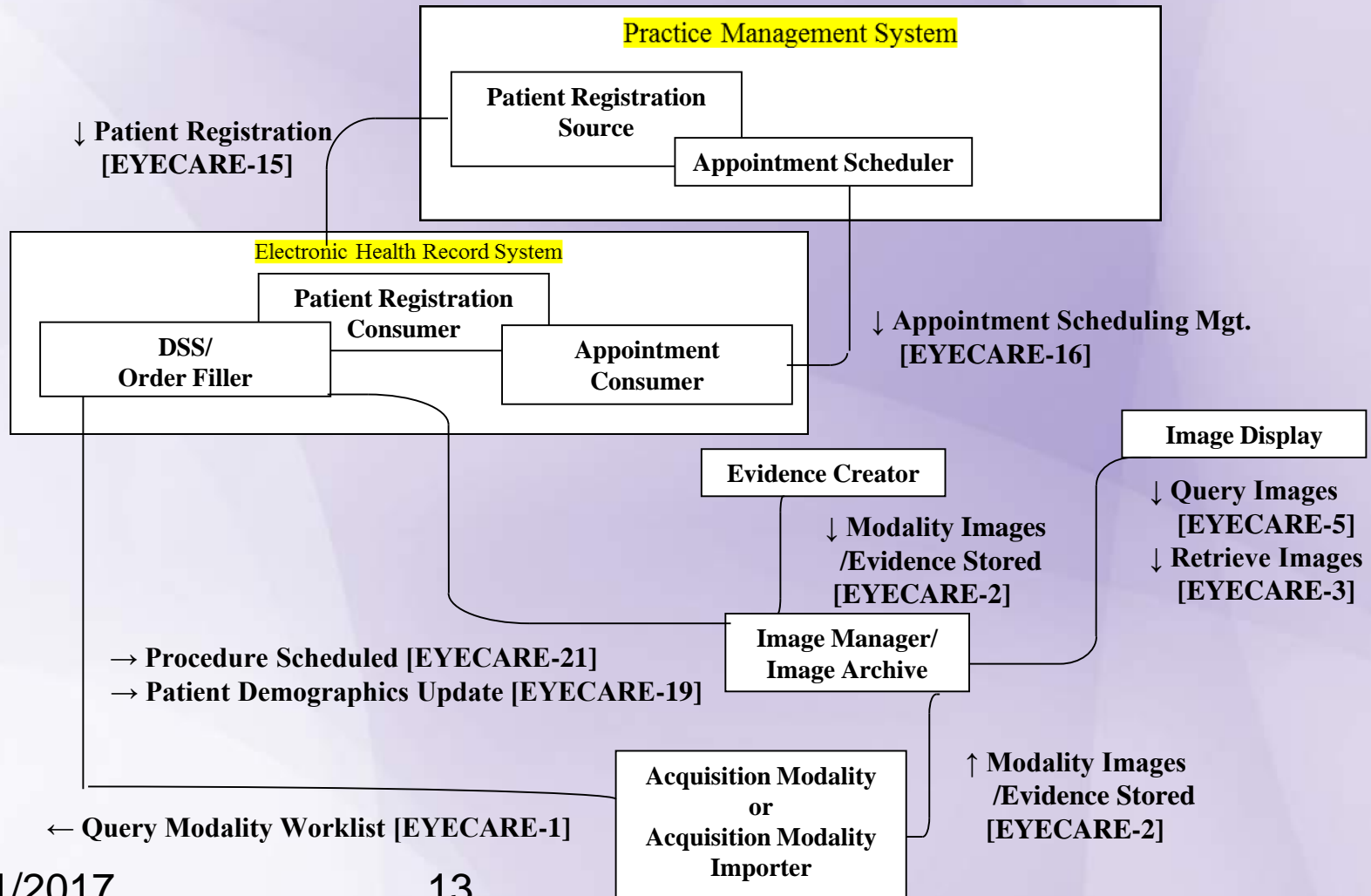
Unified Eye Care – Pat Registration and Appointments



Merge Patient IDs and Eye Care Charge Posted is optional

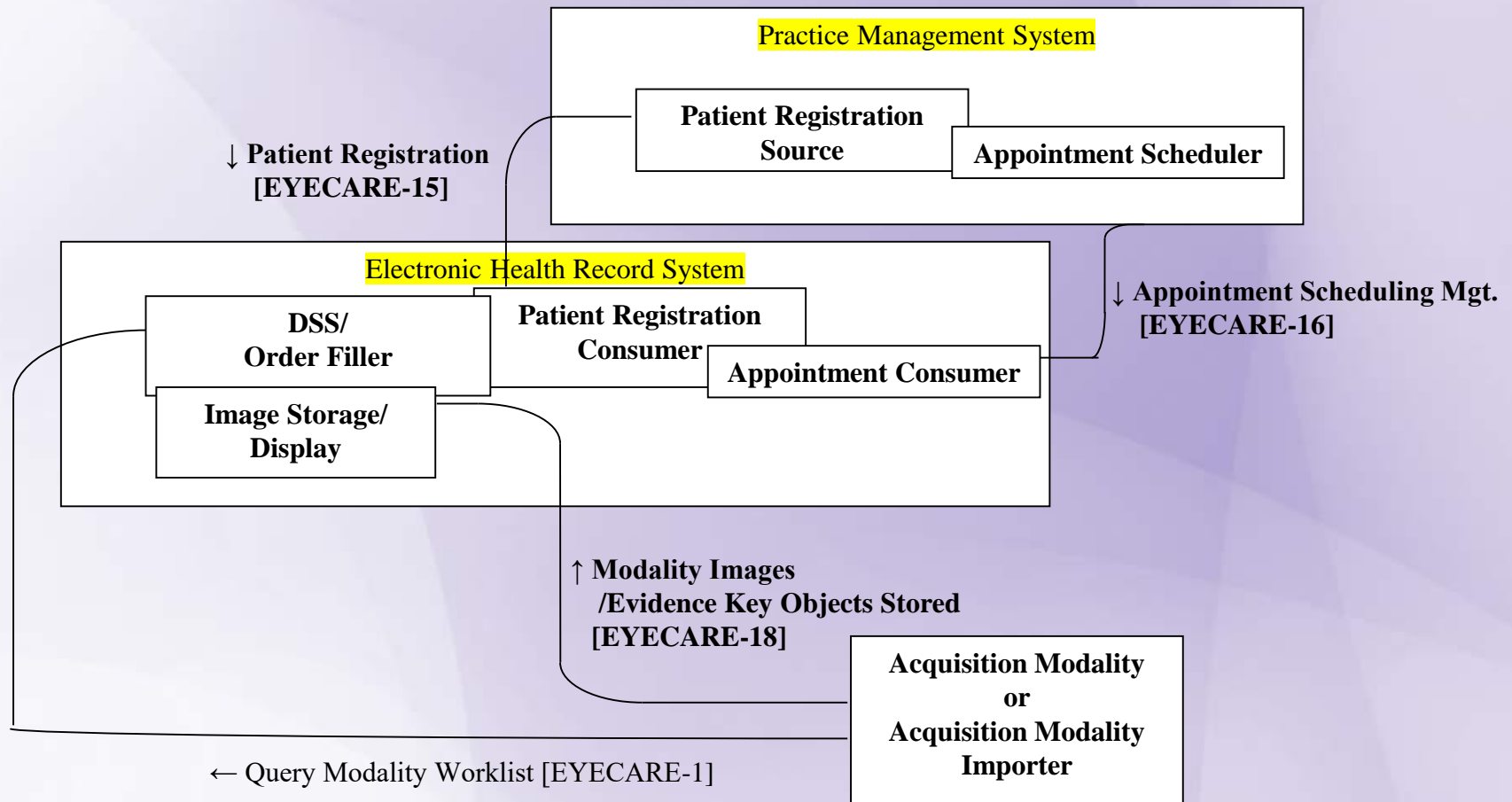
Profiles & Technical Frameworks

Unified Eye Care – Real World Model I



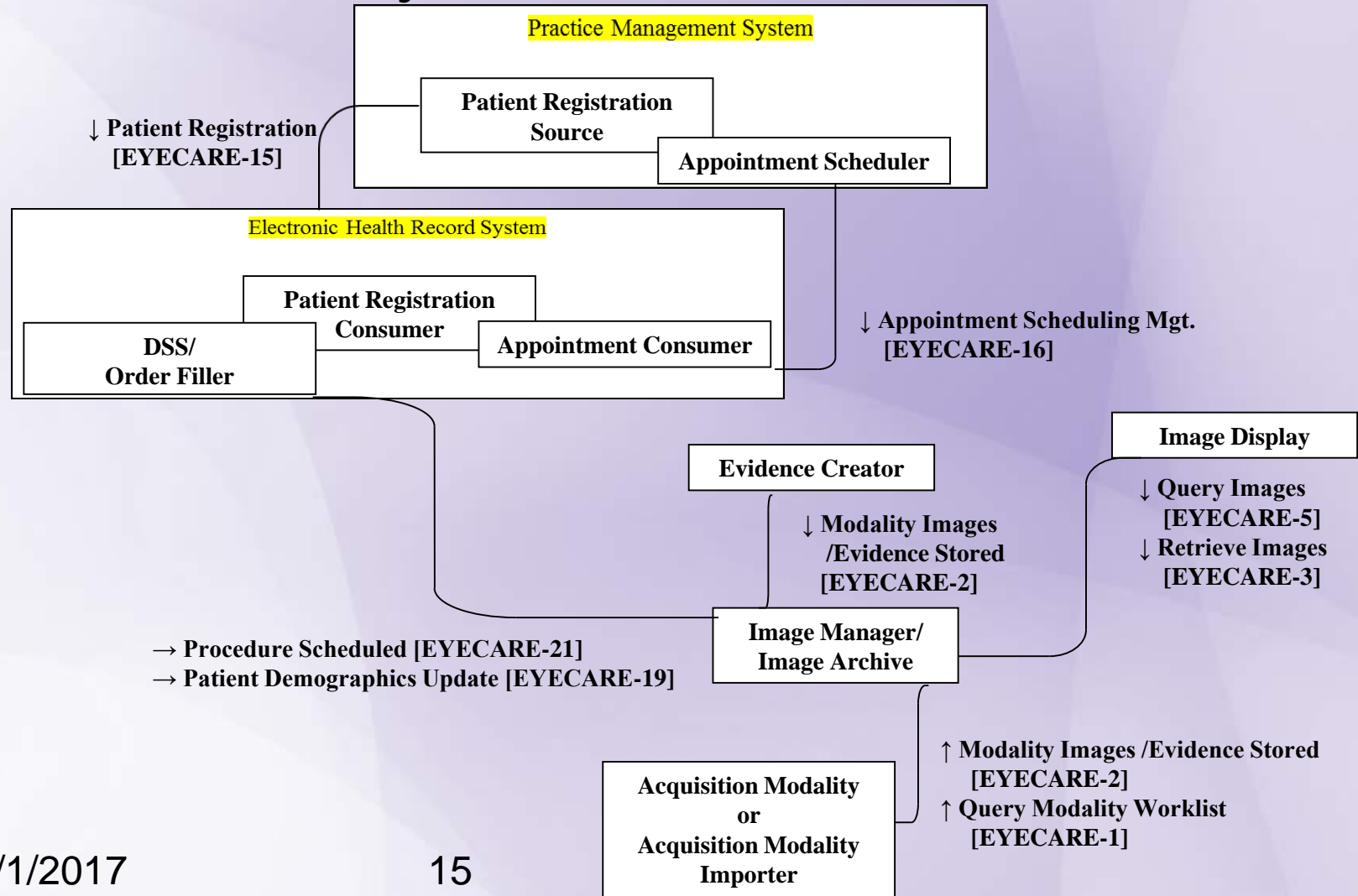
Profiles & Technical Frameworks

Unified Eye Care – Real World Model II



Profiles & Technical Frameworks

Unified Eye Care – Real World Model III



Conform to Actors/Transactions AND a Real World Model

Actors	Transactions	Model I	Model II	Model III	Section
		Transaction Optionality			
Patient Registration Source	Patient Registration [EYECARE-15]	R	R	R	EYECARE TF-2: 4.15
Appointment Scheduler	Appointment Scheduling Management [EYECARE-16]	R	R	R	EYECARE TF-2: 4.16
Patient Registration Consumer	Patient Registration [EYECARE-15]	R	R	R	EYECARE TF-2: 4.15
Appointment Consumer	Appointment Scheduling Management [EYECARE-16]	R	R	R	EYECARE TF-2: 4.16
Department System Scheduler/ Order Filler	Patient Demographics Update [EYECARE-19]	R		R	EYECARE TF-2: 4.19
	Query Modality Worklist [EYECARE-1]	R	R		EYECARE TF-2: 4.1
	Procedure Scheduled [EYECARE-21]	R		R	EYECARE TF-2: 4.21
	Modality Images/Evidence Key Objects Stored [EYECARE-18]		R		EYECARE TF-2: 4.18
Image Manager/ Image Archive (Not an Actor for Model II)	Procedure Scheduled [EYECARE-21]	R		R	EYECARE TF-2: 4.21
	Patient Demographics Update [EYECARE-19]	R		R	EYECARE TF-2: 4.19
	Query Modality Worklist [EYECARE-1]			R	EYECARE TF-2: 4.1
	Modality Images/Evidence Stored [EYECARE-2]	R		R	EYECARE TF-2: 4.2
	Modality Images/Evidence Key Objects Stored [EYECARE-18]	R		R	EYECARE TF-2: 4.18
	Query Images [EYECARE-5]	R		R	EYECARE TF-2: 4.5
	Retrieve Images [EYECARE-3]	R		R	EYECARE TF-2: 4.3
Image Storage/Display (Only required in Model II)	Modality Images/Evidence Key Objects Stored [EYECARE-18]		R		EYECARE TF-2: 4.18

Conform to Actors/Transactions AND a Real World Model

Actors	Transactions	Model I	Model II	Model III	Section
		Transaction Optionality			
Image Display (Not an Actor for Model III)	Query Images [EYECARE-5]	R		R	EYECARE TF-2: 4.5
	Retrieve Images [EYECARE-3]	R		R	EYECARE TF-2: 4.3
Acquisition Modality	Query Modality Worklist [EYECARE-1]	R	R	R	EYECARE TF-2: 4.1
	Modality Images/Evidence Stored [EYECARE-2]	R		R	EYECARE TF-2: 4.2
	Modality Images/Evidence Key Objects Stored [EYECARE-18]		R		EYECARE TF-2: 4.18
Acquisition Modality Importer	Query Modality Worklist [EYECARE-1]	R	R	R	EYECARE TF-2: 4.1
	Modality Images/Evidence Stored [EYECARE-2]	R		R	EYECARE TF-2: 4.2
	Modality Images/Evidence Key Objects Stored [EYECARE-18]		R		EYECARE TF-2: 4.18
Charge Processor	Eye Care Charge Posted [EYECARE-17]	R	R	R	EYECARE TF-2: 4.17
Evidence Creator	Modality Images/Evidence Stored [EYECARE-2]	R		R	EYECARE TF-2: 4.2
Performed Procedure Step Manager	Modality Procedure Step In Progress [RAD-6]	R			RAD TF-2: 4.6
	Modality Procedure Step Completed [EYECARE-6]	R			RAD TF-2: 4.7

Refractive Measurements

Workflow Based Profiles

- Extends U-EYECARE to standardize EHR to refractive device measurement integration
- Addresses scenarios where organizations have a PMS, EHR and refractive measurement devices such as auto-refractors, auto-keratometers, lensometers, etc.
- Based upon Japan Ophthalmic Instruments Association (JOIA) XML based specification, version 1.5
- Two workflow models are defined:
 - Refractive Measurements Model without Patient ID
 - Refractive Measurements Model with a valid Patient ID

Common format for all refractive devices

Refractive Measurements (no Pat ID)

EHR establishes “patient context” with refractive device and uses that context to ensure the measurement is imported to the correct patient

Patient Management System



Patient
Demographics
& Appointments



Electronic Health Record

JOIA XML-Based
Data Stream
(no valid Patient ID)

Establish
Patient Context



Refractive Device

- *Patient Demo & Appointments Based Upon HL7 v2.5.1*
- *EHR establishes patient context with device*
- *Device generates JOIA XML data stream with “unreliable” Patient ID*
- *EHR uses “patient context” to ensure correct link between patient and measurement*
- *EHR imports measurement into database*

Refractive Measurements (Valid Pat ID)

EHR uses valid Patient ID included with JOIA XML Data stream to ensure the measurement is imported to the correct patient

Patient Management System



**Patient
Demographics
& Appointments**



Electronic Health Record

**JOIA XML-Based Data
Stream
(with valid Patient ID)**

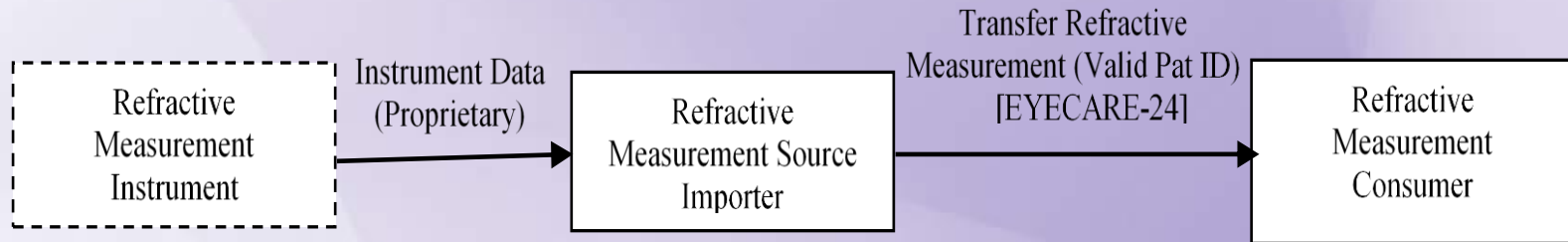


Refractive Device

- *Patient Demo & Appointments Based Upon HL7 v2.5.1*
- *Device generates JOIA XML data stream with Valid Patient ID (auto device, auto patient list, manual)*
- *EHR uses Patient ID to ensure link between patient and measurement*
- *EHR imports measurement into database*

Refractive Measurements

Refractive devices often use computers to enable EHR integration, IHE Actor called Refractive Measurement Source Importer



- *Patient Demo & Appointments Based Upon HL7 v2.5.1*
- *RMSI connects to instrument in proprietary format and converts to JOIA XML data stream with Valid Patient ID (auto device, auto patient list, manual)*
- *EHR uses Patient ID to ensure link between patient and measurement*
- *EHR imports measurement into database*

Japan Ophthalmic Instruments Association (JOIA)

- XML file based specification, IHE uses version 1.5
- Data objects are defined as “data classifications”:
 - Refractometer, Keratometer, Tonometer, Lensometer
- One or more “data classification” may be included in a file
- Transports mechanism not defined (in JOIA or IHE)
- IHE working with JOIA to add a new data classification for “auto-phoropter” - 2017

Common format for all refractive devices

IHE Unified Eye Care Workflow

- Automated Workflow in your practice – Patient Safety in Mind
- Products such as Practice Management Systems (PMS), Electronic Medical Record Systems (EMRs), Image Management (PACS), eye care image devices and refractive devices
- Patient demographics, appointments, billing, images, refractive measurements and reports
- Input patient information once
- Pick the workflow configuration that fits your practice

AAO recommends clinicians purchase systems that implement the Unified Eye Care Profile

- The Unified Eye Care Integration Profiles defines interoperability inside a single health care organization.
- IHE Content Profiles shifts the focus to the interoperability between multiple health care organizations.
- IHE Content Profiles defines document data exchange based upon the HL7 V3 CDA (Clinical Document Architecture) standard.
- There are C-CDA (Consolidated CDA) Clinical Notes templates available which define how to represent health data information of a patient in an XML document.
- But these templates only include general health care related data, such as medications, allergies, problem list These general templates are important to eye care, however do not include specific eye care health care data, e.g. no refractive measurements are included.

Eye care specific data is needed to make C-CDA documents more beneficial

- IHE Eye Care closes this gap by defining extensions to the C-CDA Clinical Notes templates.
- Eye care specific information can be added to C-CDA documents and received by systems supporting the general C-CDA templates.
- You should expect eye care specific systems to process the extended information.
- C-CDA documents contain a human readable representation of the structured data, therefore, systems can display the general and eye care extended information.
- This enables the clinician to view all the data, even if the system does not process the eye care extensions.
- IHE General Eye Evaluation (GEE) enhances the Progress Note (PN) template to capture a patient's visit.
- IHE Eye Care Summary (EC Summary) enhances the Continuity of Care Document (CCD) template to capture the eye care summary of a patient.

	PatCity PatZIP Tel: PatPhoneHome
Contact info	Work Place: PatAdd1 PatAdd2 PatCity PatZIP Tel: PatPhoneHome
Document maintained by	Get Well Clinic
Contact info	Work Place: PatAdd1 PatAdd2 PatCity PatZIP Tel: 123-456-7890

Table of Contents

- [Ocular Physical Exam](#)
- [Problems](#)
- [Plan Of Care](#)
- [Allergies Adverse Reactions, and Alerts](#)
- [Medications](#)
- [Test Results](#)
- [Procedures](#)
- [Vital Signs](#)
- [Social History](#)
- [Functional Status](#)
- [Immunizations](#)

Intraocular pressure of the eye

Date	Subject	Method	Laterality	Value	Remarks
9/1/2015 3:23:16 PM	Intraocular pressure	Goldmann applanation tonometry	Entire right eye	22 mm [Hg]	
9/1/2015 3:23:16 PM	Intraocular pressure	Goldmann applanation tonometry	Entire left eye	14 mm [Hg]	

Visual acuity

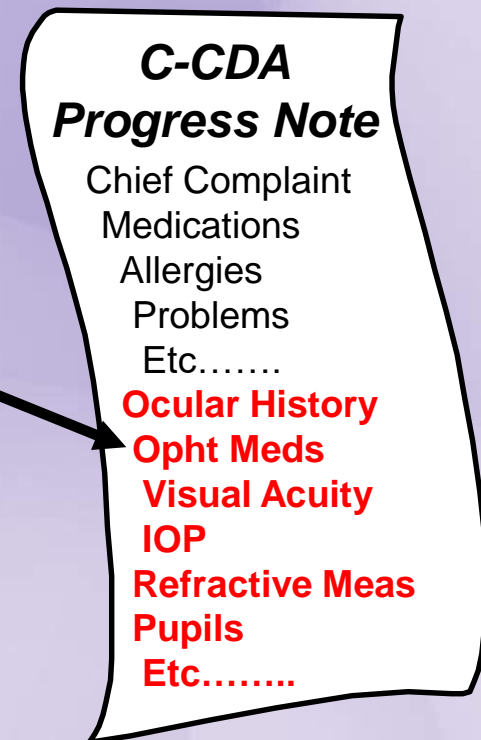
Date	Subject	Method	Laterality	Value	Remarks
9/1/2015 3:25:02 PM	Visual Acuity with qualifier	Snellen chart	Entire right eye	20/40-2	
9/1/2015 3:25:30 PM	Visual Acuity with qualifier	Snellen chart	Entire left eye	20/20+1	

Problems

Type	SNOMED CT	Problem	Date Diagnosed	Onset	Status
Assessment	414875008	Retina-Macular Degeneration-ARMD Dry OS	5/22/2012		Inactive
Assessment	414173003	Retina-Macular Degeneration-ARMD Wet OD & OS	5/22/2012		OD Active, OS Active
Assessment	193615000	Lens-PCO - Obscuring vision OD & OS	5/22/2012		OD Active, OS Active
Assessment	60189009	Vitreous-Degeneration\Detachment OD & OS	5/22/2012		OD Active, OS Active
Assessment		Lens-Pseudophakia OD & OS	5/22/2012		OD Active, OS Active
Eye History		After-Cataract Obscuring Vision (OU-Stable) 11/22/2011	3/20/2015		Active
Eye History		Diabetic Retinopathy (OU)	3/20/2015		Active
Eye History		Dry Macular Degeneration (OS-Stable) Wet OD 11/22/2011	3/20/2015		Active
Eye History		Pseudophakia-SN60WF 23.5	3/20/2015		Active

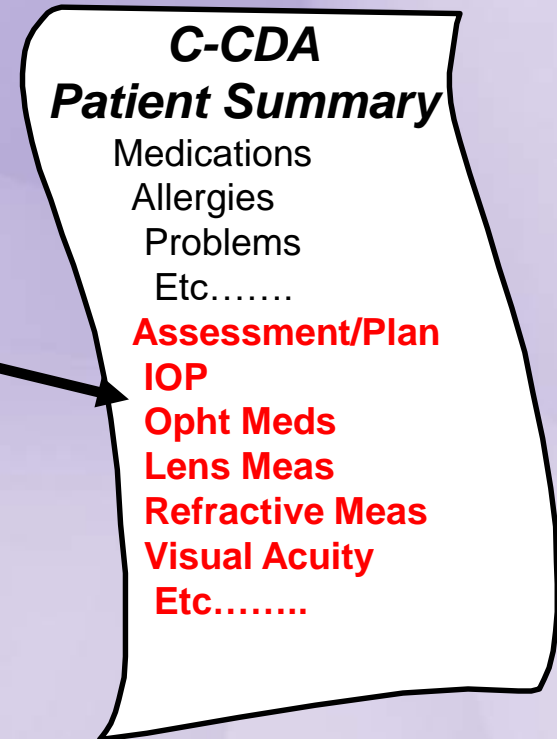
General Eye Evaluation (GEE)

- Routine adult eye exam information
- Captures each patient encounter (visit)
- EHRs may import structured Eye Care data (SNOMED, LOINC)



Eye Care Summary (EC Summary)

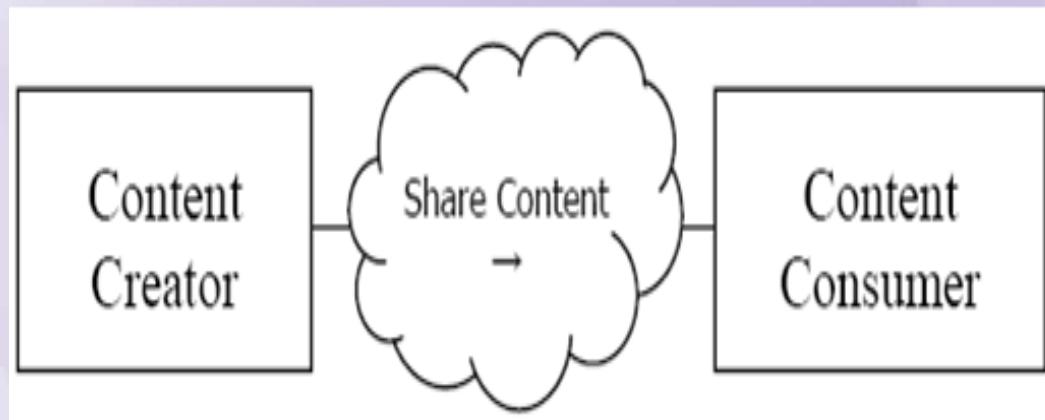
- Patient's eye care summary medical record
- Generally for the purpose of transfer or referral of care to another provider
- EHRs may import structured Eye Care data (SNOMED, LOINC)



IHE Eye Care Extensions

- Ancillary testing
- Anterior segment
- Confrontation Visual Field
- Eye External
- Intraocular pressure
- Keratometric Measurements
- Lacrimal
- Lensometry Measurements
- Ocular alignment and motility
- Ocular History
- Ocular Physical Exam
- Ophthalmic Medications
- Posterior segment
- Pupils
- Refractive Measurements
- Vision Testing
- Visual Acuity

Data Exchange Profile



Actors	Optionality	Section
Content Consumer (the Actor must support at least one of the options)	View Option	PCC TF-2: 3.1.1
	Document Import Option	PCC TF-2: 3.1.2
	Section Import Option	PCC TF-2: 3.1.3
	Discrete Data Import Option	PCC TF-2: 3.1.4
Content Creator	No options defined	



Template ID		1.3.6.1.4.1.19376.1.12.1.2.6		
Parent Template		Eyes 1.3.6.1.4.1.19376.1.5.3.1.1.9.19		
General Description		The routine eye exam section shall contain a description of any type of eye exam.		
Section Code		10197-2, LOINC, “Physical findings of eye”		
Opt	Data Element or Section Name	Template ID	Specification Document	Constraint
Subsections				
R[0..1]	Visual Acuity	1.3.6.1.4.1.19376.1.12.1.2.7	EYECARE TF-2: 6.3.2.8	
R[0..1]	Vision Testing	1.3.6.1.4.1.19376.1.12.1.2.8	EYECARE TF-2: 6.3.2.7	
R[0..1]	Refractive Measurements	1.3.6.1.4.1.19376.1.12.1.2.9	EYECARE TF-2: 6.3.2.9	
R[0..1]	Lensometry Measurements	1.3.6.1.4.1.19376.1.12.1.2.10	EYECARE TF-2: 6.3.2.10	
R[0..1]	Intraocular pressure	1.3.6.1.4.1.19376.1.12.1.2.11	EYECARE TF-2: 6.3.2.11	
R[0..1]	Confrontation Visual Field	1.3.6.1.4.1.19376.1.12.1.2.12	EYECARE TF-2: 6.3.2.12	
R[0..1]	Eye External	1.3.6.1.4.1.19376.1.12.1.2.13	EYECARE TF-2: 6.3.2.13	
R[0..1]	Lacrimal	1.3.6.1.4.1.19376.1.12.1.2.14	EYECARE TF-2: 6.3.2.18	
R[0..1]	Pupils	1.3.6.1.4.1.19376.1.12.1.2.15	EYECARE TF-2: 6.3.2.14	

How to Participate in Eye Care?

- Apply for IHE International Organizational Membership
 - Visit: <http://www.ihe.net/Join/>
 - Approved monthly by IHE International Board
 - [Review IHE's 500+ Organizational Members](#)
- Participate in IHE Domains & Committees
 - *IHE Organizational Members only have voting rights*
 - Each Domain has one planning and one technical committee
- Non-members participate in comment periods and implement IHE Technical Frameworks

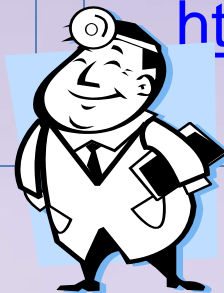
Eye Care Committee Responsibilities

Planning Committee

- Plan for Connectathon and Showcase
- Education
- Identifies committee priorities and problems
- Major projects:
 - Recruitment for 2017 Connectathon & showcase
 - Marketing and Showcase Scenarios

Contact Information

- Secretary: Flora Lum, MD (flum@aao.org)
- Co-Chairs: Linda Wedemeyer, MD, Mike Schmidt
- eyecare@ihe.net
- <http://www.ihe.net/Eyecare/committees/index.cfm>
- http://www.ihe.net/Eye_Care/



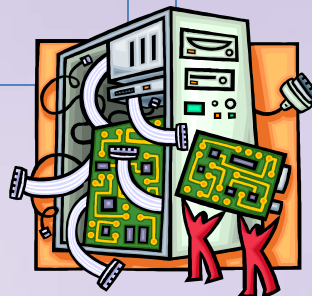
Eye Care Committee Responsibilities

Technical Committee

- Recruitment
- Development of IHE Profiles
- Maintenance of IHE Technical Frameworks
- Major Projects:
 - Cataract C-CDA projects
 - Auto_phoropter JOIA

Contact Information

- Secretary: Flora Lum, MD
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- <http://www.ihe.net/Eyecare/committees/index.cfm>
- http://www.ihe.net/Eye_Care/



IHE Eye Care

- Automated Workflow in your practice – Patient Safety in Mind
 - Unified Eye Care Workflow – patient demographics, appointments, billing, images, and reports; input patient information once
 - Pick the workflow configuration that fits your practice
- Make C-CDA documents include eye care information
 - IHE General Eye Evaluation (GEE) – patient's eye care encounter
 - IHE Eye Care Summary (EC Summary) – patient's eye care summary

- <http://www.ihe.net/>
- <http://www.iheeyecare.org/>
- <http://www.hl7.org/>
- <http://www.nema.org/stds/dicom.cfm>

- [http://en.wikipedia.org/wiki/Integrating the Healthcare Enterprise](http://en.wikipedia.org/wiki/Integrating_the_Healthcare_Enterprise)
- <http://en.wikipedia.org/wiki/HL7>
- [http://en.wikipedia.org/wiki/Continuity of Care Document](http://en.wikipedia.org/wiki/Continuity_of_Care_Document)
- [http://en.wikipedia.org/wiki/Continuity of Care Record](http://en.wikipedia.org/wiki/Continuity_of_Care_Record)
- <http://en.wikipedia.org/wiki/DICOM>

- IHE Technical Frameworks
[http://www.ihe.net/Technical Frameworks/](http://www.ihe.net/Technical_Frameworks/)
- IHE Profiles developed by Eye Care
[http://www.ihe.net/Technical Frameworks/#eyecare](http://www.ihe.net/Technical_Frameworks/#eyecare)
- IHE Connectathons
<http://www.iheusa.org/connectathon.aspx>

- IHE Eye Care 2017 Connectathon Dates: October 23-26, 2017
- AAO 2017 Showcase Dates: November 11-14, 2017

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***Thank you for your attention
Questions?***