Leveraging SMART on FHIR and the FHIR Clinical Reasoning Module to Support Neonatal Bilirubin Management

HL7 Partners in Interoperability
Georgia Institute of Technology, Atlanta, GA
March 21, 2017

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Disclosures

• In the past year, I have been a consultant or sponsored researcher on clinical decision support for:
  – Office of the National Coordinator for Health IT*
  – McKesson InterQual
  – Hitachi

*via ESAC, SRS, A+ Government Solutions, and Hausam Consulting
Context

• Part of University of Utah Interoperable Apps and Services (IAPPS) Initiative
  – Goal to improve patient care and the provider experience through innovative, interoperable extension of native EHR functionality
  – Scope includes both SMART on FHIR applications and CDS Web services using the FHIR Clinical Reasoning module and CDS Hooks

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Key Focus: Improving MD EHR Experience

Viewpoint

February 9, 2017

Addressing Physician Burnout
The Way Forward

Tait D. Shanafelt, MD¹; Lotte N. Dyrbye, MD, MHPE¹; Colin P. West, MD, PhD¹

For every hour of clinical work, physicians spent 2 hours on clerical work or EHR-related tasks

http://jamanetwork.com/journals/jama/fullarticle/2603408

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Multi-Institutional Collaboration

Kensaku Kawamoto, MD, PhD, MHS
Associate CMIO
Steering Member, IAPPS

Carole Stipelman, MD, MPH
Medical Director, University Pediatric Clinic

Scott Narus, PhD, MS
Chief Clinical Systems Architect

Ricky Bloomfield, MD
Director of Mobile Technology Strategy

Robert Lenfestey, MD
Neonatologist and Clinical Faculty

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Multiple EHR Platforms

- Epic
  - Univ. of Utah
  - Duke
- Cerner
  - Intermountain
- CareWeb
  - Healthcare Services Platform Consortium (HSPC)
- Others TBD

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Baseline Bilirubin App, Integrated with Epic (developed by Intermountain)
American Academy of Pediatrics Guidelines for Phototherapy


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American Academy of Pediatrics Guidelines for Exchange Transfusion

Current Bilirubin Application, in Production Use within Epic

Consider Exchange Transfusion:
Rationale: Patient's latest bilirubin level of 17.1 mg/dL at 46.57 hrs is above treatment threshold for exchange transfusion (16.98) given gestational age >= 35 wks and < 38 wks with risk factors for exchange transfusion.

Bilirubin Measurements

<table>
<thead>
<tr>
<th>Age (Hrs)</th>
<th>Result</th>
<th>Date/Time</th>
<th>Test Type</th>
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<td>Total</td>
</tr>
<tr>
<td>23.38</td>
<td>10.5</td>
<td>09/27/16 03:32</td>
<td>Transcutaneous</td>
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<td>30.68</td>
<td>12.2</td>
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<td>48.57</td>
<td>17.1</td>
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Albumin Measurements

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Encapsulation of Decision Support Logic within OpenCDS (www.opencds.org)

PrimaryProcess.bpmn2 - Business Processes

Editor

Overview

PrimaryProcess v.1.0 (billirubin:PrimaryProcess)

Required Inputs:
> Global: dueTime, localPersonId
> QICore Patient with birth time as extension
> QICore Observation for gestational age

Expected inputs if available:
> QICore Observations for total bilirubin and transcutaneous bilirubin
> QICore Observations for risk status
> QICore Procedure for phototherapy (not currently used)
> Input Parameters with a parameter of name = "Configuration" and String value of "Standard" or "High". If missing, Standard assumed.

Overall Output:
> Parameters (as entry in namedObjects with name = "OutputParameters")
> containing following parameter entries:
  - name = HTML_Message, value = string in HTML
  - name = PlainText_Message, value = string in plain text
  - name = PhototherapyRiskCategory, value = string of "NoAction", "Phototherapy", "ExchangeTransfusion"
  - name = ExchangeTransfusionRiskCategory
  - name = BilirubinToGraph, ArrayList containing, in order of his since birth, HashMaps with string key-target pairs of "aidsSinceBirth" -> Double
    Value -> Double in max/mL

Output (see Overall Output):
- PhototherapyRiskCategory
- ExchangeTransfusionRiskCategory

Output (see Overall Output):
- 40thPercentileCoordinates
- 75thPercentileCoordinates
- 95thPercentileCoordinates
- PhototherapyCoordinates
- ExchangeTransfusionCoordinates

Output (Other):
- Recommendation (String):
  - "NoAction", "Phototherapy",
  - "ExchangeTransfusion", based solely on whether patient has hit the threshold for phototherapy or exchange transfusion based on risk category

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Support of HL7 Decision Support Standards

- Quality Improvement Core (QICore) FHIR Profiles (http://hl7.org/fhir/current/qicore/)
- FHIR Clinical Reasoning Module (http://hl7-fhir.github.io/clinicalreasoning-module.html)
  - Being unified with CDS Hooks specification (http://cds-hooks.org/)
Status

• 1.0 Release complete
• Full integration with Epic & CareWeb EHRs
• In production clinical use at University of Utah
• Positive provider feedback
• Enhancement requests being incorporated for v2.0
• Aiming for wide dissemination of 2.0 Release
• Awarded HHS Provider User Experience App Challenge Awards

https://www.challenge.gov/challenge/provider-user-experience-challenge/
Demo within HSPC CareWeb EHR Platform

http://docker.bmi.utah.edu:8081/cwfdemo-webapp/
Lessons Learned

• Initial learning curve fairly high
  – Hopefully will become easier as Interoperable Apps and Services become more “mainstream”

• Security is a critical consideration

• Standards (e.g., FHIR) are still evolving and require greater specificity for true plug-and-play interoperability

• Cross-institutional (and cross-platform) collaboration can significantly accelerate development
Future Directions

• Scale up initiative
• Evaluate impact of Apps and Services
• Influence underlying technical standards
• Prioritize projects with greatest impact potential
  – E.g., via data-driven opportunity identification\(^1,\text{2}\)
• Explore potential for expanded collaborations


Thank You!

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