Integrating the Healthcare Enterprise
International – IHE Eye Care

Webinar Series July 2018

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  • IHE Eye Care Co-Chair Technical Committee
• Abdiel Marin, CEO EyeMD EMR Healthcare Systems, Inc.
  • IHE Eye Care Planning Committee and Technical Committee Member
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.
• IHE is a framework or architecture for achieving a useful clinical workflow involving all kinds 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:**

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

Practice Management System

Patient Demographics & Appointments

Electronic Health Record

Orders/Worklist (Demographics)

Image Display

Advanced Image Display

Image Management System (PACS)

Storage

Eye Care Device

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Real World Model II

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

- **Practice Management System**
- **Patient Demographics & Appointments**
- **Post Charges (Optional)**
- **Electronic Health Record**
- **Orders/Worklist**
- **Eye Care Device**
- **Storage of Key Images/Reports (No PACS)**

- **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**

↓ Patient Registration [EYECARE-15]  
↓ Merge Patient IDs [EYECARE-20]  
↓ Appointment Scheduling Mgt. [EYECARE-16]

→ Eye Care Charge Posted [EYECARE-17]

*Merge Patient IDs and Eye Care Charge Posted is optional*
Unified Eye Care – Real World Model I

Profiles & Technical Frameworks

Practice Management System

Patient Registration Source

Appointment Scheduler

Patient Registration Consumer

Electronic Health Record System

Appointment Scheduling Mgt. [EYECARE-16]

→ Procedure Scheduled [EYECARE-21]
→ Patient Demographics Update [EYECARE-19]

← Query Modality Worklist [EYECARE-1]

DSS/Order Filler

→ Patient Registration [EYECARE-15]

Evidence Creator

↓ Modality Images/Evidence Stored [EYECARE-2]
↓ Retrieve Images [EYECARE-3]

Image Manager/Image Archive

↑ Modality Images/Evidence Stored [EYECARE-2]

Acquisition Modality Importer

↑ Modality Images/Evidence Stored [EYECARE-2]

Image Display

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Unified Eye Care – Real World Model II

Profiles & Technical Frameworks

Practice Management System

Patient Registration Source

Appointment Scheduler

Patient Registration Consumer

Electronic Health Record System

DSS/Order Filler

Image Storage/Display

Modality Images/Evidence Key Objects Stored
[ECARE-18]

Query Modality Worklist [ECARE-1]

Appointment Scheduling Mgt.
[ECARE-16]

Acquisition Modality or Acquisition Modality Importer

↑ Modality Images/Evidence Key Objects Stored [ECARE-18]

↓ Patient Registration [ECARE-15]

↓ Appointment Scheduling Mgt. [ECARE-16]
Unified Eye Care – Real World Model III

Profiles & Technical Frameworks

Practice Management System

Patient Registration Source
Appointment Scheduler

Electronic Health Record System

Patient Registration Consumer
Appointment Consumer

DSS/Order Filler

Evidence Creator

→ Procedure Scheduled [EYECARE-21]
→ Patient Demographics Update [EYECARE-19]

Image Manager/Image Archive

↑ Modality Images /Evidence Stored [EYECARE-2]
↑ Query Modality Worklist [EYECARE-1]

↑ Modality Images /Evidence Stored [EYECARE-5]
↓ Retrieve Images [EYECARE-3]

↓ Query Images [EYECARE-5]

↓ Appointment Scheduling Mgt. [EYECARE-16]

↓ Patient Registration [EYECARE-15]

Acquisition Modality or Acquisition Modality Importer

↑ Query Modality Worklist [EYECARE-1]
### Conform to Actors/Transactions AND a Real World Model

<table>
<thead>
<tr>
<th>Actors</th>
<th>Transactions</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Section</th>
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<td>Patient Registration Source</td>
<td>Patient Registration [EYECARE-15]</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>EYECARE TF-2: 4.15</td>
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<tr>
<td>Appointment Scheduler</td>
<td>Appointment Scheduling Management [EYECARE-16]</td>
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<td>R</td>
<td>R</td>
<td>EYECARE TF-2: 4.16</td>
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<tr>
<td>Patient Registration Consumer</td>
<td>Patient Registration [EYECARE-15]</td>
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<td>R</td>
<td>R</td>
<td>EYECARE TF-2: 4.15</td>
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<tr>
<td>Appointment Consumer</td>
<td>Appointment Scheduling Management [EYECARE-16]</td>
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<td>R</td>
<td>R</td>
<td>EYECARE TF-2: 4.16</td>
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<tr>
<td></td>
<td>Query Modality Worklist [EYECARE-1]</td>
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<td>R</td>
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<td>EYECARE TF-2: 4.1</td>
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<tr>
<td>Image Manager/Image Archive</td>
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<td>R</td>
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<td></td>
<td>R</td>
<td>EYECARE TF-2: 4.1</td>
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<td></td>
<td>Modality Images/Evidence Stored [EYECARE-2]</td>
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<td></td>
<td>EYECARE TF-2: 4.2</td>
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<td></td>
<td>R</td>
<td>EYECARE TF-2: 4.18</td>
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<tr>
<td></td>
<td>Retrieve Images [EYECARE-3]</td>
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<td>R</td>
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<td>EYECARE TF-2: 4.3</td>
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<td>R</td>
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<tr>
<td>(Only required in Model II)</td>
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## Conform to Actors/Transactions AND a Real World Model

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<thead>
<tr>
<th>Actors</th>
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<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Section</th>
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<tr>
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<td>Retrieve Images [EYECARE-3]</td>
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<td>R</td>
<td></td>
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<td>Query Modality Worklist [EYECARE-1]</td>
<td>R</td>
<td>R</td>
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<td>EYECARE TF-2: 4.1</td>
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<td>Modality Images/Evidence Stored [EYECARE-2]</td>
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<td>EYECARE TF-2: 4.2</td>
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<tr>
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<td>Modality Images/Evidence Key Objects Stored [EYECARE-18]</td>
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<td></td>
<td>R</td>
<td>EYECARE TF-2: 4.18</td>
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<td>Acquisition Modality Importer</td>
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<td>EYECARE TF-2: 4.1</td>
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<tr>
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<tr>
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<td>R</td>
<td>R</td>
<td></td>
<td>EYECARE TF-2: 4.2</td>
</tr>
</tbody>
</table>
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
Ref 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 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**

Practice Management System

Patient Demographics & Appointments

Electronic Health Record

Refraction Device

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

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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-phoroptor” - 2018

Common format for all refractive devices
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>

  <nsCommon:Common>
    <nsCommon:Company>COMPANY NAME</nsCommon:Company>
    <nsCommon:ModelName>MODEL NAME</nsCommon:ModelName>
    <nsCommon:MachineNo>00</nsCommon:MachineNo>
    <nsCommon:ROMVersion>1.01.04</nsCommon:ROMVersion>
    <nsCommon:Version>1.2</nsCommon:Version>
    <nsCommon:Date>2012-01-01</nsCommon:Date>
    <nsCommon:Time>12:34:56</nsCommon:Time>
    <nsCommon:User>
      <nsCommon:Operator>
      </nsCommon:Operator>
    </nsCommon:User>
  </nsCommon:Common>

  <nsLM:Measure type="LM">
    <nsLM:DiopterStep unit="D">0.25</nsLM:DiopterStep>
    <nsLM:AxisStep unit="deg">1</nsLM:AxisStep>
    <nsLM:PrismStep unit="D">0.25</nsLM:PrismStep>
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    <nsLM:LensType>glass</nsLM:LensType>
    <nsLM:AbbeNumber>-</nsLM:AbbeNumber>
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    <nsLM:L>
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      <nsLM:Add1 unit="D">12</nsLM:Add1>
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</xml:Ophthalmology>
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

7/17/2018
• 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

<table>
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<tr>
<th>Date</th>
<th>Subject</th>
<th>Method</th>
<th>Laterality</th>
<th>Value</th>
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<tbody>
<tr>
<td>9/1/2015 3:23:16 PM</td>
<td>Intraocular pressure</td>
<td>Goldmann applanation tonometry</td>
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### Visual acuity

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<td>Snellen chart</td>
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## Problems

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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

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# Data Exchange Profile

**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”

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<th>Specification Document</th>
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</table>
How to Participate in Eye Care?

- Apply for IHE International Organizational Membership
  - Visit: [http://www.ihe.net/Join/](http://www.ihe.net/Join/)
  - Approved monthly by IHE International Board
  - [Review IHE's 500+ Organizational Members](http://www.ihe.net/Join/)

- 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:
  - Re-establish the financial and organizational platform

Contact Information
- Secretary: Flora Lum, MD (flum@aoa.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:
  - Key Measurements for DICOM PDF
  - Auto_phoroptor JOIA

Contact Information
- Secretary: Flora Lum, MD flum@aaoe.org
- Co-Chairs: Mark Horton, OD, MD, Peter Scherer
- eyecare@ihe.net
- http://www.ihe.net/Eyecare/committees/index.cfm
- http://www.ihe.net/Eye_Care/
IHE Eye Care Summary

• Automated Workflow in your practice – Patient Safety in Mind
  • Unified Eye Care Workflow – patient demographics, appointments, billing, images, reports, and Refractive Measurements (JOIA); input patient information once
  • Pick the workflow configuration that fits your practice need/business solution

• 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
Links/Sources

- [http://www.ihe.net/](http://www.ihe.net/)
- [http://www.iheeyecare.org/](http://www.iheeyecare.org/)
- [http://www.nema.org/standards/dicom.cfm](http://www.nema.org/standards/dicom.cfm)

- IHE Technical Frameworks

- IHE Profiles developed by Eye Care
  [http://www.ihe.net/Technical_Frameworks/#eyecare](http://www.ihe.net/Technical_Frameworks/#eyecare)

- IHE Connectathons
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Abdiel Marin - IHE Eye Care Planning and Technical Committee Member  
abdiel.marin@eyemdemr.com
Thank you for your attention!

Questions?