November 3, 2016

Education and Development Program

Roll Call

WELCOME

Disclosures

- Tonight's Program
  - Nursing Clinical Decision Support: Governance, Life Cycle and Implementation at the Bedside
- Purpose /Objective
  - The purpose of this program is to provide the participants with an overview of the implementation of nursing Clinical Decision Support (CDS) in the Electronic Health Record (EHR). The program will cover CDS governance structure, processes, and lifecycle, as well as the communication, roll out strategy and impact of nursing CDS at the bedside.
- In order to receive the contact hour(s), the participant must attend the entire program and complete the evaluation
- Conflict of interest has been disclosed and reconciled

Congratulations!

PARTNERS HEALTHCARE

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AND MASSACHUSETTS GENERAL HOSPITAL

Nursing Clinical Decision Support: Governance, Life Cycle and Implementation at the Bedside

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November 3, 2016

NENIC Fall Program

Disclosure

We disclose that we do not have relevant financial relationships with commercial interests.

Agenda

- Clinical Decision Support (CDS) Governance Structure
- CDS Lifecycle
- Nursing CDS Implementation Strategy
- Nursing CDS Interaction Usage Analysis
- CDS Impact on Nursing Workflow
- Lessons Learned

Background

- Partners Healthcare Systems (PHS) has a strong history of robust clinical decision support (CDS) solutions for clinicians
- A recent PHS initiative to move to an integrated vendor-based EHR created an opportunity to provide enterprise-wide CDS tools to nurses
  - Prior to this move the majority of nursing flow sheet and note documentation was paper-based, limiting the availability of CDS
  - Nurses were experienced with electronic medication administration (eMAR) CDS for more than 10yrs
  - Ripe opportunity to provide enterprise-wide CDS generated from nursing documentation

What is Clinical Decision Support?

- Computer-based tools which provide clinicians, patients or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.

- Includes:
  - **alerts and reminders**
  - dosing guidance
  - order sets
  - patient data reports and summaries
  - documentation templates
  - diagnostic support
  - contextually relevant reference information
  - …

http://www.healthit.gov

CDS Governance at Partners Healthcare

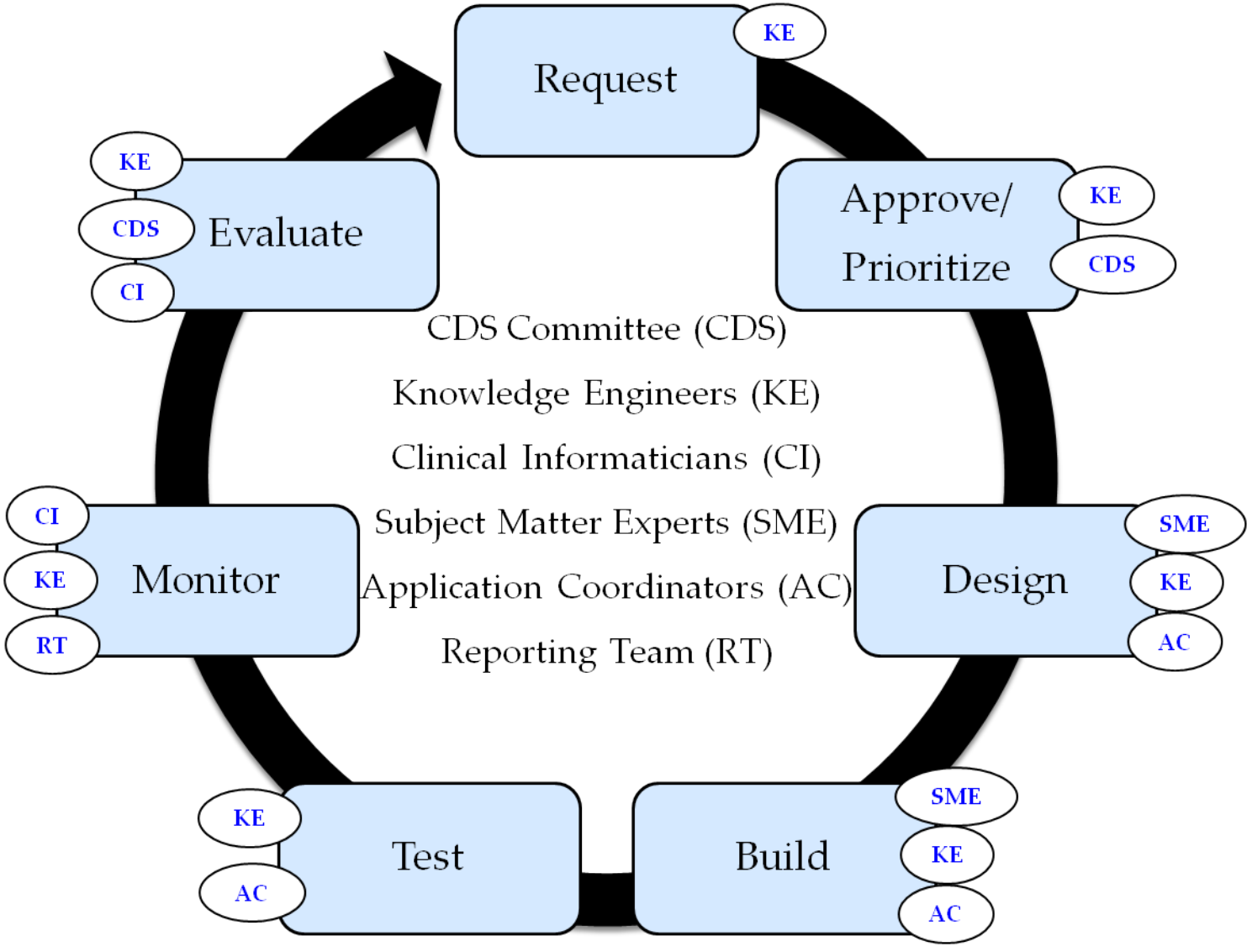
- **CDS Committee (Approval and Prioritization)**
  - ~50 voting members
    - Enterprise wide health professionals from different specialties
  - ~30 non-voting members
    - Representatives from clinical informatics, application teams, clinical content, and EHR vendor
  - In-person meetings and asynchronous discussions via collaboration tools
- **CDS Planning Committee (Oversight)**
  - Sub-group of the CDS Committee
    - Representatives from clinical informatics, application teams, clinical content, and EHR vendor
  - Reviews options for how best to implement requests
  - Summarizes and prepares requests for review by the CDS Committee
  - May make decisions on behalf of the CDS Committee
  - May seek decisions or advise from enterprise councils or committees (i.e. Nursing Informatics Advisory Committee (NIAC))

Processes and Tools to Guide CDS Implementation

- Process is driven by the CDS lifecycle with consistent implementation across the enterprise.
  - Site-specific CDS is built on an exception basis according to predefined guidelines
- Process includes:
  - Site CDS inventory prior to go-live
  - New and Temporary CDS requests
  - Enhancements , silencing or retiring of existing CDS

Governance	Rules and enterprise decisions for CDS
Lifecycle	Process framework for CDS
Collaboration tools	Means for asynchronous communication, decisions
CDS tracking tool	Database of CDS interventions
Testing tools	Testing tracking and bug reporting
Monitoring portal	Robust set of CDS monitoring tools
Support and issue tracking	Database for all issues identified in the production environment

CDS Lifecycle Phases

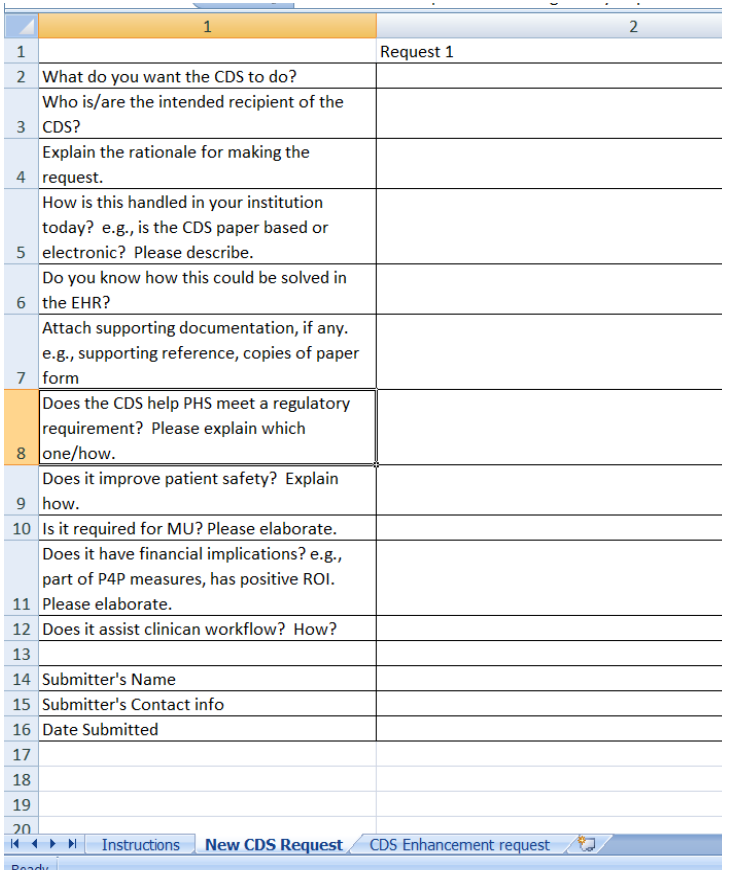


CDS Lifecycle Phases

KE

Request

- PHS personnel make requests for CDS
  - Anyone can submit a request
    - Varying background/expertise
  - Requests should be well formed and require minimal clarification
  - Ability to identify similar, related or duplicate requests
  - The submitter is kept informed of the status of their request
  - Requests are tracked with robust metadata



	1	2
1		Request 1
2	What do you want the CDS to do?	
3	Who is/are the intended recipient of the CDS?	
4	Explain the rationale for making the request.	
5	How is this handled in your institution today? e.g., is the CDS paper based or electronic? Please describe.	
6	Do you know how this could be solved in the EHR?	
7	Attach supporting documentation, if any. e.g., supporting reference, copies of paper form	
8	Does the CDS help PHS meet a regulatory requirement? Please explain which one/how.	
9	Does it improve patient safety? Explain how.	
10	Is it required for MU? Please elaborate.	
11	Does it have financial implications? e.g., part of P4P measures, has positive ROI. Please elaborate.	
12	Does it assist clinican workflow? How?	
13		
14	Submitter's Name	
15	Submitter's Contact info	
16	Date Submitted	
17		
18		
19		
20		

Instructions | New CDS Request | CDS Enhancement request

- Current state is an Excel worksheet
  - Available via collaboration and CDS tracking tools
  - Contains instructions and e-mail address for submission
- We are transitioning away from excel worksheet to online form with the ultimate goal of a self-serve model

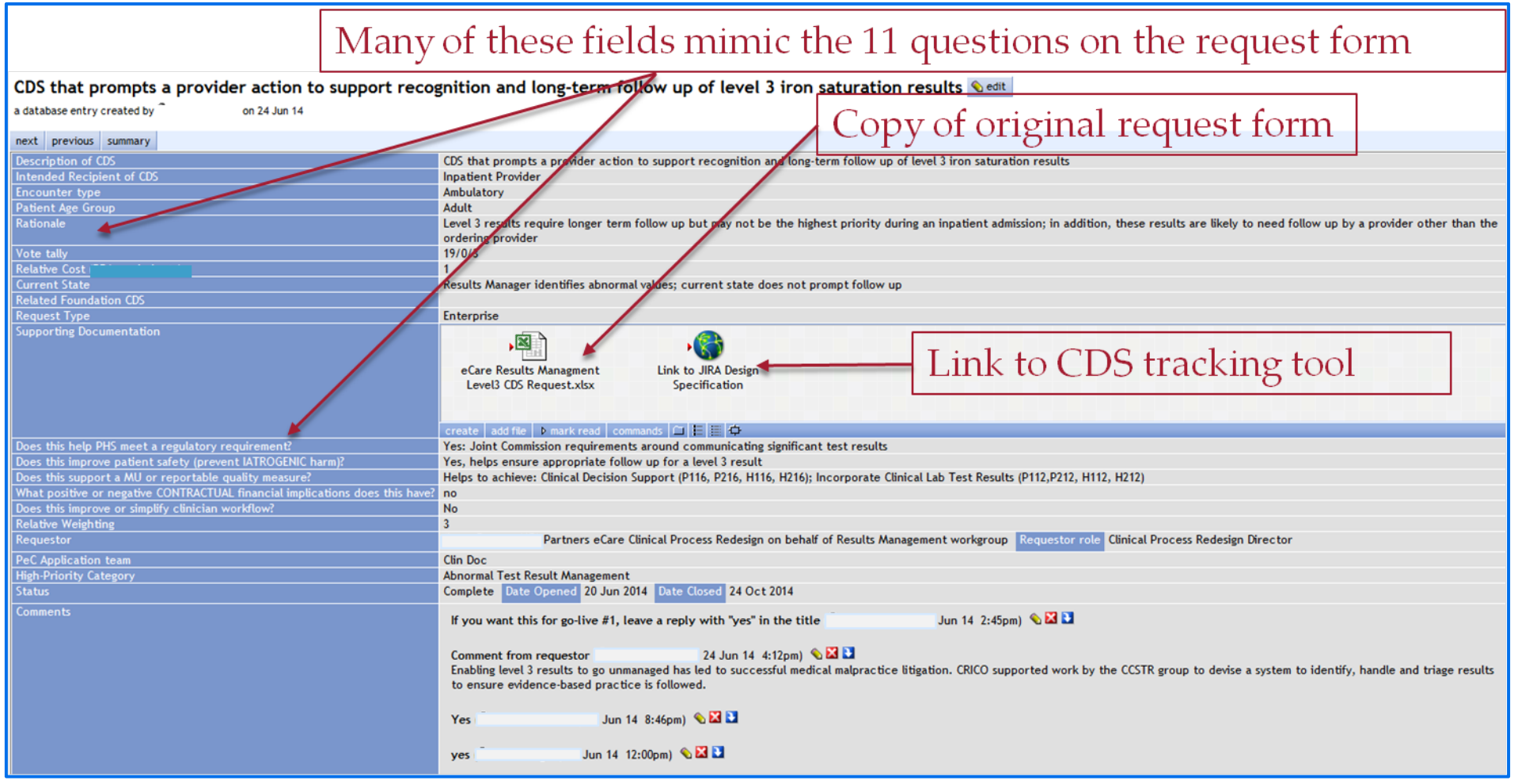
CDS Lifecycle Phases

- CDS requests are accepted, processed and released on a continuous rolling basis
  - Worked on based on site prioritizations
  - Workload is balanced against support and maintenance requests
- Evaluation and prioritization is made by representatives of a broad set of stakeholders
  - Members of CDS Committee and CDS Planning Committee
- Requests are systematically evaluated
  - Desirability and feasibility of CDS
  - Cost/benefit to organization
  - Consider the best method of implementation
  - Regulatory requirements often drive prioritization
- Decisions are transparently documented
  - Ability to raise/discuss questions, concerns
  - Formal voting and vote tally with recorded and transparent decisions

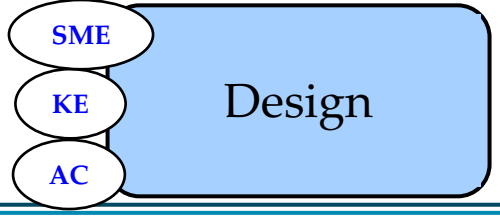
CDS Lifecycle Phases

KE
CDS
Approve/ Prioritize

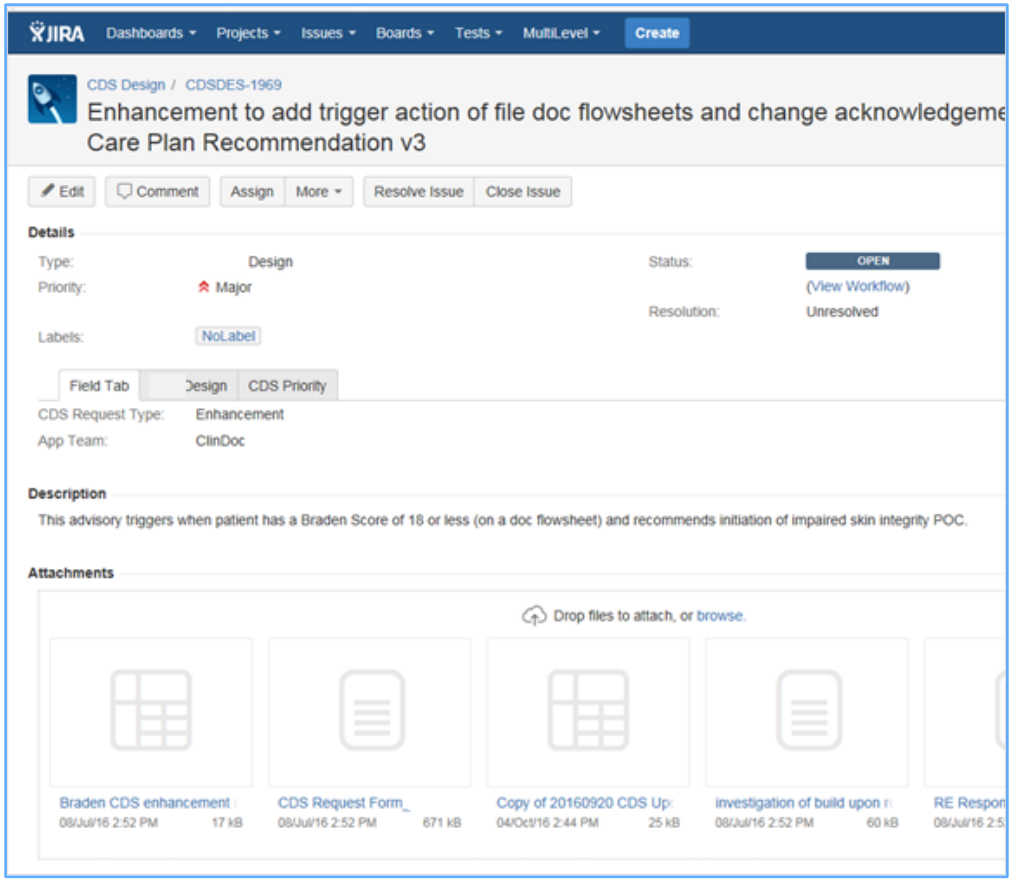
- Collaboration tool used for CDS approval process



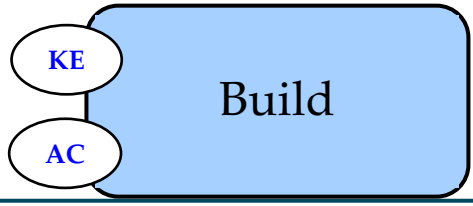
CDS Lifecycle Phases



- The Design Phase output is a CDS design specification
  - Specifies the design requirements for build within the EHR (the blueprint for build)
- Specification documented within a semi-structured form within CDS tracking tool
  - Well-documented collaboration between SME, KE and AC
  - Ability to report and export content
  - Robust metadata to link design to other phases of lifecycle
- Continually improving the CDS tracking tool with more structured fields, filters and dashboards



CDS Lifecycle Phases

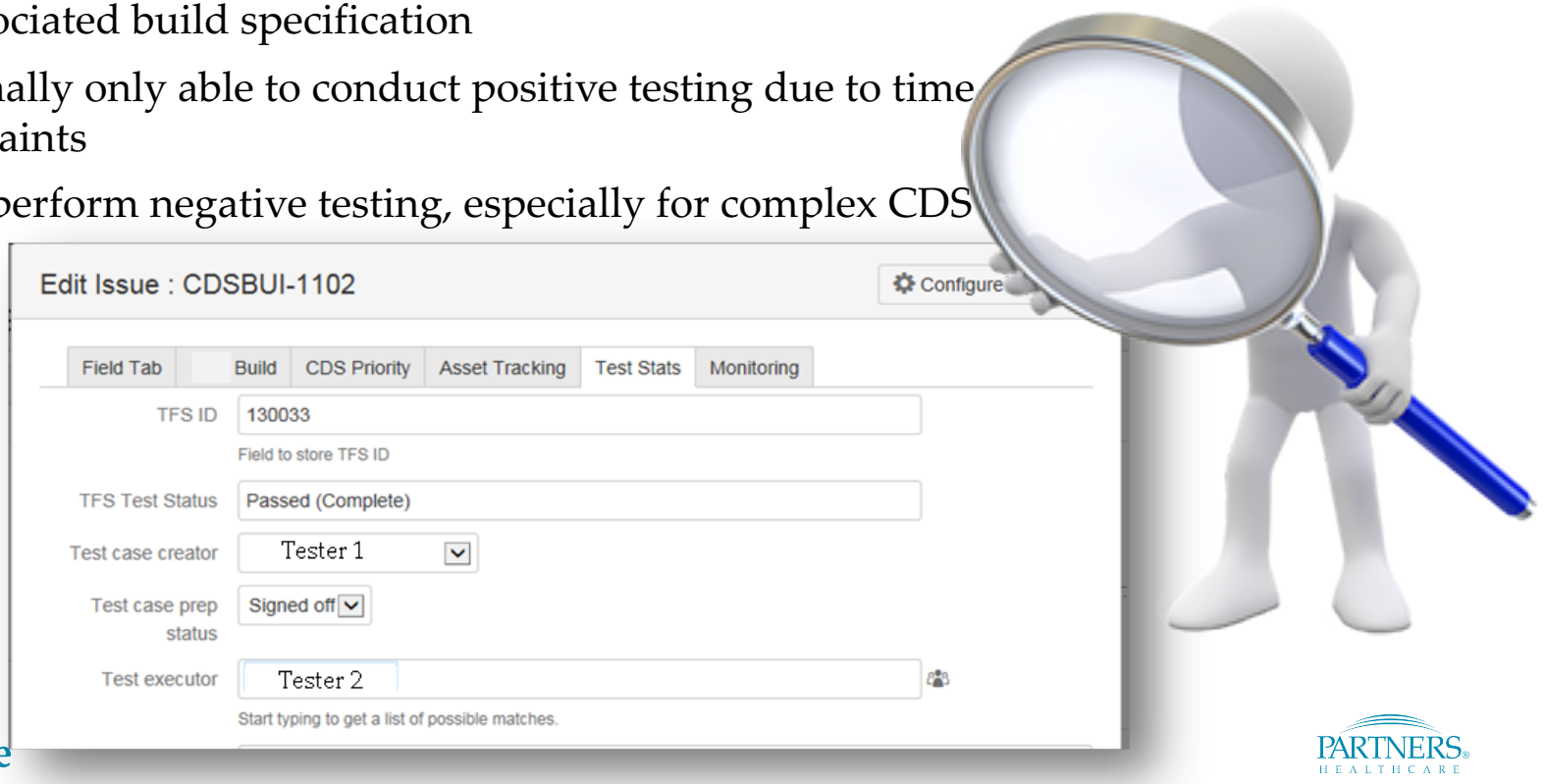


- The Build Phase output is the build of the CDS in the EHR as well as a build specification
  - Manual documentation of actual CDS build
- Specification is documented within a semi-structured form within CDS tracking tool
  - Well-documented collaboration between KE and AC
  - Ability to report and export content
  - Robust metadata to link build specifications to the design specification on which they are based
  - Build specification mirrors design specification
- Future state:
  - More structured fields for build details and dependencies
    - » e.g., content IDs (flowsheet rows), build groupings (subsets for medications) and other criteria (custom built criteria rules)
- *FUTURE* future state:
  - Extract automatically from EHR editors

CDS Lifecycle Phases

KE
AC
Test

- The purpose of the testing phase is to test the CDS interventions that have been built using test cases
- Current state:
  - Test cases are written and executed in testing software
  - Bugs, if any, are resolved
  - Testing results are imported back into CDS tracking tool and linked to associated build specification
  - Originally only able to conduct positive testing due to time constraints
  - Now perform negative testing, especially for complex CDS

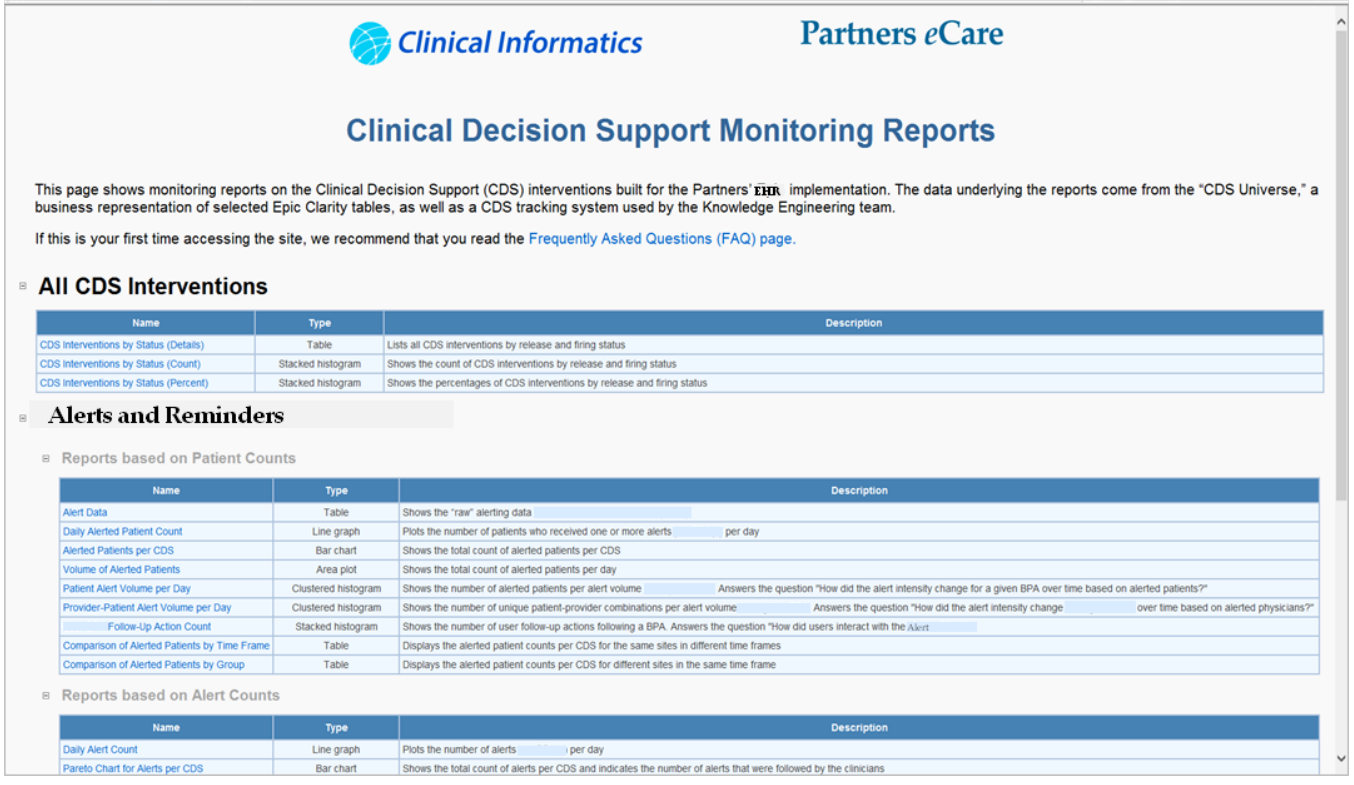


CDS Lifecycle Phases

CI
KE
RT
Monitor

- The purpose of monitoring is to confirm that CDS continues to work as intended (after testing)
- CDS monitoring portal provides reports and graphs which present CDS firing data from the production environment

- Rate of firing acceptable?
- For the right patients?
- To the right provider?
- At the right time?
- Within the right workflow ?
- Appropriately silenced?



Clinical Informatics

Partners eCare

Clinical Decision Support Monitoring Reports

This page shows monitoring reports on the Clinical Decision Support (CDS) interventions built for the Partners' EHR implementation. The data underlying the reports come from the "CDS Universe," a business representation of selected Epic Clarity tables, as well as a CDS tracking system used by the Knowledge Engineering team.

If this is your first time accessing the site, we recommend that you read the Frequently Asked Questions (FAQ) page.

All CDS Interventions

Name	Type	Description
CDS Interventions by Status (Details)	Table	Lists all CDS interventions by release and firing status
CDS Interventions by Status (Count)	Stacked histogram	Shows the count of CDS interventions by release and firing status
CDS Interventions by Status (Percent)	Stacked histogram	Shows the percentages of CDS interventions by release and firing status

Alerts and Reminders

Reports based on Patient Counts

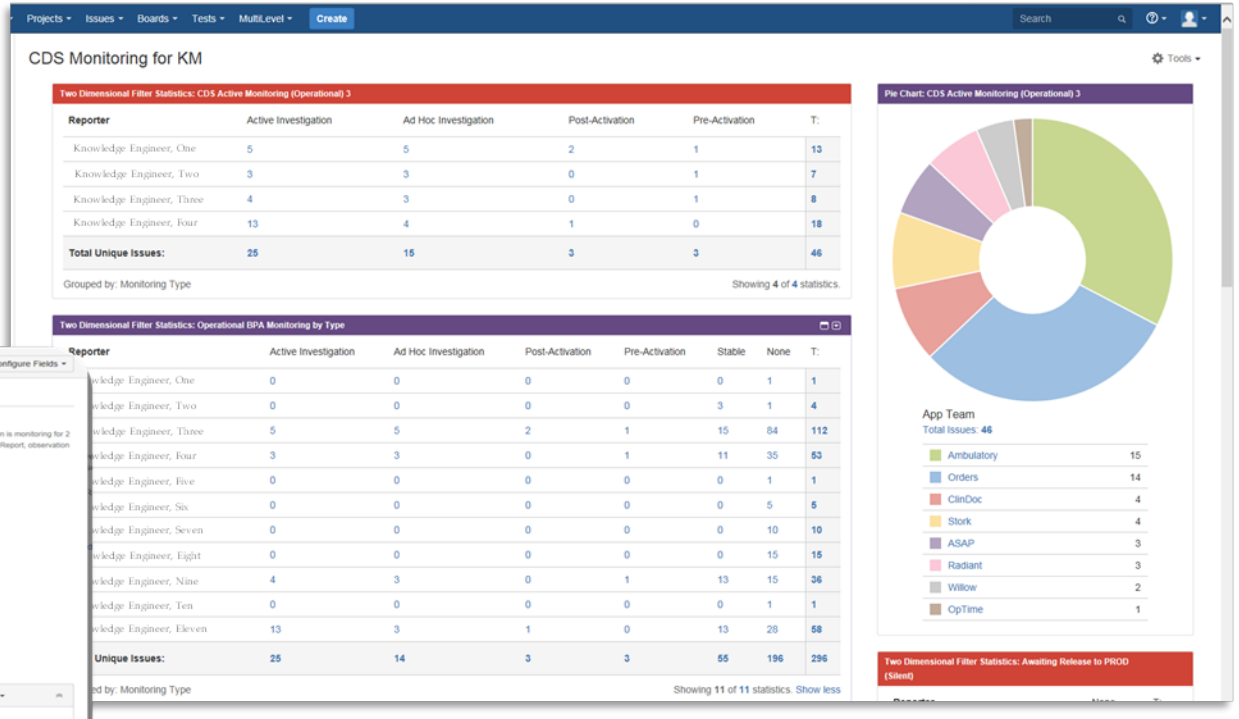
Name	Type	Description
Alert Data	Table	Shows the "raw" alerting data
Daily Alerted Patient Count	Line graph	Plots the number of patients who received one or more alerts per day
Alerted Patients per CDS	Bar chart	Shows the total count of alerted patients per CDS
Volume of Alerted Patients	Area plot	Shows the total count of alerted patients per day
Patient Alert Volume per Day	Clustered histogram	Shows the number of alerted patients per alert volume Answers the question "How did the alert intensity change for a given BPA over time based on alerted patients?"
Provider-Patient Alert Volume per Day	Clustered histogram	Shows the number of unique patient-provider combinations per alert volume Answers the question "How did the alert intensity change over time based on alerted physicians?"
Follow-Up Action Count	Stacked histogram	Shows the number of user follow-up actions following a BPA. Answers the question "How did users interact with the Alert
Comparison of Alerted Patients by Time Frame	Table	Displays the alerted patient counts per CDS for the same sites in different time frames
Comparison of Alerted Patients by Group	Table	Displays the alerted patient counts per CDS for different sites in the same time frame

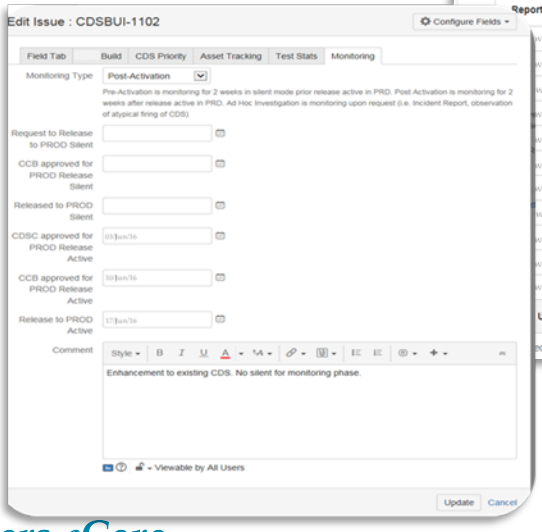
Reports based on Alert Counts

Name	Type	Description
Daily Alert Count	Line graph	Plots the number of alerts per day
Pareto Chart for Alerts per CDS	Bar chart	Shows the total count of alerts per CDS and indicates the number of alerts that were followed by the clinicians

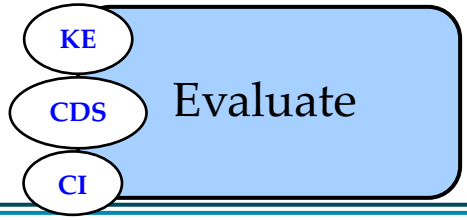
CDS Lifecycle Phases

- CDS tracking database captures the monitoring summary and individual CDS details
  - Dashboard summary of all CDS
  - Details of individual CDS
- Types of monitoring
  - Pre-activation
  - Post-activation
  - Ad- hoc





CDS Lifecycle Phases



- The purpose of evaluation is to determine if the CDS is having the intended effect (Value)
  - How are recipients responding to it? (alert fatigue)
    - » Ex. override rates, number needed to remind (Einbinder, 2010)
  - What behavior is it trying to change? (process measures)
    - » Ex. Increased rate of discontinuing urine Foley catheters after 3 days
  - What patient characteristics is it trying to change? (clinical outcomes)
    - » Ex. Decreased incidence of hospital acquired urinary infections
- Current state
  - CDS monitoring portal
    - » Reports and graphs
    - » Can be exported to Excel and/or SQL database for further analysis
- Future State
  - More detailed reports of user actions associated to CDS recommendations

BWH Strategy to Implement Nursing CDS Tools

- CDS has been successfully integrated into electronic health records (EHRs) to enhance nursing decision-making and to drive evidence-based practice.(Bakken et al., 2008)

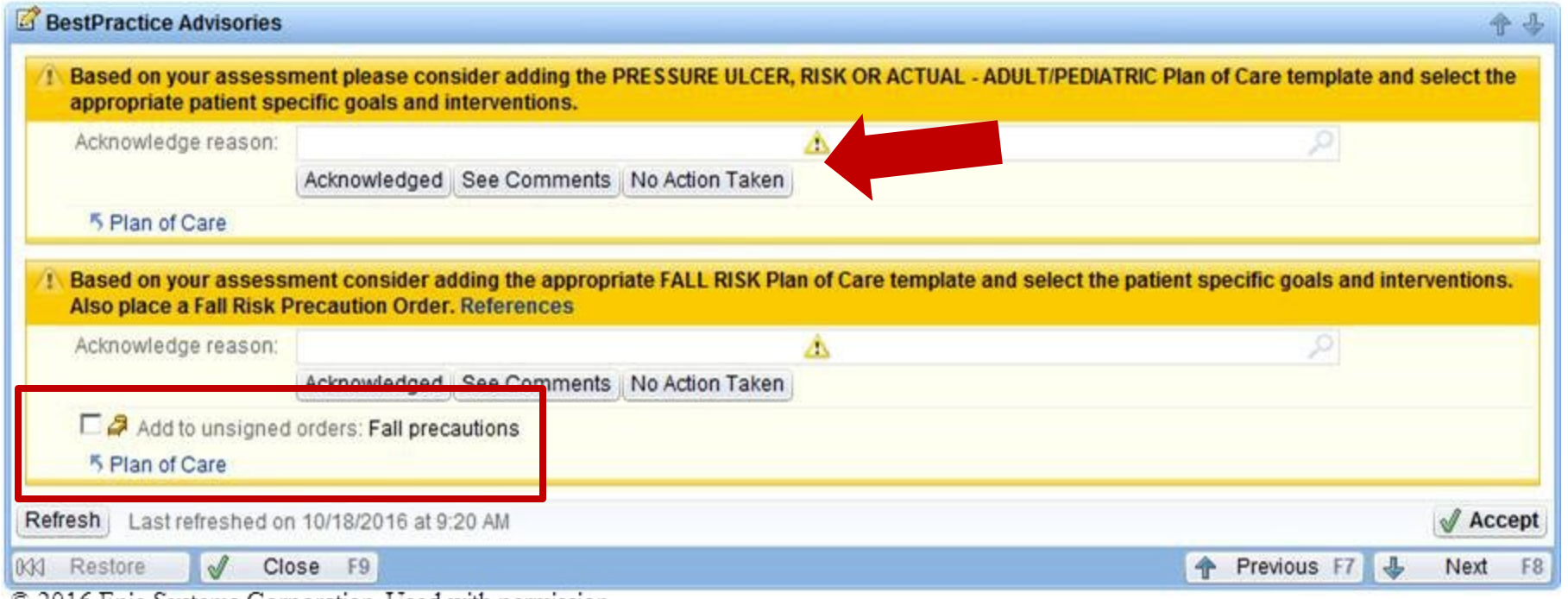
- We conducted an analysis of the CDS nursing requests that were received within a three month time span in spring 2014. The highest priority categories for nursing CDS requests were:

  - Risk Assessments/Risk Reduction/Promotion of Healthy Habits (24%) and High cost/risk intervention (17%).
    (**Whalen K**, Bavuso K, Bouyer-Ferullo S, Goldsmith D, et al. Analysis of Nursing Clinical Decision Support Requests and Strategic Plan in a Large Academic Health System. 2016)

- These high priority categories are consistent with the core of nursing care, nurse decision making, and rigorous research on clinical decision support for nursing. (Alvey, Hennen,& Heard, 2012; Dykes et al., 2010)

Strategic Nursing Clinical Decision Support Design

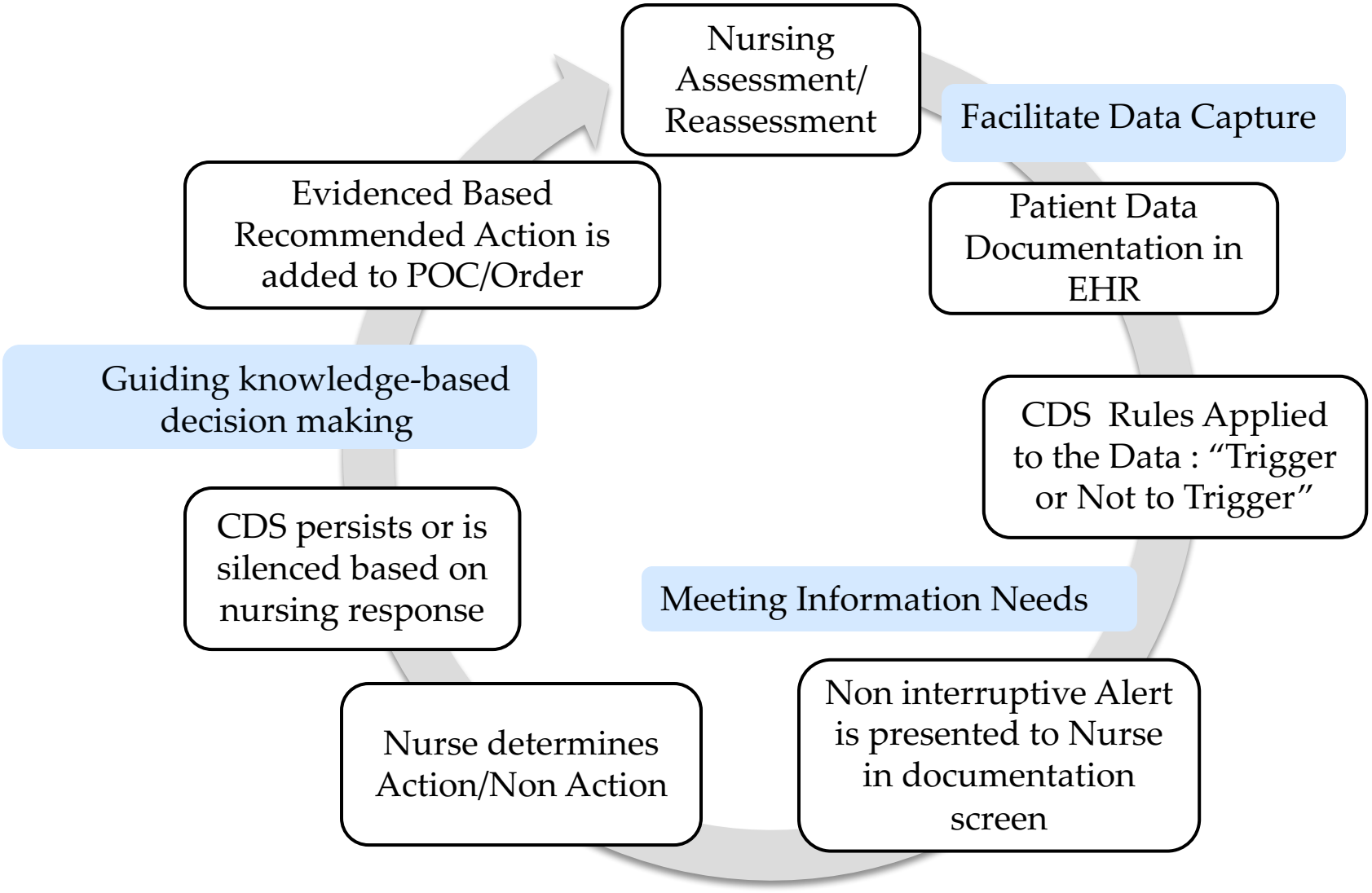
- Interventions are rules based and driven off nursing assessment documentation
- Non interruptive alerts presented as an interactive window within the admission assessment and shift assessment documentation screen
- When presented with CDS nurses can:
  - Agree with and act on recommendation
  - Acknowledge but not act on recommendation
  - Choose to not interact with the alert



Not So Strategic Nursing CDS Education

- CDS (or Best Practice Advisories) were reviewed/taught in the pre implementation training program
- CDS education was not "highlighted" or stressed in the training materials
- Some passive expectation that alerts and reminders were familiar to nurses who had been using an eMAR for years
- Scope of EHR implementation prioritized nursing documentation over CDS implementation
- Post implementation evaluation reveals that additional emphasis on CDS would be beneficial to achieving the intended impact of the CDS

Clinical Decision Support in Nursing Workflow



Evaluation of CDS in Nursing Practice

- We evaluated the actions taken by nurses when presented with evidenced-based POC/Order intervention alerts related to:
  - Risk for falls
  - Risk for skin breakdown
  - Patient restraint use

- These domains were chosen to evaluate primarily because:
  - The CDS rules fire solely within nursing documentation
  - Accountability for assessment, intervention and outcomes associated with these elements are within the scope of nursing practice
  - Fall risk and skin integrity are contained within the National Database of Nursing Quality Indicators
  - Appropriate restraint use is a Joint Commission (TJC) standard

Process of Data Analysis

- CDS alert firing data was extracted from the EHR
  - Separated into discrete excel worksheets
  - Custom sort by Date, then Time, the patient ID, then Follow-up action
  - Removed rows that were not unique instance of a CDS intervention
  - Coded actions as "accepted" (recommended action taken) or "overridden"
    - Accepted - **Clicking a link within the alert message/selecting an order**
    - Overridden - Acknowledged, commented on, or labeled as insignificant without taking the recommended action
    - Ignored - No interaction with the alert window at all
- Data set represents 22 week time period beginning 5 months following EHR implementation

Results of our Data Analysis

- The 3 CDS intervention alerts collectively fired more than 30,600 times over the 22 weeks of data collection
- When nurses interacted within the CDS window the recommended actions was taken 15 to 52% of the time

CDS 11/15 - 04/16	CDS Fired n=	CDS Nurse Interaction n=	**% CDS Recommended Action Taken**	**% CDS Overridden**
High Fall Risk Morse Score >=45	17,398	1,539	**52%** (799)	48% (740)
Risk for Impaired Skin Integrity Braden Score <=18	4,292	219	**31.5%** (69)	68.5% (150)
Restraint Plan of Care Active Restraint Order w/o POC	8,944	428	**15%** (64)	85% (364)

Nurse Focus Group Feedback

Following data analysis we held focus group with 32 clinical nurses to explore the following questions:

1. Does CDS for nurses that recommend POC interventions have value within your documentation workflow?
2. We choose these CDS alerts to be non interruptive to your work flow. Was this the right decision?
3. What reason might you have for not acting on the alert recommendation?

Themes that emerged from analysis of the discussion comments:

1. Design in the workflow
2. Lack of knowledge
3. Alert fatigue

Design in the Nurse's Workflow

- "I've never seen it"
  - There are pathways in the system to document and avoid the locations where the CDS advisory is located
- "Didn't even see that link to the Plan of Care"
  - "acknowledge" users didn't see and/or realize that the POC link was there to take them to the POC to add the problem
- "I wasn't ready to go to the plan of care"
  - POC documentation occurs after completion of the assessment.
  - This workflow represented an interruptive change
- "Can the problem automatically populate the POC when alert fires?"
- "Can the BPA display in the POC?"
  - Because all nurses are "required" to review and update the patient's POC daily they felt the alert would be more visible and less likely to be ignored.
  - Technical limitations to this approach

Strategic Nursing Clinical Decision Support

- Interventions are rules based and driven off nursing assessment documentation
- **Non interruptive alerts presented as an interactive window within the admission assessment and shift assessment documentation screen**
- When presented with CDS nurses can:
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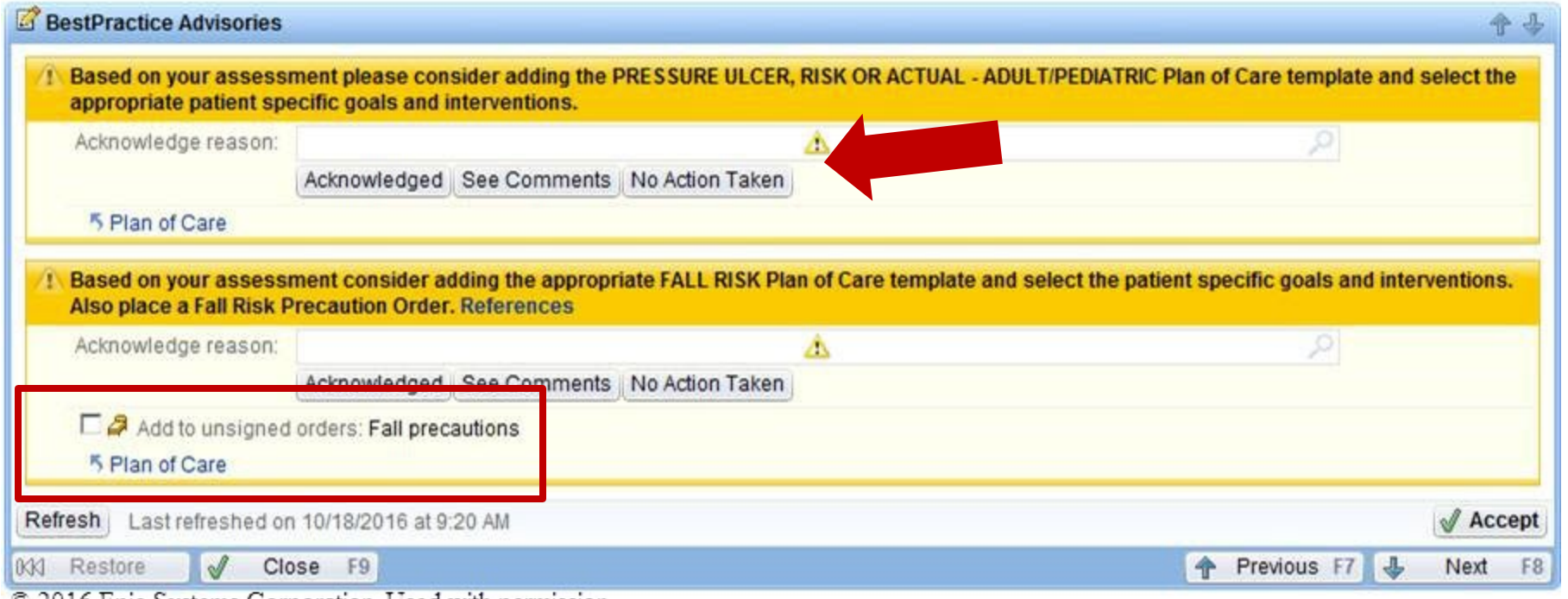

Lack of Knowledge & Alert Fatigue

- "I didn't understand what it was"
  - Understood the content of the alert but not the intent…
  - Did not understand

    That "acknowledge" was an "override" action

    That "clicking" the POC link was an "accepted" action

- "every patient gets it, so I just ignore it"
  - Most of our inpatients are at risk for falls or impaired skin integrity

- "its just one more thing to look at"
  - Novice EHR users continue to be overwhelmed by the documentation requirements and "busy" screen design

Implementation Lessons

- CDS education effort was lost in the larger implementation activities.
  - Purpose of the CDS advisory & response expectation of the user
- "Make it easy to do the right thing"
  - Rationale for using a non interruptive alert was sound
  - Location of the alert was not in a user "workflow" friendly location
  - The recommendation "actions" were less evident then the "override" actions
- Contextualize the alerts
  - Placing the alerts within the reassessment flow sheets would have emphasized their importance
- Continue CDS Lifecycle process that includes direct care nurses
  - Place greater emphasis on Nursing requestor/owner pre/post implementation responsibilities

What's next for us?

Applying changes/enhancements to align with best practices/and our lessons learned.

Design in the Nurse's Workflow

1. A user interface that guides user towards the recommendation action is now in place
2. Reconsidering location placement for all non-interruptive nursing alerts

Lack of Knowledge & Alert Fatigue

1. Instituting a broad re-education and communication program
2. Continue to monitor program to identify improvements
3. Recommend the CDS requestors/owners identify a quality improvement initiative associated with their request; (i.e. articulate a goal for the CDS implementation and a measurement of success)
4. Recommend the CDS requestors propose a communication plan

Conclusion

- Best practices for CDS exist in the literature, and overall, align/confirm with these lessons
  - Interface design principles for usable decision support: A targeted review of best practices for clinical prescribing interventions. (Horsky, Schiff, Middleton et, al 2012)
  - Grand Challenges in Clinical Decision Support v10. (Sittig, Wright, Bates, et, al 2008)
  - Best Practices in Clinical Decision Support. (Wright, Phansalkar, Bates, et, al, 2010)
  - Ten Commandments for Effective Clinical Decision Support: Making the Practice of Evidence-based Medicine a Reality (Bates, Kuperman, Middleton, et, al, 2003)

- Our findings demonstrate that application of known best practices for CDS requires explicit translation to:
  - Apply them to nursing documentation workflows
  - Work within technical limitations of nursing documentation modules, particularly the plan of care

Acknowledgements

Implementation of the Nursing CDS would not be possible without the valuable contributions and indispensable support of our:

- Requestors,
- Subject Matter Experts,
- CDS Committee members,
- Application Coordinators,
- Knowledge Engineers,
- Clinical Informaticians,
- Associate Director and Director of Clinical Informatics,
- Clinical Informatics development staff,
- Enterprise Research Infrastructure and Services engineers
- Local site-based implementation leaders and teams

Thank You!!

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