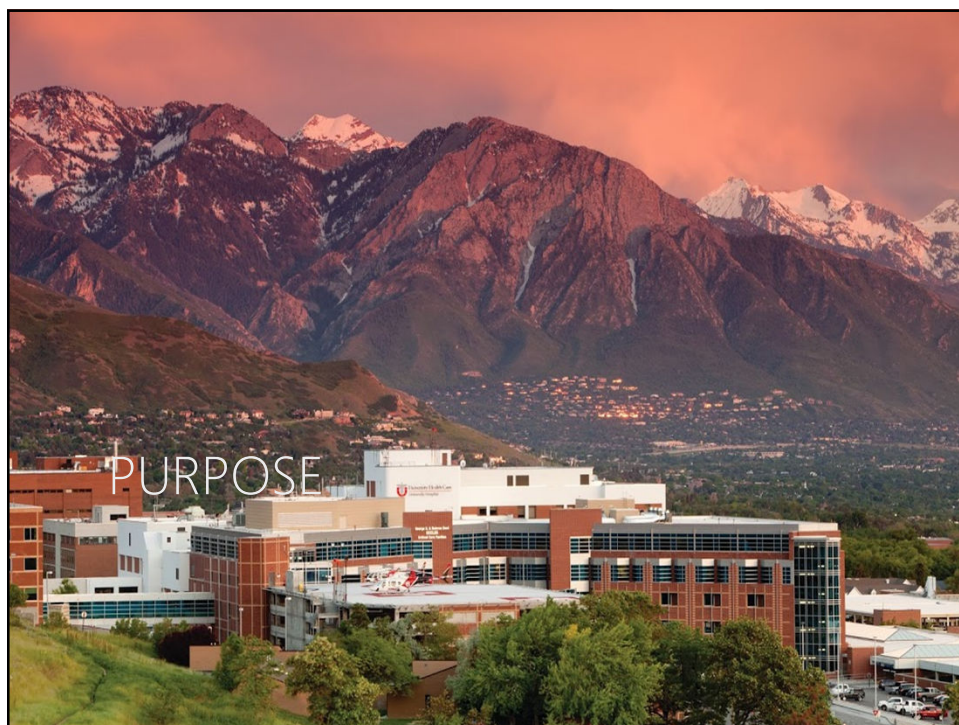
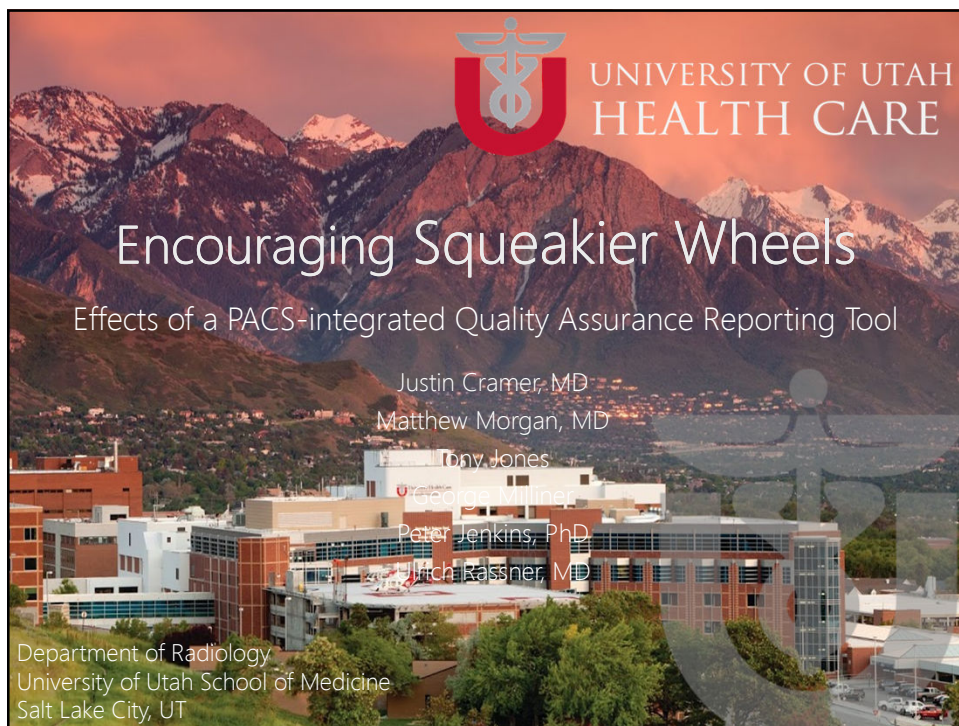
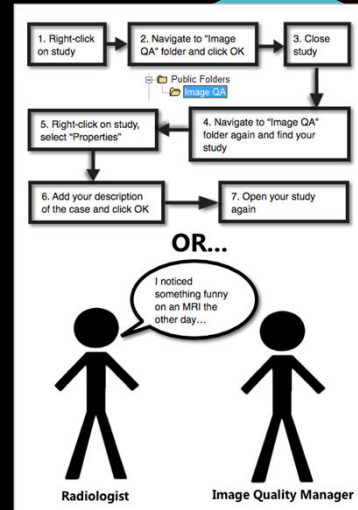




Purpose

- ▶ Our existing system for reporting image quality problems was cumbersome
- ▶ Consequently, not many issues were reported or addressed
- ▶ Our desire was to replace the existing system with a PACS-integrated, user-friendly tool

OLD SYSTEM



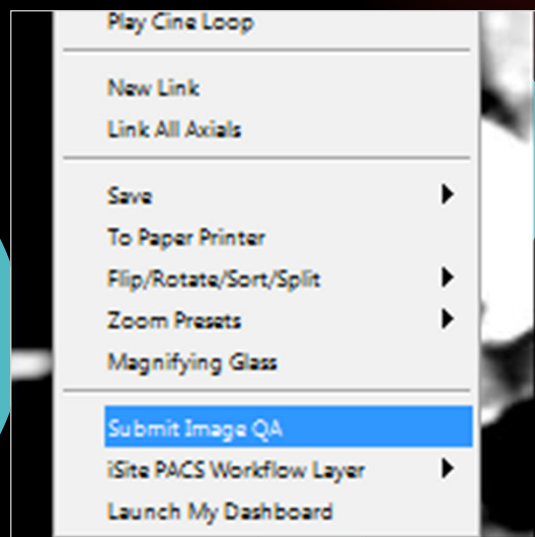
Methods

- ▶ Determine functional requirements
- ▶ Project Team:
 - ▶ Chief of Imaging Informatics
 - ▶ Director of Radiology IT
 - ▶ Director of Clinical Services
 - ▶ Medical Director of Modality Safety
 - ▶ Medical physicist
 - ▶ Modality managers
 - ▶ Software engineer

Methods

Functional Requirements – Image Quality Report Form

- ▶ PACS integration via a right-click context menu
- ▶ Launches image QA reporting tool for the radiologist (AKA the “Image Quality Report Form”)



Methods

Functional Requirements – Image Quality Report Form

- ▶ Image Quality Report Form
 - ▶ Balance between structured data and usability
 - ▶ Minimize number of user-filled fields
 - ▶ Maximize amount of auto-captured data

Methods

Functional Requirements – Image Quality Report Form

- ▶ Auto-captured fields (not all displayed to user):
 - ▶ Patient demographics, including accession number
 - ▶ Study series and image number
 - ▶ Performing technologist
 - ▶ Modality name and location
 - ▶ Date and time of submission
 - ▶ Date and time of imaging study

The screenshot shows a web-based form titled "Image Quality Report Form". At the top, it displays patient and study information: "CT - CTA NECK W CONT", "Acc #:", "PID:", "DOB:", and "Age:". Below this, it shows "Series: 4. Image: 1/509". The main section is titled "Issue Details" and contains a "Category:" dropdown menu with options: "(Select)", "(Select)", "Praise", "Technical Issue", "Patient Issue", "Technologist Issue", "Physician Issue", and "Other". Below the dropdown are three questions with radio button options for "Yes" and "No": "Was this scan repeated?", "Did you contact anyone regarding this issue?", and "Did this issue impact or delay patient care?". At the bottom, there are "Submit" and "Cancel" buttons, and a "Disclaimer" link.

Methods

Functional Requirements – Image Quality Report Form

- ▶ User-filled fields:
 - ▶ Issue Category
 - ▶ Issue description (free text)
 - ▶ Whether the issue required the scan to be repeated
 - ▶ Whether anyone was contacted regarding the issue
 - ▶ Whether the issue impacted patient care

The screenshot shows a web-based form titled "Image Quality Report Form". At the top, it displays patient information: "CT - CTA NECK W CONT", "Acc #:", "PID:", "DOB:", "Series: 4, Image: 1/509", and "Age:". Below this is a section titled "Issue Details" which contains a "Category:" dropdown menu. The dropdown is open, showing options: "(Select)", "(Select)", "Praise", "Technical Issue", "Patient Issue", "Technologist Issue", "Physician Issue", and "Other". Below the dropdown are three questions with radio button options for "Yes" and "No": "Was this scan repeated?", "Did you contact anyone regarding this issue?", and "Did this issue impact or delay patient care?". At the bottom of the form are "Submit" and "Cancel" buttons, and a "Disclaimer" link.

Methods

Functional Requirements – Admin Tool

- ▶ Administrative interface for tracking submitted issues (aka "Admin Tool") was also designed
- ▶ Required functions:
 - ▶ List all outstanding issues
 - ▶ Display issues by modality
 - ▶ Sub-categorize issues into additional categories not visible to the end-user (see next slides)
 - ▶ Apply a status to an issue (outstanding, resolved, etc.)
 - ▶ Allow free-text notes on an issue

Methods

Functional Requirements – Admin Tool – Additional Curation Categories

Submittor	Curator
Praise	Praise
Technical issue	Technical - artifact: avoidable
	Technical - artifact: Improvable
	Technical - artifact: Unavoidable
	Technical – Contrast issues
	Technical – Incorrect or incomplete recons
	Technical – Scanner failure
Patient issue	Patient – incorrect patient
	Patient - Refused
	Patient - Uncooperative
	Patient issue

Methods

Functional Requirements – Admin Tool – Additional Curation Categories

Submittor	Curator
Technologist	Technologist – Incorrect parameters
	Technologist – Incorrect protocol
	Technologist – Incorrect technique
	Technologist issue
Physician	Physician – Incorrect protocol
	Physician – Incorrect/poor technique
	Physician – Unclear/confusing instructions
	Physician issue
Other	Other
	Other – Physician
	Other - Technologist
	Technologist issue

Methods

Functional Requirements – Admin Tool

ome Logout

Image Quality Assurance Issues

Filter for admin workflow → Status: All New Curated Reviewed Completed Modality: All

ID	Status	Modality	Resource	Location	Submitted By	Technologist	Submitted
85	New	CR	PRIRAD				2014-12-23 21:50:14
120	New	CR	PRIRAD	PRIR			2015-01-06 14:44:24
225	New	CR	PRIRAD	PRIR			2015-02-03 12:57:18

Patient MRN: **Accession:** **Series:** 3 **Image:** 1 of 1

User Category: Technologist Issue

Description: Suboptimal lateral view -- can't see lateral process properly

Tried Contact: No **Scan Repeated:** No **Patient Impact:** No

Category: Technologist Issue

Notes:

Save Curation

Methods

Functional Requirements – Admin Tool

ome Logout

Image Quality Assurance Issues

Status: New Modality: All CT MR NUCS US XA/Angio GenRad ← Filter by modality

ID	Status	Modality	Resource	Location	Submitted By	Technologist	Submitted
85	New	CR	PRIRAD				2014-12-23 21:50:14
120	New	CR	PRIRAD	PRIR			2015-01-06 14:44:24
225	New	CR	PRIRAD	PRIR			2015-02-03 12:57:18

Patient MRN: **Accession:** **Series:** 3 **Image:** 1 of 1

User Category: Technologist Issue

Description: Suboptimal lateral view -- can't see lateral process properly

Tried Contact: No **Scan Repeated:** No **Patient Impact:** No

Category: Technologist Issue

Notes:

Save Curation

Methods

Functional Requirements – Admin Tool

Home

Image Quality Assurance Issues

Status: Modality:

ID	Status	Modality	Resource	Location	Submitted By	Technologist	Submitted
85	New	CR	PRIRAD	PRIR	Technologist	Technologist	2014-12-23 21:50:14
120	New	CR	PRIRAD	PRIR	Technologist	Technologist	2015-01-06 14:44:24
225	New	CR	PRIRAD	PRIR	Technologist	Technologist	

Patient MRN:
Accession:
User Category:
Description:
Tried Contact: **Scan Repeated:** **Patient Impact:**
Category:
Notes:

Quality team reviews each issue, categorizes it, and enters relevant notes about what was done.

Methods

Functional Requirements – Admin Tool

Example of a resolved issue

ID	Status	Modality	Resource	Location	Submitted By	Technologist	Submitted
255	Completed	CT	HCHCT	IHCBM4540	Quigley, Edward		2015-02-13 14:39:52

Patient MRN:
Accession:
Series: 5
Image: 38 of 154
User Category:
Description:
Tried Contact: **Scan Repeated:** **Patient Impact:**
Final Category:
Curation Notes:

Curated By: **Completed By:**
Revert Status:

Methods

Roll-Out

- ▶ Demonstration at resident and faculty meeting
- ▶ Department-wide e-mail detailing usage



Results

New Image QA Workflow

- ▶ Radiologist submits an issue with the Image Quality Report Form
- ▶ Submissions are reviewed (curated) by the respective modality managers
 - ▶ Many issues are addressed at this stage (talk to technologist, track down incorrect protocol, et cetera)

Results

New Image QA Workflow

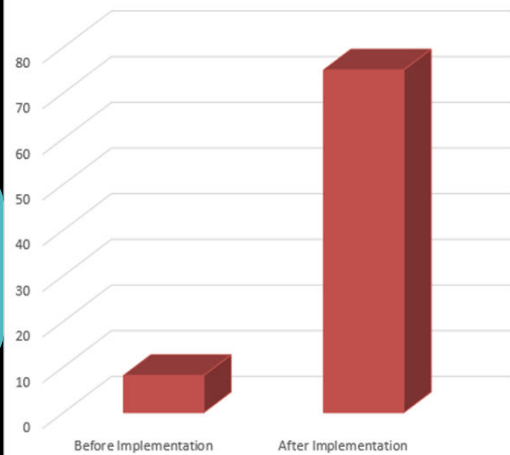
- ▶ Curated submissions are reviewed by the Image QA committee at a weekly meeting attended by:
 - ▶ Modality managers
 - ▶ Medical physicist
 - ▶ Director of Clinical Services
 - ▶ Radiologist Medical Director of CT/MRI
- ▶ The Image QA Committee assigns a more detailed category to each issue
- ▶ An issue may be "completed" at that time or require further work (checking on scan parameters on the machine, servicing a machine, running tests et cetera).
 - ▶ Status in the curation tool ("New", "Curated", "Reviewed", and "Completed") to indicate the progress of a submission

Results

Number of Issues Submitted

- ▶ Large rise in the number of issues submitted
- ▶ Pre-implementation
 - ▶ 8 issues/month
- ▶ Post-implementation
 - ▶ 75 issues/month over 11 months

Average QA Submissions Per Month

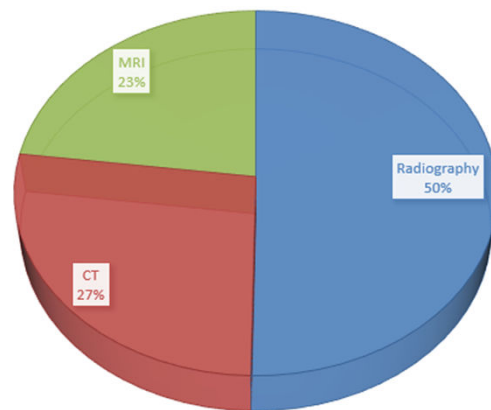


Results

Number of Issues Submitted

- ▶ Post-implementation
 - ▶ Totals over 11 months:
 - ▶ 831 total submissions
 - ▶ 416 radiography
 - ▶ 221 CT
 - ▶ 190 MRI

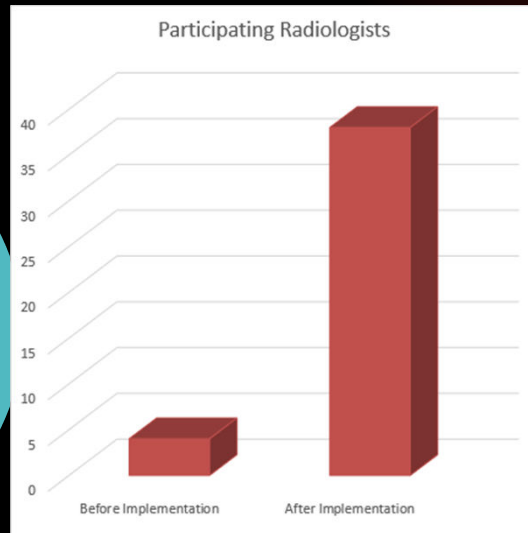
SUBMISSIONS BY MODALITY



Results

Number of Participating Radiologists

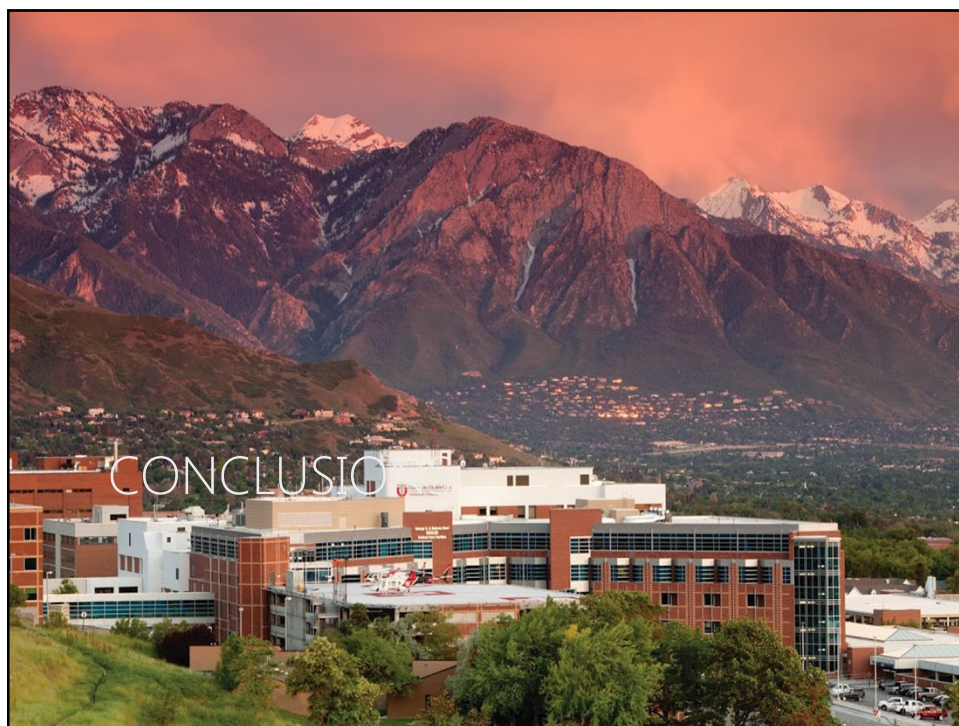
- ▶ Large rise in the number of participating radiologists
- ▶ Pre-implementation
 - ▶ 4 radiologist participants
- ▶ Post-implementation
 - ▶ 38 radiologist participants



Results

Examples of Newly Discovered Issues

- ▶ Differing protocols on different scanners
 - ▶ Different technical parameters for same protocol on different scanners
- ▶ Incorrect servicing of an x-ray machine
- ▶ Incorrect calculation of deviation indices
- ▶ Incorrect dose modulation adjustment parameters
- ▶ Faulty AEC cell in radiography system
- ▶ Faulty CR reader creating subtle artifact
- ▶ Different radiologists giving technologists different guidelines about studies (e.g. when to use a grid on portable radiographs, when to repeat a study or additional views). We asked the responsible section to discuss what criteria they wanted to use in order to give consistent guidance to technologists



Conclusions

- ▶ To increase image QA participation, we needed to make it painless to submit issues
- ▶ A PACS-integrated image QA submission tool minimally disrupted radiologist's workflow
- ▶ This resulted in a dramatic increase in the number of submitted issues and number of participating radiologists
- ▶ The rise in the rate of QA issues reflects an increase in participation, NOT a reflection of worse system performance
- ▶ We now have a much more accurate view into our imaging quality and can take appropriate steps to improve

