Changing Horses in Midstream – Real World Experience with Switching Electronic Medical Records at Midnight

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Conflict of Interest Statement

NONE

What is an Electronic Medical Record (EMR) anyway?

- Is it just a digital equivalent of a paper chart with history, test results, diagnoses and treatment viewed on a screen?

As defined, it is just that – single practice, single device, and just history, tests, diagnoses, treatment

It really needs to offer even more…

- Electronic Medical Record vs Electronic Health Record

Add portability, accessibility from multiple locations/providers and even more

- Personal Health Records

An EHR but accessed and managed by patients

And that "even more…' includes:

- Physician access to patient information

- Access to new and past test results among providers in multiple care settings

- Computerized provider order entry

- Computerized decision-support systems to prevent drug interactions and improve compliance with best practices

- Secure electronic communication among providers and patients

- Patient access to health records, disease management tools, and health information resources

- Computerized administration processes, such as scheduling systems

- Standards-based electronic data storage and reporting for patient safety and disease surveillance efforts

Easier said than done…

- High capital cost and insufficient return on investment (esp. for small practices and safety net providers)

- Underestimation of the organizational capabilities and change management required

- Failure to redesign clinical process and workflow to incorporate the technology systems

- Concern that systems will become obsolete

- Lack of skilled resources for implementation and support

- Concern regarding negative unintended consequences of technology

Unintended Consequences

- *Unexpected benefit*: A positive unexpected benefit *(luck, serendipity or a windfall)*

- *Unexpected drawback*: An unexpected detriment occurring in addition to the desired effect of the policy (e.g., while irrigation schemes provide people with water for agriculture, they can increase waterborne diseases that have devastating health effects, such as schistosomiasis in Egypt after Aswan dam)

- *Perverse result*: A perverse effect contrary to what was originally intended *(when an intended solution makes a problem worse, 'backfire')*

  The **law of unintended consequences** *has come to be used as a warning that an intervention in a complex system tends to create unanticipated and often undesirable outcomes*

The Mayo EHR Story

- Paper records ~ early 1900's

- Computer based test results ~ early 1990's

- Computer based notes – gradual transition from paper to digital - 1995 – 1998

- Computerized orders – phased in from 1995 onwards

- Digital Imaging - limited viewing to full conversion ~from 1996

- SYNTHESIS – Browser/aggregator front end 2005

And then the problems…

- Patchwork of upgrades, solutions

- Not 'intelligent'

- Shrinking support infrastructure

- End-of-life of core systems

2016
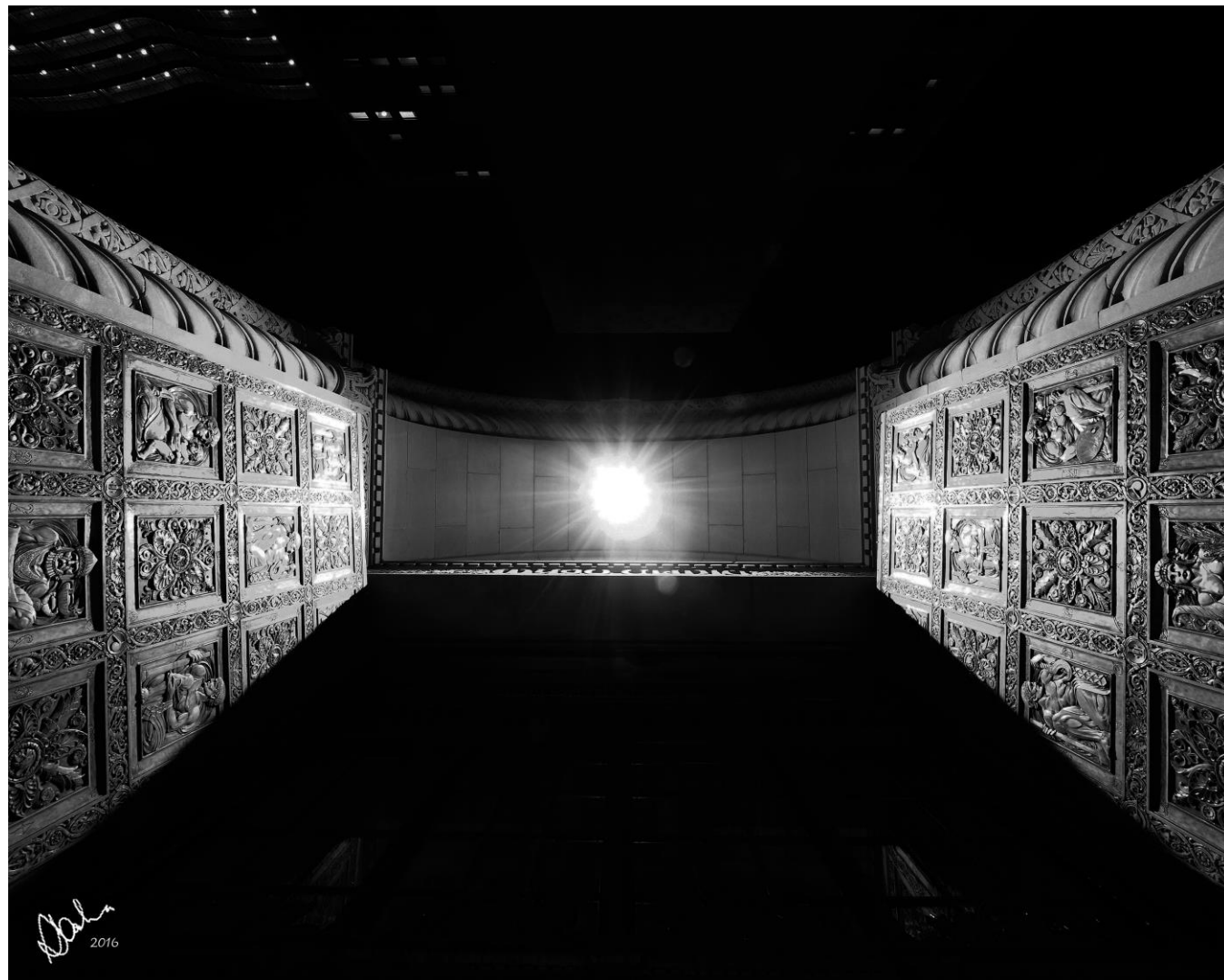
Henry Stanley Plummer, MD
(Plummer-Vinson syndrome, Plummer's nails, Plummer's disease)

- Joined Mayo brothers 1901

- Developed first integrated, patient-centered medical record

- Pneumatic tube system for moving files between floors and buildings

- Color-coded status lights outside examination rooms

Architect of the modern medical practice

Plummer Project

- EMR Task Force – 2009-10
  - Focus on interoperability
    - Two core EMR vendors, multiple specialty systems
  - Formed Practice Convergence Council under Clinical Practice Committee

- EMR Direction Task Force – 2013
  - Pursue a converged single EMR for all Mayo Clinic sites

Journey to Plummer

- EMR Selection Task Force: 2014
  - Selection of Epic as single instance, converged EHR/RCM

- Approval Feb 2015
  - Confirm Epic selection
  - Approve implementation strategy
  - Approx. $1B project
    - Majority of cost is Mayo Clinic staff, implementation
    - Initially 52 major systems identified for "sun-setting"
    - After full scope review > 200 major systems decommissioned

Inpatient

Prelude Registration/ADT
Cadence Scheduling
Health Info Mgmt (HIM)
EpicCare Clinical System
- **EMR**
- **Clinician Order Entry**
- **Decision Support**
- **Results Review**
- **Clinical Documentation**
- **MAR**
- **Rover Barcoding**
- **Clinical Pathways**
- **Care Plans & Education**
- **Infection Control**
- **Clinical Case Management**
- **ICU**
- **Long Term Acute Care**

Willow Inpatient *Pharmacy*

Ambulatory

Prelude Registration
Cadence Scheduling
Call Management/CRM
EpicCare EHR
- **Charting**
- **Clinician Order Entry**
- **e-Prescribing**
- **Decision Support**
- **Results Review**
- **Coding & Benefits**

Nurse Triage
Willow Ambulatory *Pharmacy*
Welcome Patient Check-in

Pop Health & Analytics

Healthy Planet *Population Health/ACO/CINs*
Cogito Analytics
- **Dashboards**
- **Reporting**
- **Analytics**
- **Enterprise Data Warehouse**

Benchmarking
Epic Earth *Collaboration*

Access & Rev Cycle

Resolute Hospital Billing
Resolute Professional Billing
Charge Router
Eligibility
Referrals
Contract Modeling
Financial Assistance
Patient Estimates

Health Plans

Enrollment/Eligibility
Claims/Capitation
Utilization Management
Premium Billing
PlanLink

Patient Portals

MyChart *Shared EMR for patients*
MyChart Bedside *for hospital patients*
MyChart Virtual Care *chronic disease mgmt*
MyChart Health Coach *promotes wellness*
Lucy *Free-standing PHR*

Clinician mobile

Haiku *for smartphone*
Canto *for tablet*
Limerick *for watch*

One Unified Platform
POPULATION HEALTH
ACCESS · CLINICAL · REVENUE
AMBULATORY
INPATIENT
SOCIAL CARE
HEALTH PLAN
PATIENT ENGAGEMENT
EPIC SOFTWARE

Specialties

OpTime *OR Management*
Anesthesia
ASAP *Emergency Dept*
Beaker *Lab*
Radiant *Radiology*
Beacon *Oncology*
Cupid *Cardiology*
Stork *OB Labor/Delivery*
Kaleidoscope *Ophthalmology*
Phoenix *Transplant*
Bones *Orthopaedics*
Wisdom *Dental*

Education

Supervisory support for Attendings
Residency workflows
Medical student training

Research

Patient Enrollment
Research Analytics
Research Billing
CTMS Interface

Telemedicine

Video visits
Specialty consults
Remote interpreters
Care Team member
Pediatric distance care
Urgent help (trauma)

Telestroke
Telepsych
Remote monitoring
ICU / bed monitoring
Virtual rounds
Virtual beds

Interoperability

Community Connect
EpicCare Link
Care Everywhere
Share Everywhere
Lucy

Post-Acute & Social Care

Home Health & Hospice
Long Term Care
Community Care
Child Welfare
Behavioral Health
**Schools**

Strategic Objectives

- An EHR/RCM platform that will support and drive practice convergence (e.g. >450 converged inpatient order sets)

- Efficiency to implement innovation and enhancements with a converged EHR platform (e.g. common best practice alerts, single charge description master)

- Efficiencies gained through a single EHR for information and transactions

- Operational efficiencies and work-sharing gains by standardization of the platform and workflows (e.g. work from any site)

- Establishment of a formal and significant collaboration/innovation with a world leader in the EHR field (Joint Strategic Partnership with Epic)

Journey to Plummer

- Constant "discovery"
  - Adjustments to practice
  - Adherence to convergence strategy
  - Examples: Variable locations of stored results, complex outside relationships, complexity of Charge Data Master (CDM) consolidation (48 CDM, 800k items reduced to 20k)

- Focus on change management
  - Formalized plan: Awareness, Desire, Knowledge, Ability, Reinforcement (ADKAR)

- 2016 Focus on build and testing

- 2017 Legacy data conversion, first two implementations

Design by Subject Matter Experts

- Six collaborative build sessions July – December 2015
    - \>7,000 total participants
    - \>2,200 design decisions
    - All sites participating

- New paradigm; speed in decision making
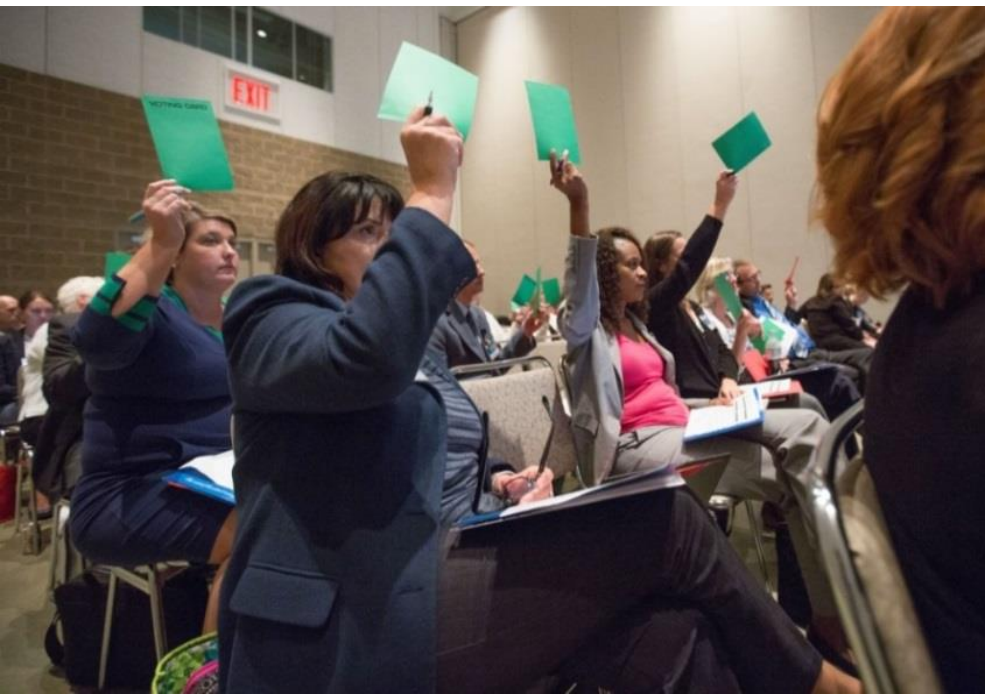
Mayo Clinic
Plummer Project By the Numbers

TECHNOLOGY / MODERNIZATION COST

INVESTING AN ESTIMATED $1.5 BILLION FOR A MULTI-YEAR TECHNOLOGY & MODERNIZATION PROJECT THAT INCLUDES THE PLUMMER PROJECT, TECHNOLOGY AND PERSONNEL FOR ADVANCING PATIENT CARE, UPGRADING THE DATA NETWORK, AND IMPROVING INFORMATION SECURITY.

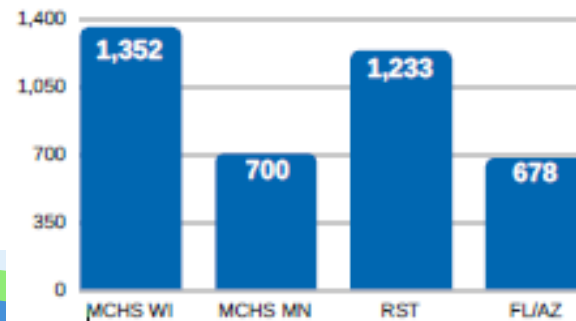**1,352** Project length in days

460+ Core team members

LEGACY SYSTEMS SUNSET

287 Systems

SITES INVOLVED

22 Hospitals

80 Clinics

3,379 Beds

TRAINING

52,367 End Users

171,555 End User Devices

223 Classrooms + Labs

INPATIENTS AT CUTOVER

MCHS WI	MCHS MN	RST	FL/AZ
293	230	890	409

GO-LIVE

Issues submitted on go-live day

MCHS WI	MCHS MN	RST	FL/AZ
1,352	700	1,233	678
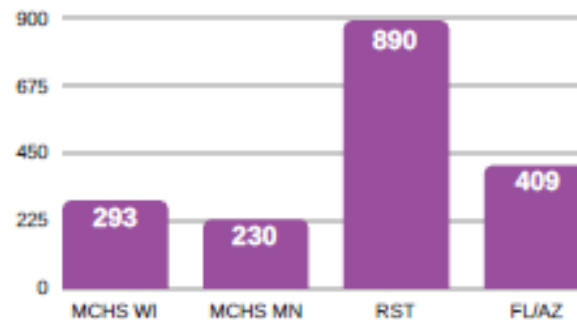
Issues submitted on the first full business day after go-live

MCHS WI	MCHS MN	RST	FL/AZ
2,827	1,493	3,023	1,593

WHAT ABOUT THE PEOPLE?

398 Credentialed Trainers

~40 Principal Trainers

6,581 Super Users

840 Site Readiness Owners

**988** Charge Champions

785 Provider Advocates

5,532 Readiness Agents

Implementation

- MCHS WI July 8, 2017
  - 7 hospitals, 20 clinics; 9,000 users
  - 293 inpatients at cut-over, 6 hour downtime
  - 4 week stabilization period

- MCHS MN November 4, 2017
  - 11 hospitals, 40 clinics; 7500 users
  - 230 inpatients at cut over, 4 hour downtime
  - 2 week stabilization period (command center closed 10 days early)

- 13 externally dependent projects at same go-live
  - e.g. Single Sign-On, Radiology image viewer, SoftLab, Documents Viewer (Onbase)

- Rochester: 26,000 users, 1200 inpatients

- AZ/FL 9,800 users, 575 beds

Week of April 15 Rochester data conversions (750,000 orders)
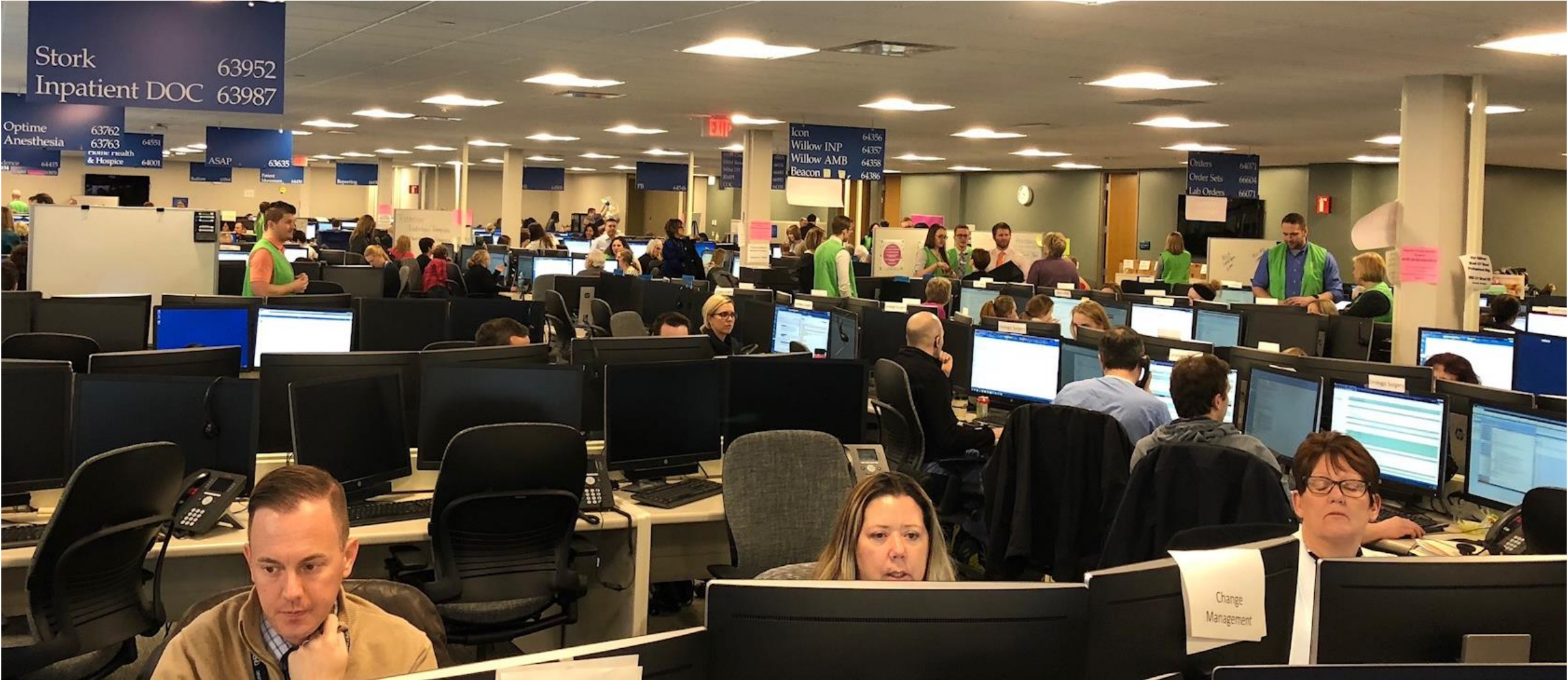
Contract support check in for Rochester

Command Center

Rochester Implementation

- Go-live 4 am, May 5

- Core command center 500 staff

- Go-live Epic support 1400

- Contract support 1500

- Mayo Super Users 2200

- Increase in concurrent users to 14,000 (total 42,000)

Early Go Live Successes

- System stable

- Effective command center structure
  - Communication among key stakeholders and leadership
  - Response time to correct issues

- Hospital and surgical practices quickly up to speed

- Outpatient back to full capacity third week

- On time and budget

- Epic support and responsiveness

- Epic and Deloitte evaluation: successful go live

Prospectively Monitored Implementation Metrics

- No attributable patient harm events during go-live and stabilization

- Outpatients, admissions, length of stay, and procedure volume to baseline by end of fourth week

- Call center wait times and abandonment within acceptable deviation from baseline

- Queuing at high volume desk back to baseline by end of second week

- 90% of patients with appointments within the first two months have records abstracted

- Staff utilization functioning at level that allowed majority of contracted "at-the-elbow" support to be dismissed within two weeks

- Resolution of incident tickets at acceptable levels during stabilization

- >50% of revenue cycle go-live metrics in top quartile or within guard rails by 20 weeks post-go-live; patient revenue adjusted for volume restored to baseline

Rochester Highlights

- No patient harm events

- Limited patient experience complaints

- Campus command center and regional zone structure, direct physician support line

- Super users, training, change readiness

- Ownership of implementation by the practice and business

- Limited security and device issues

- No negative impacts to MCHS

Help Desk Tickets first month
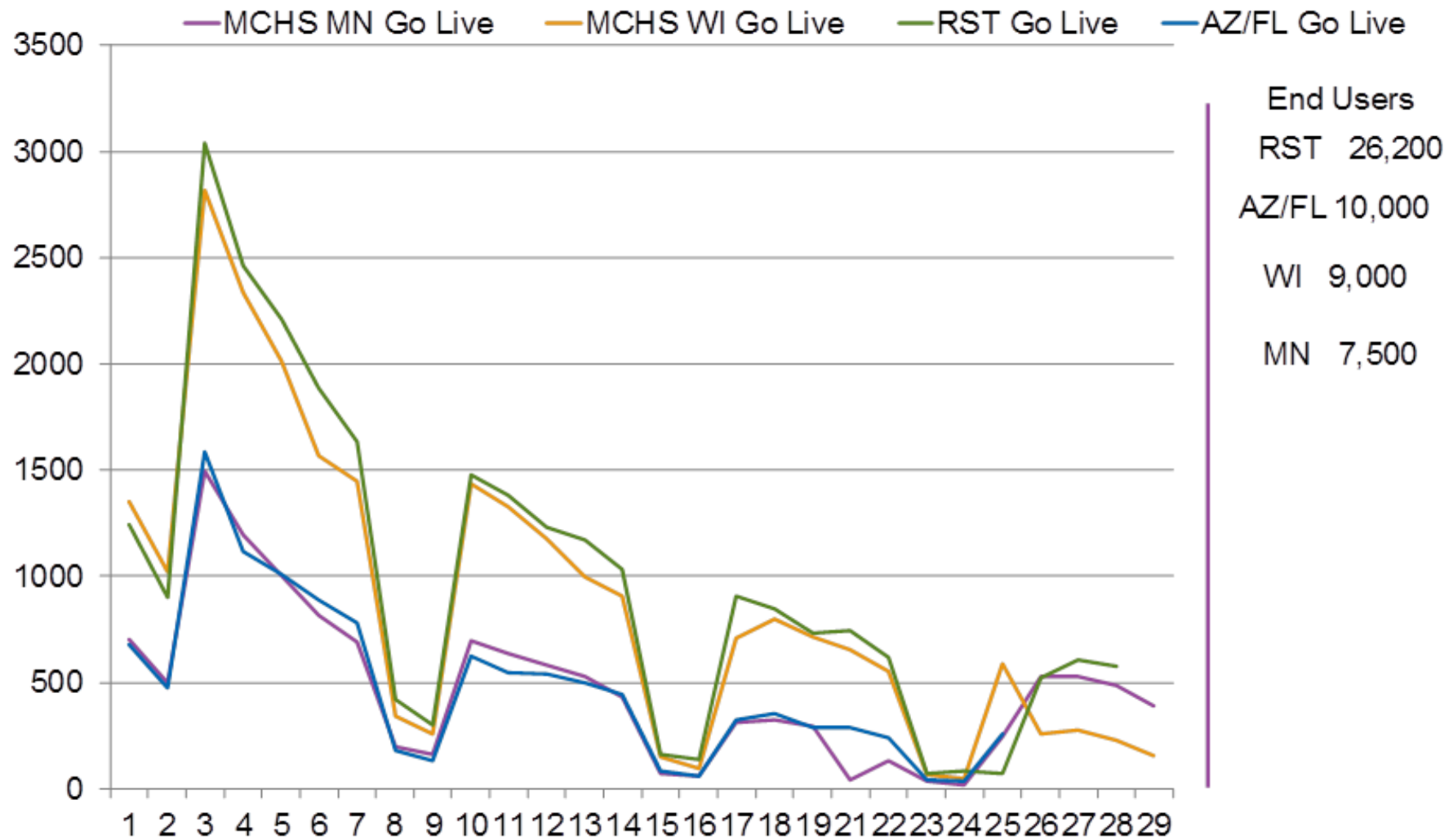
Rochester Go-Live: Taking Stock

- Successfully completed largest and most complex single instance Epic go live
- Trained over 26,200 Rochester end users.
- Now supporting ~ 43,000 end users
- Countless new workflows.
- 110 new interfaces.
- Connected 85,000 end user devices.
- Replaced over 200 applications with Epic
- Conducted a real "switch and stay" Disaster Recovery
- For the first time, allowed MCHS and Rochester users to work from a common EHR and RCM system

Dictation utilization
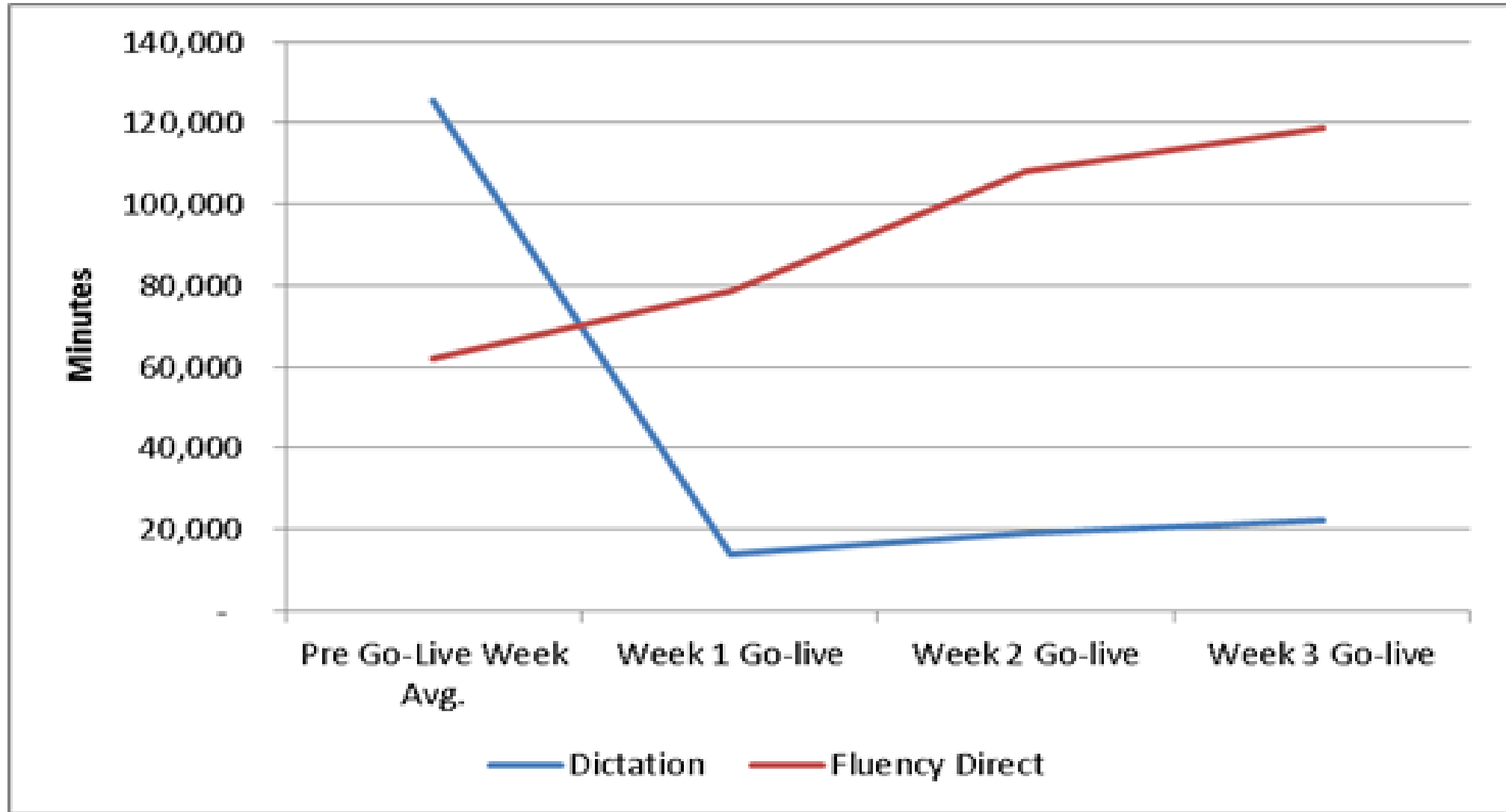
Early Provider Challenges

- Data conversion "catch up load"; manual scheduling conversions

- Phases of care, patient movement (procedural areas), encounters

- Pharmacy dispensing logic (Epic to Pyxis systems)

- Laboratory orders mapping (Epic to SoftLab); ID barcodes

- Charge champion adoption/learning process

- Rover mobile device adoption

- Anxiety of "ATE" support reduction after second week

- Kiosk optimization and utilization

- Facility changes close to go live

- Ongoing education, support long term

Early Provider Challenges

- Management of scheduling work queues

- Lines at check in first days of go live

- Telecommunication challenges: wait times, abandonment rates

- Need for registration training

- Abstraction completion from legacy systems

- Chart lock-outs - two people in same documentation area

- Complex, high-acuity hospital-based outpatient departments (bone marrow transplant, interventional radiology, infusion therapy center)

- AM Admit / OR status board, patient movement in procedural areas

Ongoing Provider Challenges

- Understanding of new workflows and converged content

- Proper charge capture and closure of encounters

- In Basket management

- Problem list management

- Physician order entry

- Utilization of "pended" or proxy orders

- Balancing convergence with needs of primary vs specialty care

- Hospital discharge process

- Integration of dictation and documentation; multiple options

Areas for optimization

Outpatient Practice

- Orders, Scheduling

- InBasket Management

- Documentation

- User Efficiency/ Practice Performance Metrics

Hospital Practice

- Medication Management

- Specimen Workflows

- Discharge Process

Surgical and Procedural Practice

- Orders and Scheduling

- Pre-operative Order Sets and Workflows

- Operative Notes (editing abilities), Teaching Physician Rule

- History and Physical (H&P), and Admission Notes

- Chart Locks

Research Changes with Epic

Before

- No Research information on clinical encounter in EMR
- Few Electronic Research Protocol Order Sets
- No participant tracking in the EMR
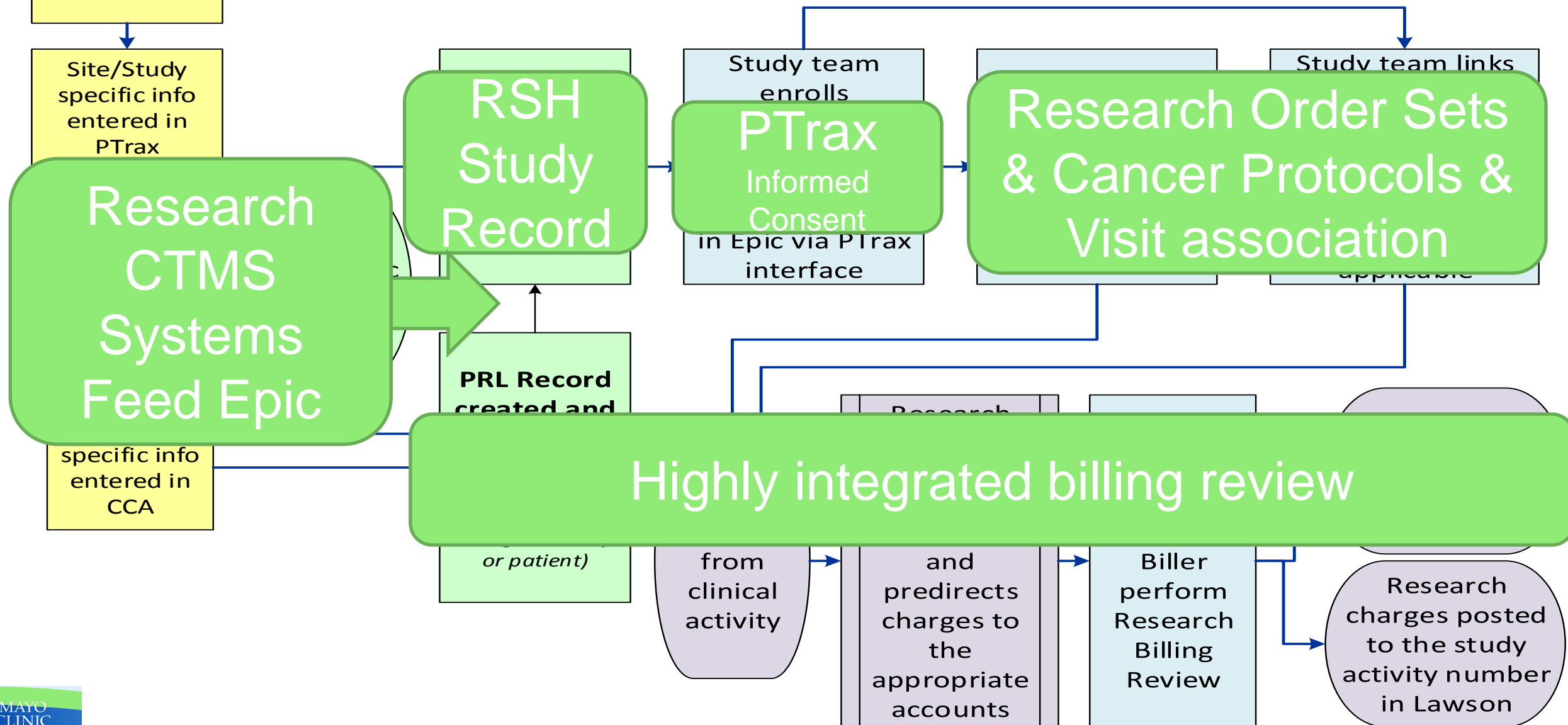- Manual billing review process

After

- Study specific data associated with clinical encounter(s)
- Many Research Protocol Order Sets
- Real time participant tracking
- Systematic billing review, highly auditable

Epic Research Process Overview

Study specific Info entered in IRBe

Site/Study specific info entered in PTrax

Research CTMS Systems Feed Epic

specific info entered in CCA

RSH Study Record

PRL Record created and *(or patient)*

PTrax Informed Consent

Study team enrolls in Epic via PTrax interface

Research Order Sets & Cancer Protocols & Visit association

Study team links applicable

Highly integrated billing review

Research from clinical activity

and predirects charges to the appropriate accounts

Biller perform Research Billing Review

Research charges posted to the study activity number in Lawson

MAYO CLINIC

Key Gains for Research

- Integrated environment between Research and Clinical Practice

- Research consent tightly managed and used in the EMR clinical environment

- Stronger ability to match patients to trials

- Quality of care via Order Sets and Beacon Protocols (Cancer)

- Systematic billing review process with strong audit features

- Research Record vital data element in Epic links all aspects of the research protocol

Lessons learned

- Value of Practice Convergence initiatives prior to Plummer Project

- Formal process with a rigorously tracked follow-up plan enhanced successive implementations

- Complex workflows for high-acuity patients with significant parallel processing were difficult for staff to master at go-live; required significant training, and post go-live follow-up

- Formal change management program essential in managing a massive level of change caused by EHR/RCM replacement.

- Practice areas not functioning at high performance levels prior to go-live struggled

- Massive code changes needed to replicate or mirror previous work flows
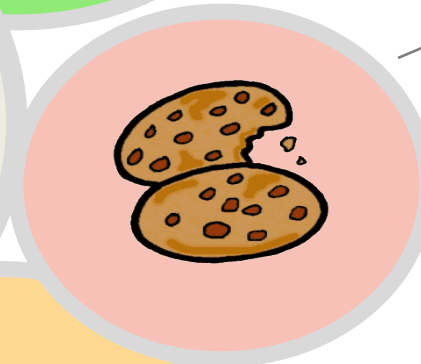
Rochester Go-live Catering
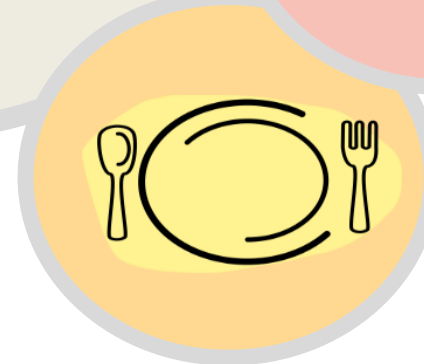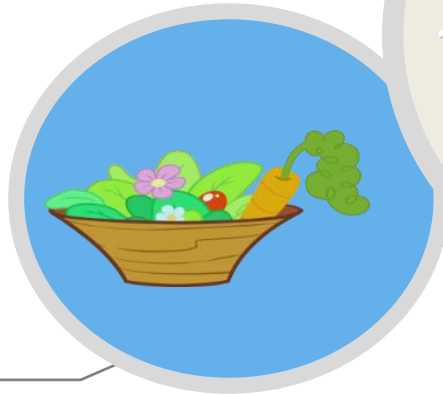
1000 kg Eggs
500 kg Bacon

64,000 Cups of Coffee
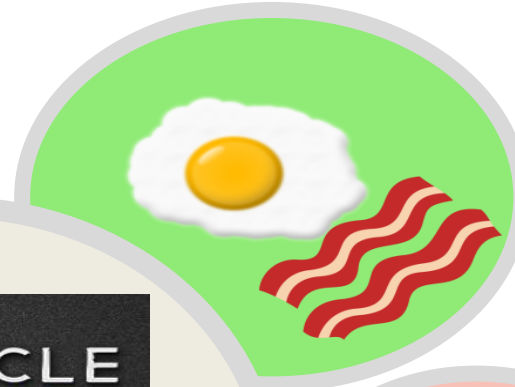
Over 10,000 Cookies

PINNACLE CATERING

Pinnacle Catering served over 1200 participants for Lunch on our busiest day of Go-live

800 kg Lettuce

40,000 Dinner Plates

Does the EHR provably improve patient care?

1.Yes

2. No

3. It does not matter as either way that is what we have to do