

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

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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



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>



Multi-Institutional Collaboration



UNIVERSITY OF UTAH
HEALTH CARE

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

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



Intermountain®
Healthcare

Scott Narus, PhD, MS
Chief Clinical Systems Architect

Ricky Bloomfield, MD
Director of Mobile Technology Strategy



DukeHealth

Robert Lenfestey, MD
Neonatologist and Clinical Faculty

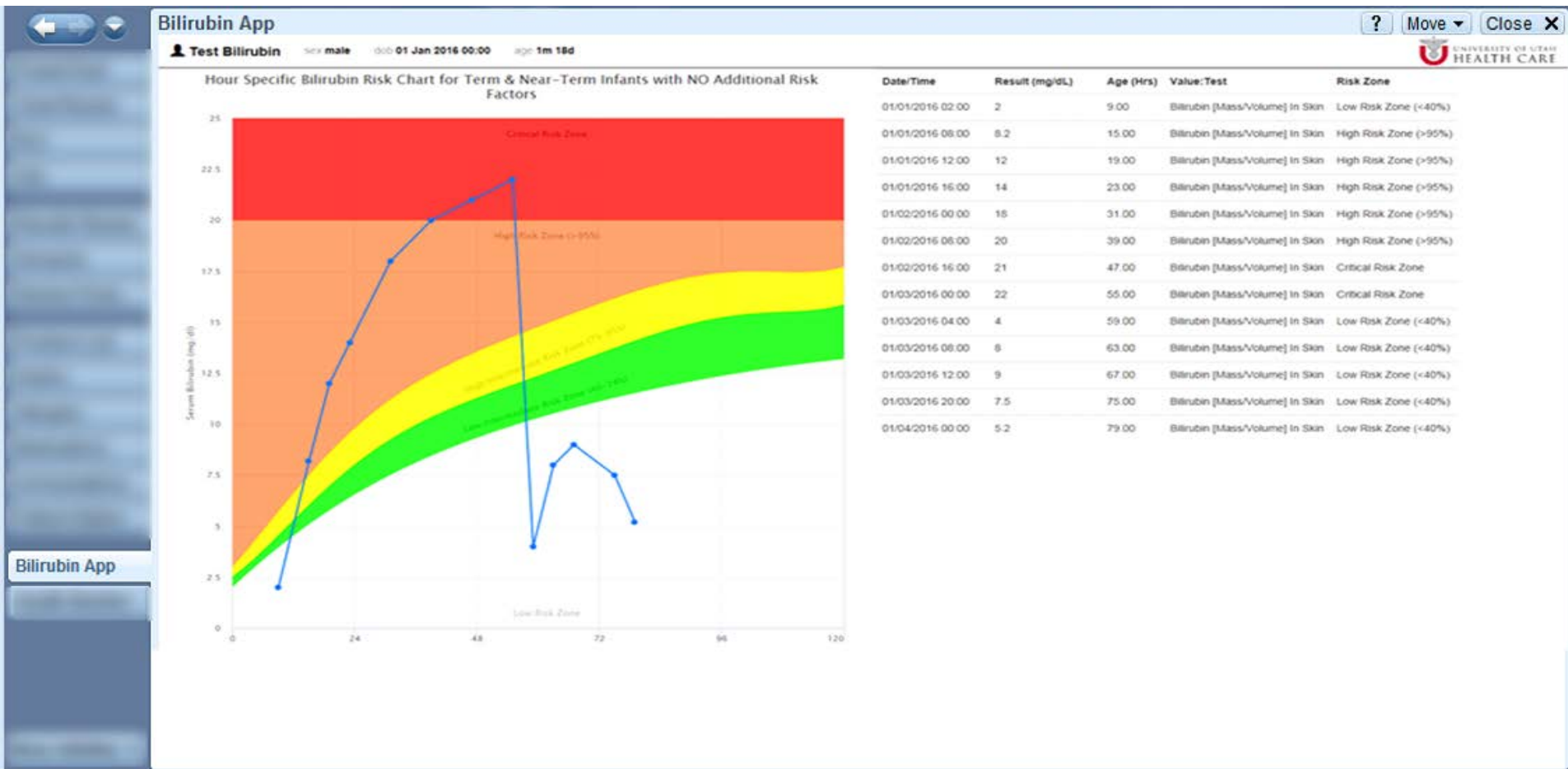


Multiple EHR Platforms

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

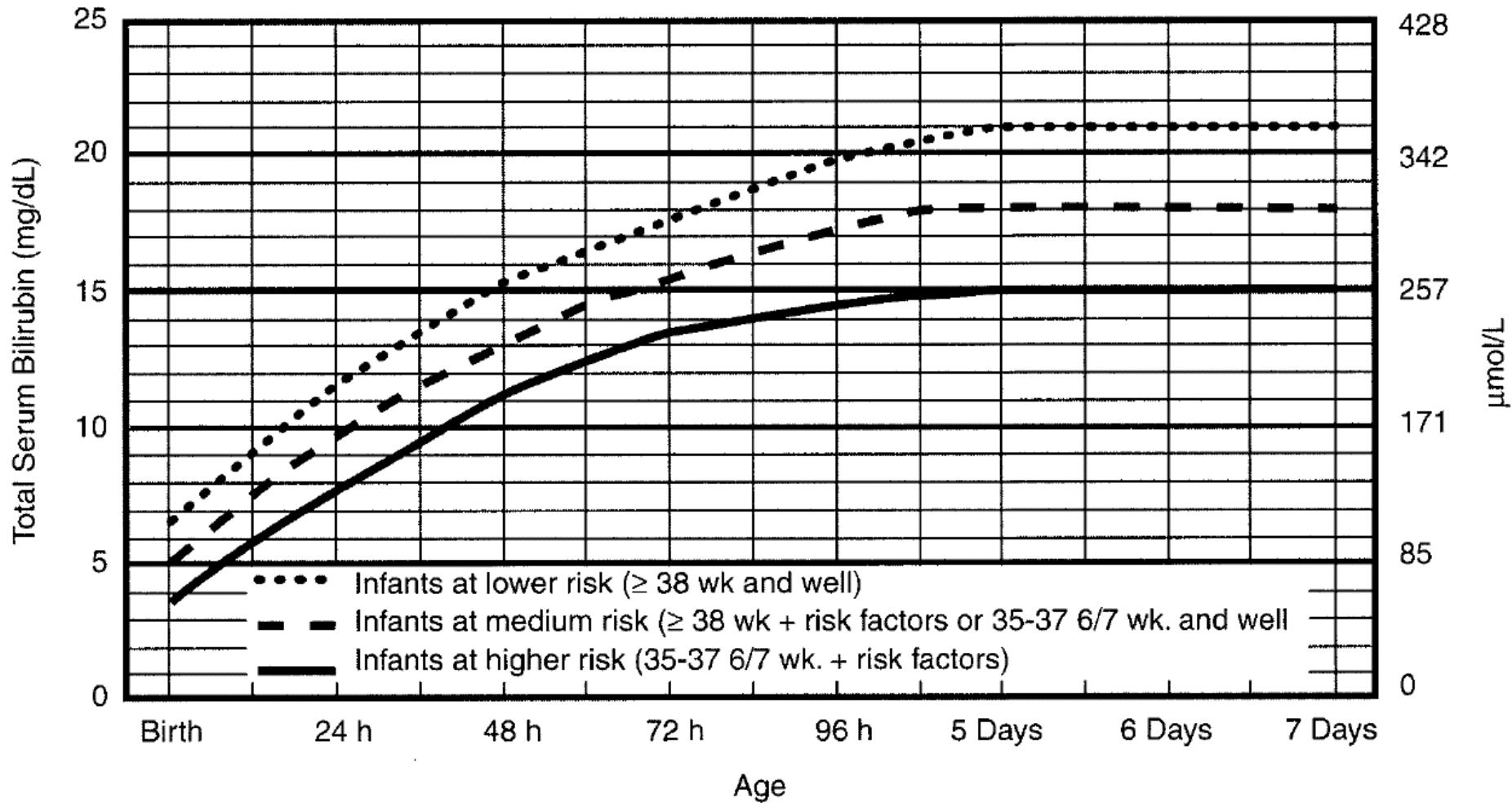


Baseline Bilirubin App, Integrated with Epic (developed by Intermountain)



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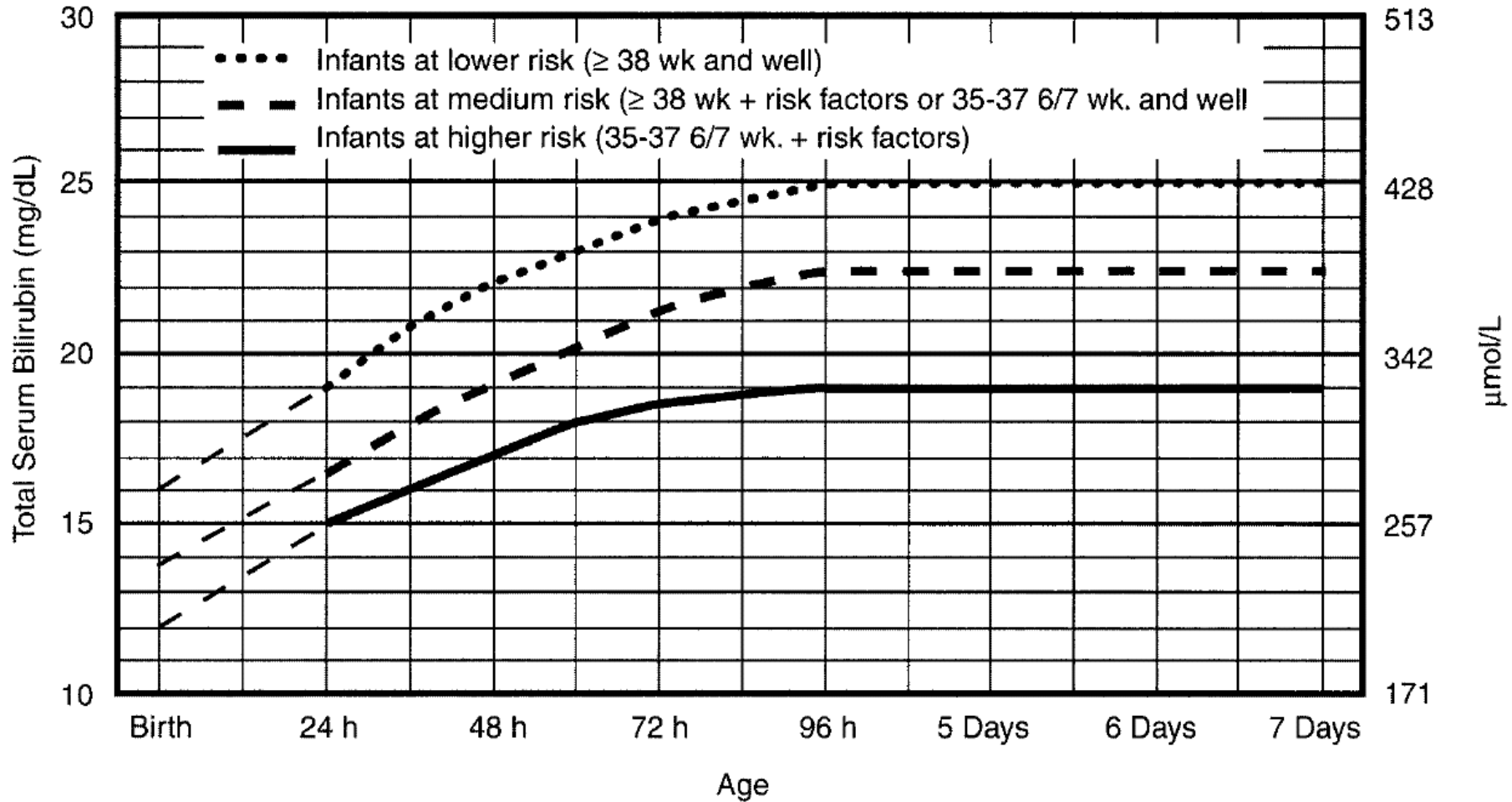
American Academy of Pediatrics Guidelines for Phototherapy



American Academy of Pediatrics. Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. *Pediatrics*. 2004 Jul;114(1):297-316.

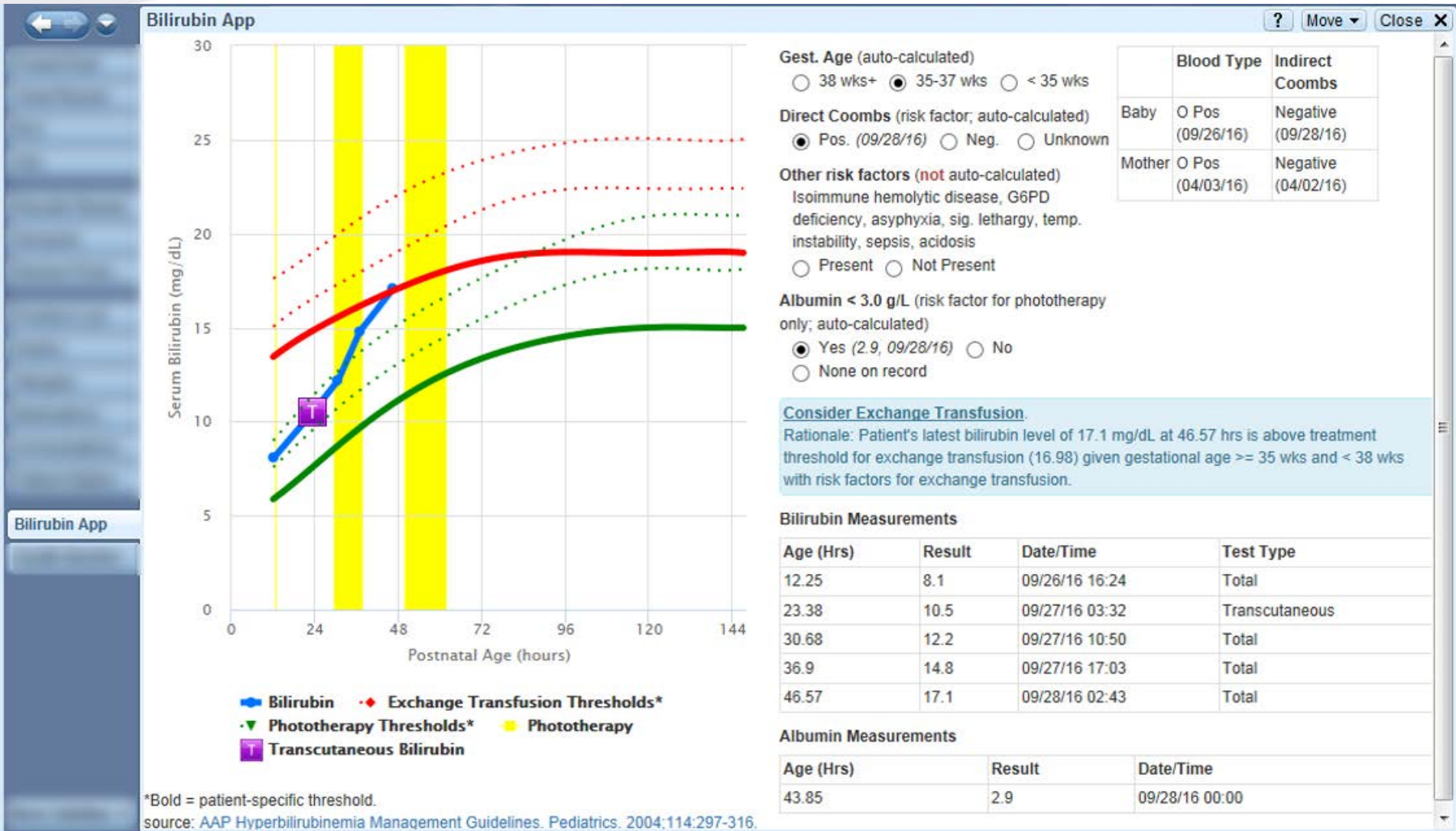


American Academy of Pediatrics Guidelines for Exchange Transfusion



American Academy of Pediatrics. Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. *Pediatrics*. 2004 Jul;114(1):297-316.

Current Bilirubin Application, in Production Use within Epic



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

PrimaryProcess.bpmn2 - Business Processes ▾

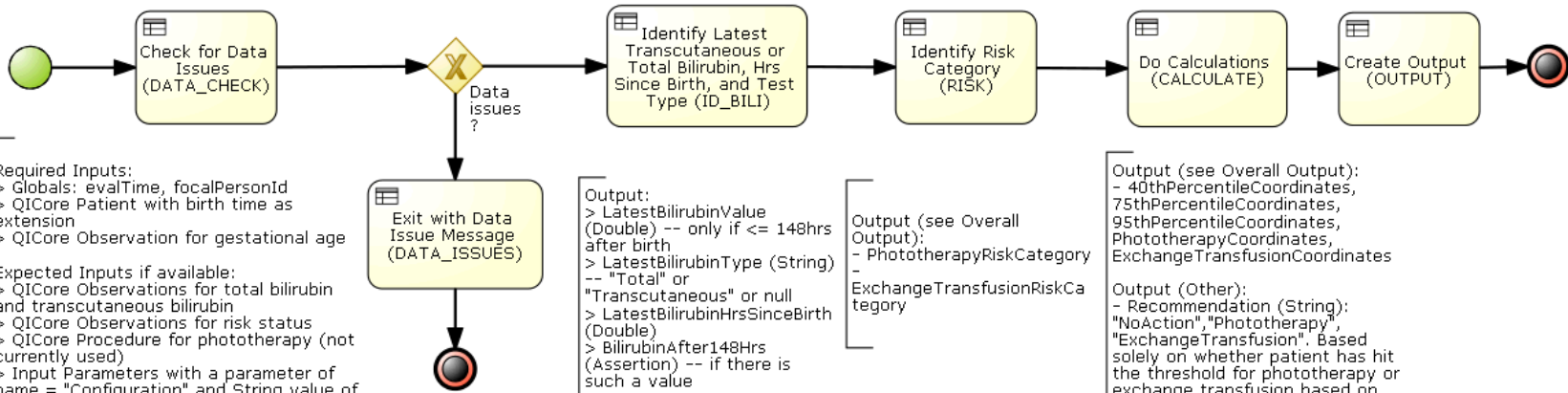
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Editor Overview



Process Modelling Simulation Results Process Documentation

PrimaryProcess v.1.0 (billrubin.PrimaryProcess)



Required Inputs:
> Globals: evalTime, focalPersonId
> 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 "IHC". 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 "38+WksAndWell", "38+WksAndRisk", "35to37WksAndWell", "35to37WksAndRisk", "LT35Wks".
- name = ExchangeTransfusionRiskCategory, String value same as above for phototherapy
- name = BilirubinsToGraph, ArrayList containing, in order of hrs since birth, HashMaps with string key-target pairs of HrsSinceBirth -> Double Value -> Double in mg/dL

Output:
> LatestBilirubinValue (Double) -- only if <= 148hrs after birth
> LatestBilirubinType (String) -- "Total" or "Transcutaneous" or null
> LatestBilirubinHrsSinceBirth (Double)
> BilirubinAfter148Hrs (Assertion) -- if there is such a value

Output (for Overall):
> BilirubinsToGraph

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.

Support of HL7 Decision Support Standards

- Quality Improvement Core (QICore) FHIR Profiles (<http://hl7.org/fhir/current/qicore/>)
- HL7 Decision Support Service (http://www.hl7.org/implement/standards/product_brief.cfm?product_id=12)
- 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^{1,2}
- Explore potential for expanded collaborations

Ref 1. Kawamoto K et al. Value Driven Outcomes (VDO): a pragmatic, modular, and extensible software framework for understanding and improving healthcare costs and outcomes. *J Am Med Inform Assoc.* 2015;22:223-35.

Ref 2. Lee VS, Kawamoto K et al. Implementation of a Value-Driven Outcomes program to identify high variability in clinical costs and outcomes and association with reduced cost and improved quality. *JAMA.* 2016;316:1061-72.



Thank You!

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