Vaishnavi Kannan, DuWayne Willett
Scaling Agile for Larger Electronic Health Record-Based Initiatives
Agenda

• Updates: What’s been happening since 2016
• What worked well
• Challenges
• Future Directions
• Conclusions
“Designing effective Clinical Decision Support (CDS) tools in an Electronic Health Record (EHR) can prove challenging due to complex clinical scenarios and changing requirements; application of agile principles and practices proves helpful in the development and delivery of effective CDS tools for use in clinical care.”
Background: Healthcare’s late move from paper to digital

• Healthcare transitioned relatively late from paper medical charts to digital

• A few pioneers showed improved care quality using an electronic health record (EHR)

• Automated clinical decision support (CDS) tools help close gaps in best care

• 2009 HITECH Act: $$ incentives for doctors’ offices and hospitals to adopt an EHR and implement CDS

• Consolidation of EHR vendors

• Market-leading EHRs allow local configuration of novel feature sets
Summary of Project

• Challenge we faced:
  o Create an EHR patient registry with clinical quality measures for each of our medical specialties
  o First registries took 1-2 years each
  o Needed to build 40+ in 1 year

• What we did / methods
  o Adopted agile methods for project: agile project management, agile modeling
  o Employed re-usable framework in EHR and in our enterprise data warehouse

Outcomes

• Results (< 1 year):
  o 43 registries
  o 111 electronic data capture and clinical decision support tools
  o 163 electronic quality measures
  o 30 dashboards

Updates since 2016

• Updates on our agile specialty registry project
• Updates on adopting agile more broadly
Updates since 2016: Registry project

• # of patient registries ↑ to 105
  o Diverse health conditions: Sickle Cell Disease, Pediatric Cancer, Sleep Apnea, Adults with Congenital Heart Disease, Macular Degeneration, ...
  o New registry requests continue to arrive:
    • Seizure disorders
    • Brain surgery (craniotomy) patients
    • Heart valve surgery candidates

• # of patients followed actively on 1 or more registries now > 100,000
Updates: Adopting agile - benefits

• 75% ↑ in EHR Team productivity --via ↓ in abandoned work

• 17% ↓ in customer-reported defects

• ↓ time in backlog:  
  From 9-12 months → 6 weeks

• ↓ in after-hours work

Trend in user stories completed and Fault/failure incidents over time
Updates since 2016: Spread of agile adoption

Within UTSW

• Diverse teams have adopted agile
  o Revenue Cycle
  o Training
  o Health Information Management

• Leadership supports agile methods

Nationally in healthcare

• Healthcare Organizations (HCOs) presenting on use of Agile methods at Epic EHR Conferences:

• Healthcare Software Companies
  o Epic release cycle 18 mos → quarterly
  o Pop Health, Analytics software companies
What worked well

• User stories as lightweight requirements

• Agile modeling; model-driven development

• Use case diagrams for scaling to larger initiatives

• Dimensional data modeling for analytics
What worked well: User Stories as lightweight requirements

• Helps us quickly get to shared understanding of “who”, “what”, and “why” for any new feature request

• Useful when scaling agile to larger initiatives:
  o Overall “epic” story →
  o Individual stories for iteration assignment

Prostate Cancer Registry – User Story:
As a physician caring for prostate cancer, I want to track the status of each patient’s cancer including urinary, bowel, sexual, and hormonal functions so that I can monitor their progression and provide optimal care.

Acceptance Criteria (partial):
• EHR patient portal questionnaire to capture patient-reported symptoms and outcomes
• Set up questionnaire series to distribute at desired intervals based on treatment approach
• Ability to document problem level information in a form to track status and recurrence of condition.
• EHR-based list (registry) of patients with prostate cancer, with key pertinent information
• Ability to extract data out of the EHR on patients with prostate cancer, both individually and overall
What worked well: Agile Modeling, Model-Driven Development

• Find especially useful when scaling agile to larger, cross-team initiatives

• Benefits:
  o Remove ambiguity
  o Promote shared understanding of problem being solved and solution being designed
  o Enable peer review of designs

• Common models:
  o Decision tree, for CDS logic
  o Use Case Diagram, for scope – also Feature Breakdown Structure
  o Activity Diagrams (swimlane workflow)
  o Object diagrams for solution designs
  o State diagrams for patient journey
State Diagram for Patient Journey (Care Path)

Prostate cancer being evaluated

- Assigned to non-surgical treatment
- Assigned to surveillance
- Assigned to surgery

Assigned to surveillance

Treated with Radiation Therapy

Recurrence post surgery

- Recurrence: Assigned to Radiation Therapy
- Recurrence: Assigned to Hormone Therapy
- Recurrence: Assigned to Radiation and Hormone Therapy
What worked well: Use Case Diagrams

- Depict user stories as use cases: “business level” use case diagram

- Benefits:
  - Visual aid during story splitting, prioritization discussions
  - Emphasizing which stories provide value to which roles
  - Shared “table of contents” and naming of user stories
What worked well: Use Case Diagrams for larger initiatives
What worked well: Use Case Diagrams for larger initiatives

Prostate Cancer Epic Registry Use Cases

- Review patient’s chart
- View Urology-related Problems in Problem List
- Answer pre-visit questionnaire
- Prompt to add Prostate Cancer to the Problem List
- Answer questionnaire series
- View Prostate Cancer problem details (staging, recurrence status, etc.)
- Update Prostate Cancer problem details
- View list of Prostate Cancer patients with columns/metrics of interest (Epic registry)
- Prompt to update
What worked well: Dimensional data model for analytics

- Initial dimensional model: one row per displayed alert
- Benefits of interactively exploring clinical decision support (CDS) behavior:
  - Discover unintended behavior (under- or over-firing of alerts)
  - Analyze user responses → iteratively evolve user interfaces, behavior
  - Help decide which alerts to retire
Challenges

• Prioritizing across multiple product owners' backlogs for our single EHR

• Coordinating work on a single project across multiple teams

• Tooling
Challenge: Single System, Multiple “Owners”, Multiple Teams

Single Product Owner → Prioritized Backlog → Single System → Iteration Work → Single Team

Multiple Product Owners → Prioritized Backlogs → Single System → Iteration Work → Multiple Teams

Collated Prioritized Backlog
Challenge: Tools

Agile Project Management

Incident Management

Configuration Management
Future Directions

• Test-Driven Development
• A/B Testing
• Randomized Controlled Trials
• Broaden Analytics for our Clinical Decision Support tools
Future Directions: Test-Driven Development

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<td>Green</td>
<td>Write code to pass the test.</td>
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<td>Refactor</td>
<td>Clean up your code and the test.</td>
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**Assertions: 23 right, 21 wrong, 0 ignored, 0 exceptions**

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<th>Lockout Hours?</th>
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<td>3</td>
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**Assertions: 47 right, 0 wrong, 0 ignored, 0 exceptions**

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Future Directions: A/B Testing of EHR Configurations

Set up another A/B Test

Create UI Variations

Define Test Plan

Collect Data on User Actions

Design Base UI Layout

Run with Best Option

A/B Testing

Adapted from:

% BPA Respondents Adding DM to Problem List, by Role

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Future Directions: Randomized controlled trials

• Evidence for agile benefit anecdotal (though compelling) → can we add to scientific base?

• Ideas: Randomize CDS tools to:
  o Develop with TDD vs. status quo
  o Develop with A/B Testing vs. status quo
Future Directions: Broaden analytics for user story benefit

- Goal: expand star-schema dimensional model beyond alerts
- Multiple grains of interest
  - Each type of EHR feature (such as CDS tool) may have own specific grain
  - Generalizable model for assessing if “so that” section of user story being met?
- Grain: 1 row per measurable expected benefit per EHR feature per time period
- Facts/measures
  - Actual numeric value of measure
  - Target numeric value of measure
  - Met goal? Y/N (1/0)
Conclusions

• Agile methods scale well to larger healthcare initiatives involving EHR features
• Challenges at scale include balancing multiple stakeholder groups’ priorities and distributing iterative work across teams
• Lightweight governance benefits from User Stories
• Story-splitting benefits from agile modeling for both scope analysis and solution design
• Data-driven evolution of features looks promising
Acknowledgements

Our Teammates (partial list)

- Krystal Baldwin
- Mujeeb Basit
- Deepa Bhat
- Michael Burton
- Angela Carrington
- Ashley Chen
- Ling Chu
- Paul Corey
- Irma Donahue
- Jason Fish
- Emily Flahaven
- Kathryn Flores
- Jimmie Glorioso
- Ki Lai
- L.D. McElrath
- Richard Medford
- Scott Minnerly
- Jacqueline Mutz
- Vinod Nair
- Mark Rauschuber
- Evan Sara
- Seth Toomay
- Karen Wang
- Josh Youngblood

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