

Using Information Technology to Drive Patient Care: Case Study in EHR Implementation

With Help From Monkeys, Mice, and Penguins

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MIT Medical
Cambridge, MA
March 2007



MIT Medical



Staff

- 122 Clinical Staff (Nearly all salaried)
- 38 Administrative staff
- 121 Support Staff

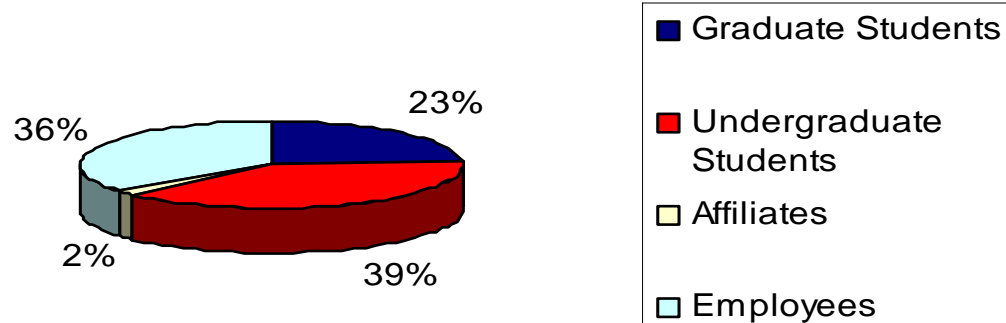
Scope of services

- Internal Medicine and Subspecialties
 - Center for Health Promotion and Wellness
 - Dental / Oral Surgery
 - General Surgery and Subspecialties / Eye Service
 - Mental Health
 - Nutrition
 - Obstetrics / Gynecology
 - Pediatrics / Adolescent medicine
 - Urgent Care
 - Worksite Health / Environmental Med / Health Screen
 - On Site: •Laboratory •Radiology •Pharmacy
-

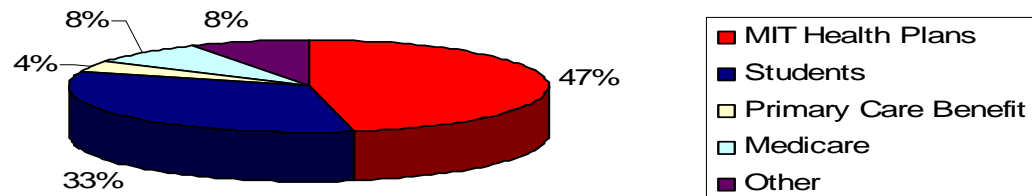


Demographics / Visits

Total Population 20,259



131,670 Visits to MIT Medical 2006





EMR Implementation: Major Goals



- Improve Care
 - Control Costs
 - Increase Productivity
 - Increase clinician satisfaction
 - Increase patient satisfaction (Make clinical information available to the patient)
 - Meet Compliance Guidelines
 - Interface With Practice Management System
-

Our Journey Began in Late 1997





Stages of Adopting to Technology

- Duplication Phase Also Known as the Please Don't Spank Me Phase
 - Substitution Phase
 - Innovation Phase
 - Transformation Phase
-

November 1999

Stage 1 - Duplication

February 2001

Stage 2 - Substitution

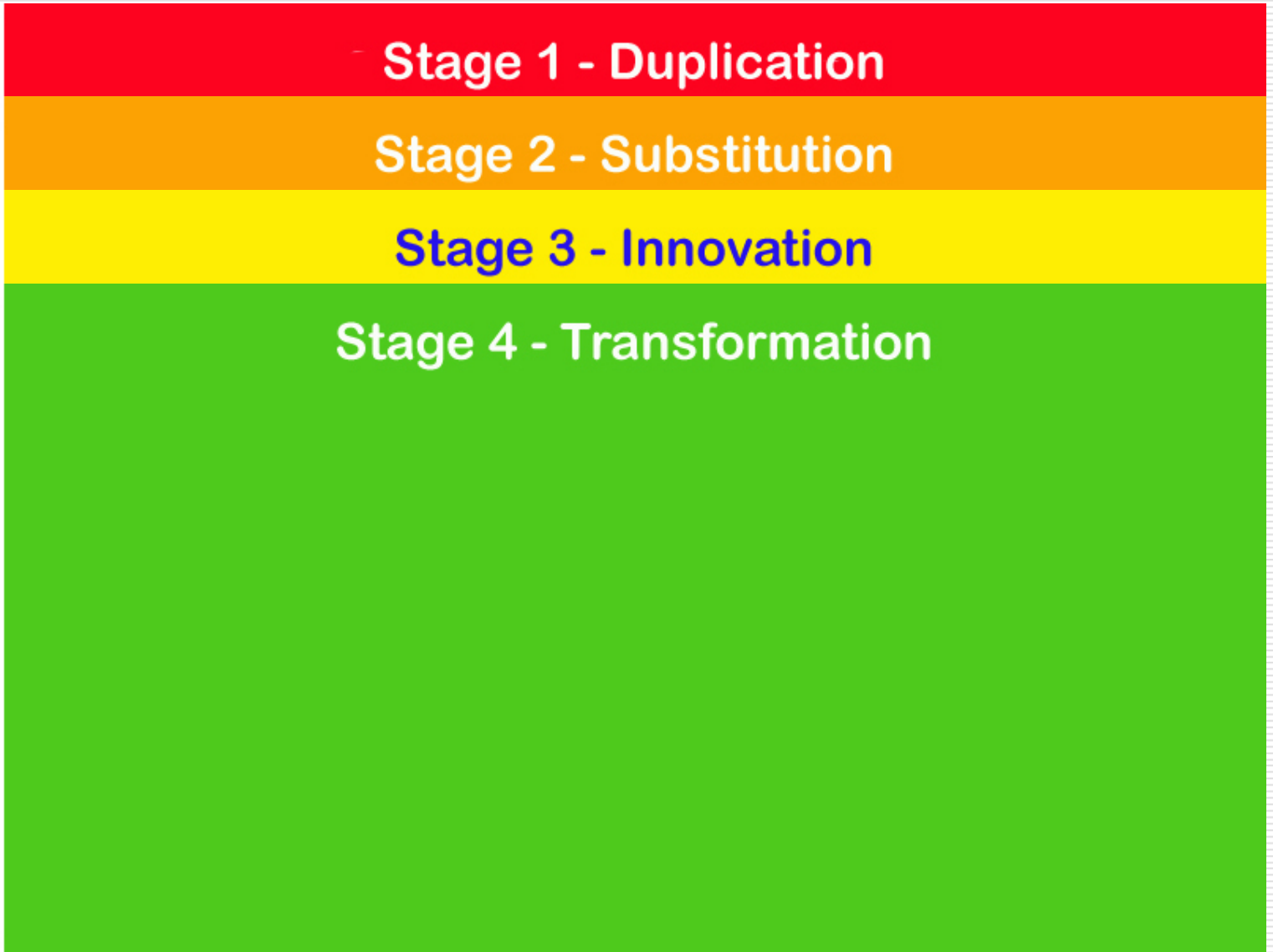
March 2003

Stage 3 - Innovation

July 2004

Stage 4 - Transformation

Current



Duplication Via Building a Repository (beginning Late 1999)



- Stock the Water!
 - Data Repository
 - Dictations
 - Lab / X-ray / Cytology
 - Pharmacy Interface (Pharm -> EMR)
 - Provider Schedules
 - Patient Demographics
 - Duplicate The Existing Paper Record

Duplication Phase at MIT Medical



Another Example of the Duplication Phase

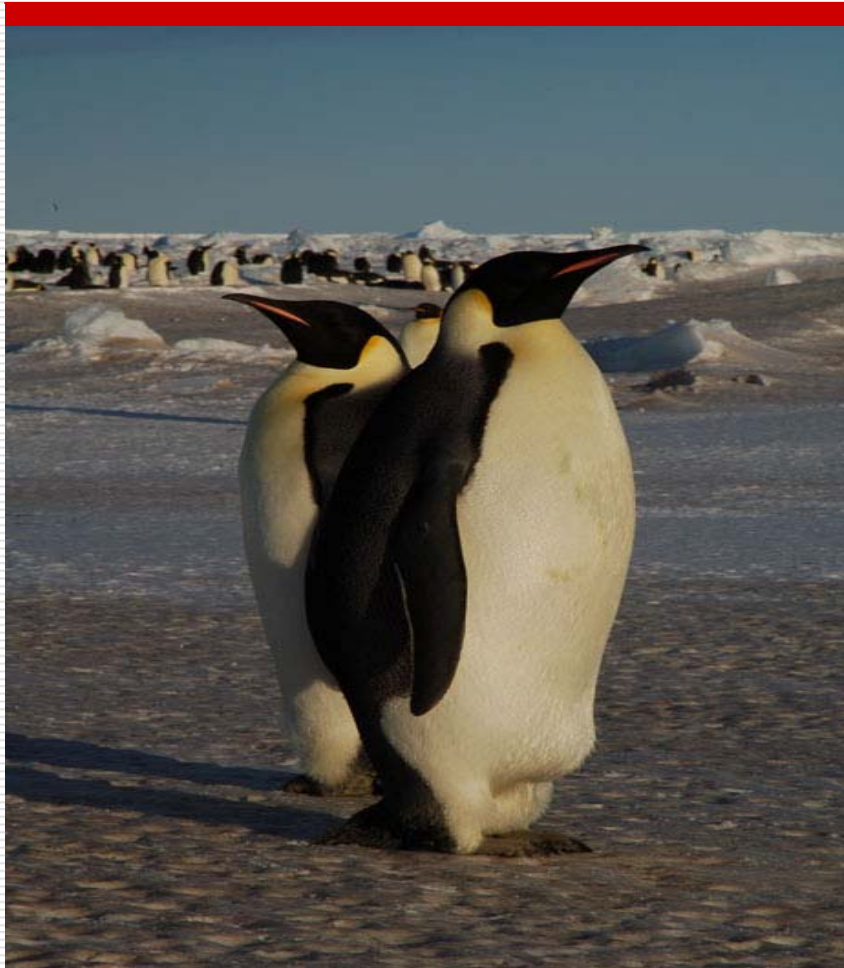




Substitution Phase Begins Q1 2001

- Phone Messages into the EMR
 - No paper messages
 - No phone notes filed in the paper chart
 - Interoffice communications
 - Referral Note
 - Specialist cc
 - Follow up from Urgent Care
 - E-mail
 - Copy to EMR, no paper note
-

No Substitution without a Physician Champion



- ❑ Any organization that wants to implement an EHR needs a Physician Champion
- ❑ Plus a strong Medical Director

A New Paradigm



- Clinician Interacts With EMR
 - Need to look for Tasks
 - Retrieve clinical information here!
 - Use EMR to communicate
 - Document all patient interactions in the EMR
-

Adoption



- No Choice
 - Medical Director Mandate
 - Took Some Getting Used To
 - No Rebellion
 - Set A Path To Widespread EMR Use
 - Grumpy Old Men Will Go For A Swim!
-

Our Medical Director meets with a reluctant clinician



An Opportunity to Sweep Away Bad Habits



We Realized These Are Bad For Our Health



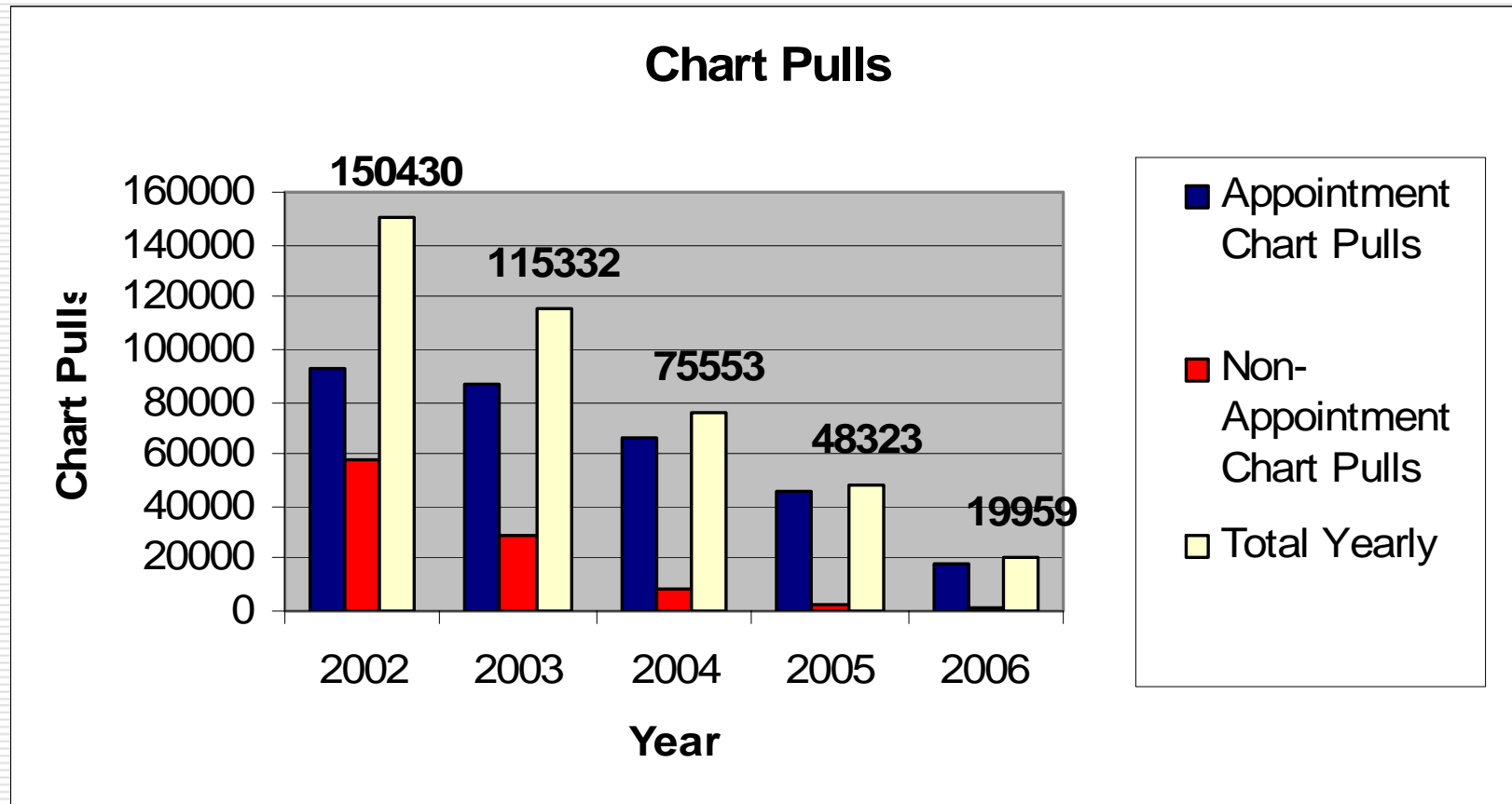
- Deep fried outer shell
- Loaded with "trans" fatty acids
- Red #5 Dye
- Artificial Flavoring
- Lots of preservatives
- High in sodium

And...The Paper Charts Were Very Difficult To Transport





87% Reduction in Total Chart Pulls



Innovation Phase Begins

March 2003



- Laboratory and Radiology results electronically verified by clinician
 - Electronic Prescriptions
 - Began scanning outside consults, diagnostic test results, and older notes
 - One electronically signed note per visit required without printing for the paper chart.
 - Remote access added
-

Result Verification Made Easy



Results Verification [Personalize](#)

View: Last Updated: 02/12/2007 2:49 PM

Patient	Results (4 of 4 selected)	Annotations																																																												
	<p>Encounter: Appointment,08 Feb 2007</p> <p>Hypertension</p> <p><input checked="" type="checkbox"/> COMPREHENSIVE PANEL W/ REFLEX TO DBIL COMP <input type="button" value="Print"/> SHEIN,DAVID 09 Feb 2007 11:49 AM Final</p> <table border="1"> <thead> <tr> <th>Test</th> <th>Result</th> <th>Flag</th> <th>Ref. Range</th> </tr> </thead> <tbody> <tr> <td>B.U.N.</td> <td>25 MG/DL</td> <td>Abn H</td> <td>7-24</td> </tr> <tr> <td>CREATININE</td> <td>1.1 MG/DL</td> <td></td> <td>0.6-1.3</td> </tr> <tr> <td>GLUCOSE</td> <td>82 MG/DL</td> <td></td> <td>70-110</td> </tr> <tr> <td>ALBUMIN</td> <td>4.1 G/DL</td> <td></td> <td>3.4-5.0</td> </tr> <tr> <td>CALCIUM</td> <td>9.0 MG/DL</td> <td></td> <td>8.5-10.5</td> </tr> <tr> <td>ALKALINE PHOSPHATASE</td> <td>108 U/L</td> <td></td> <td>40-136</td> </tr> <tr> <td>SGOT(AST)</td> <td>17 U/L</td> <td></td> <td>10-37</td> </tr> <tr> <td>TOTAL BILIRUBIN</td> <td>1.9 MG/DL</td> <td>Abn H</td> <td>0.0-1.0</td> </tr> <tr> <td>SGPT(ALT)</td> <td>39 U/L</td> <td></td> <td>20-65</td> </tr> <tr> <td>SODIUM</td> <td>146 MMOL/L</td> <td>Abn H</td> <td>135-145</td> </tr> <tr> <td>POTASSIUM</td> <td>4.2 MMOL/L</td> <td></td> <td>3.6-5.2</td> </tr> <tr> <td>CHLORIDE</td> <td>105 MMOL/L</td> <td></td> <td>98-110</td> </tr> <tr> <td>TOTAL CO2</td> <td>33 MMOL/L</td> <td>Abn H</td> <td>21-32</td> </tr> <tr> <td>TOTAL PROTEIN</td> <td>6.9 G/DL</td> <td></td> <td>6.4-8.2</td> </tr> </tbody> </table> <p><input checked="" type="checkbox"/> URINALYSIS W/ REFLEX TO MICROSCOPIC UA <input type="button" value="Print"/> SHEIN,DAVID 09 Feb 2007 11:49 AM Final</p>	Test	Result	Flag	Ref. Range	B.U.N.	25 MG/DL	Abn H	7-24	CREATININE	1.1 MG/DL		0.6-1.3	GLUCOSE	82 MG/DL		70-110	ALBUMIN	4.1 G/DL		3.4-5.0	CALCIUM	9.0 MG/DL		8.5-10.5	ALKALINE PHOSPHATASE	108 U/L		40-136	SGOT(AST)	17 U/L		10-37	TOTAL BILIRUBIN	1.9 MG/DL	Abn H	0.0-1.0	SGPT(ALT)	39 U/L		20-65	SODIUM	146 MMOL/L	Abn H	135-145	POTASSIUM	4.2 MMOL/L		3.6-5.2	CHLORIDE	105 MMOL/L		98-110	TOTAL CO2	33 MMOL/L	Abn H	21-32	TOTAL PROTEIN	6.9 G/DL		6.4-8.2	<p>Annotate Here</p>
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Patient Action: For:

User: good Site: MIT Medical Department Done



Electronic Prescribing

- Two Way Interface With MIT Pharmacy
 - Three-Click Refills
 - Time Saving for Provider, Pharmacy and Patient
 - Error Reduction
 - Formulary Information
 - Cost Saving for Health Plan, Pharmacy and Patient
 - Information To Improve Health Outcomes
 - Drug – Drug Interactions
 - Drug – Allergy Interactions
 - Drug – Disease Interactions
-



Wide Screen

- MIT Clinician
- Homebase
- Schedule
- Tasks
- Chart
- Patient Lists
- Call Process
- User Options
- Printer Defaults

- SnapShot
- Outline
- Problems
- Note
- Demographics
- Appointments
- Meds
- New Rx
- Immun
- Results
- Vitals
- Flowsheets
- Break Glass

New Rx

Rx Benefit: MIT

[Edit](#) [Personalize](#)

Problems	Active	All	Pending Prescriptions	Linked Problems
<input type="checkbox"/> a cough 786.2				
<input type="checkbox"/> abdominal pain 789.00				
<input type="checkbox"/> ABSENT PERICARDIUM 423.8				
<input type="checkbox"/> ADULT PHYSICIAN 12345.00				

New Problem

Problem-I

Medication

- amoxi
- Amoxicill
- Amoxicill
- Atenolol
- Atenolol
- Azmacor
- B-D Ins
- Bactroba
- Beconas
- Benzona

MIT PHARMAC

Confirm
Formulary A

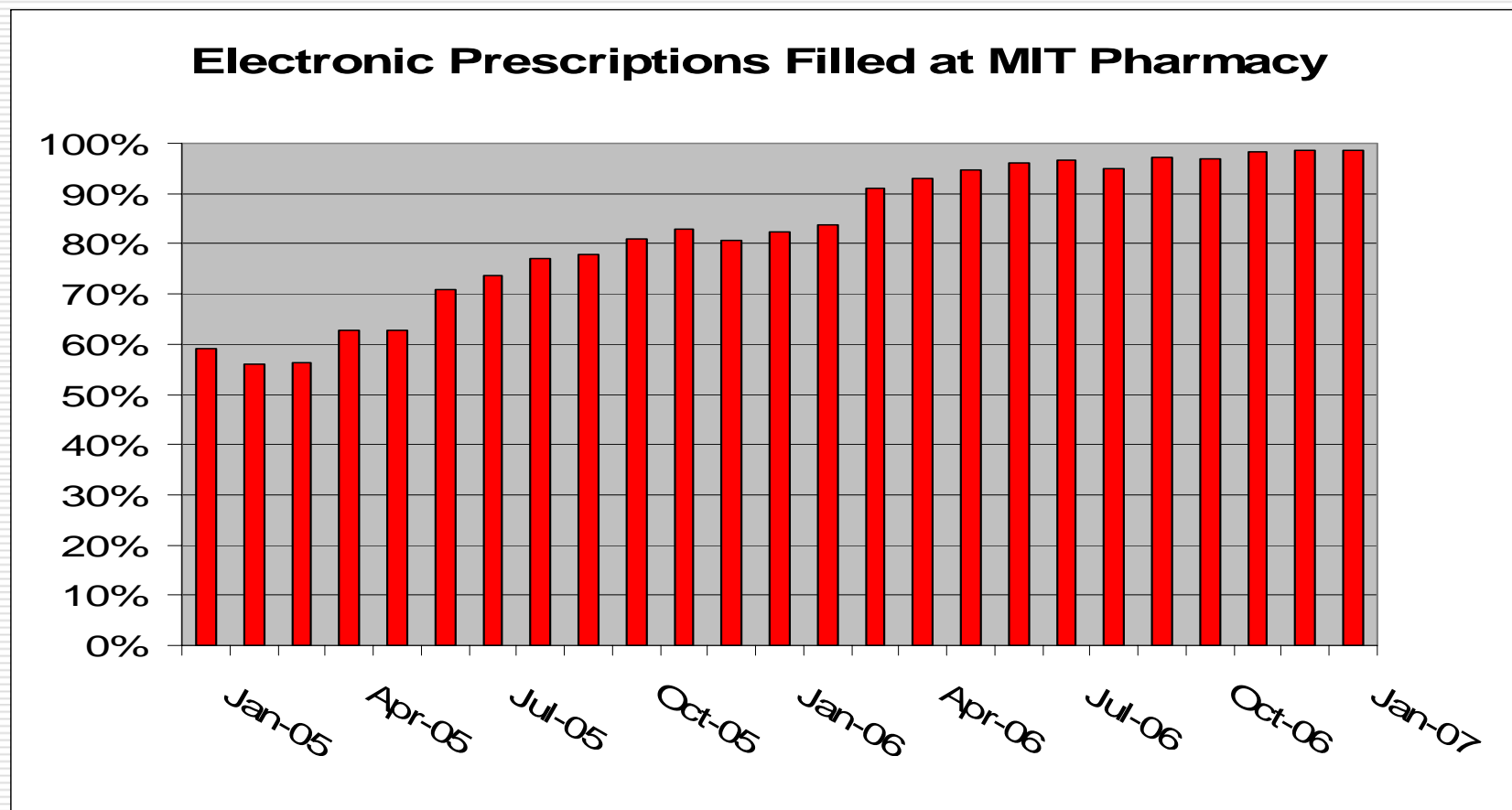
DUR Checking Results -- Web Page Dialog

DUR Messages

Prior Adverse Reactions
 Prescribed drug: [Cephalosporins](#)
 Adverse Reaction(s) have been reported with prior [Amoxicillin](#) administration.
 Symptoms: , [Anaphylaxis](#)

Prescribed drug: [Penicillins](#)
 Symptoms: ,

% Electronic Prescriptions Filled at MIT Pharmacy





Scanning Items into our EHR

- Implementation October 2003
 - No New Papers Filed in Charts from October 15, 2003 ($\rightarrow \infty$)
 - 725,000+ Documents scanned in to date
 - No New Paper Charts
 - Eventually Reduced Staffing
 - 5.5 FTE reduction in medical record staffing
-

Scanned Items Viewed from the EHR



MIT Medical MRN: OTHER: SSN: Sex: Age: DOB: AKA: Phone: Allergy: Directives: Security: PCP: Wide Screen

Select Patient

SnapShot Outline Problems Note Demographics Appointments Meds New Rx Immun Results Vitals Flowsheets Break Glass

MIT Clinician Homebase Schedule Tasks Chart Patient Lists Call Process User Options Printer Defaults Help Settings Tear-off Pause Exit

Outline View: All All Save Settings as Default Print Chart

Rev Chrono Chrono Owner:IDXAdmin,IDX Status:Final - Receipt

Documents

- 10Mar2004 Intoff
- 02Mar2004 PtEmail
- 03Feb2004 E-mail
- 23Jan2004 sReferral
- 23Jan2004 sReferral
- 16Jan2004 sOrthCons
- 16Jan2004 sOrthCons
- 14Jan2004 sBoneDens
- 11Dec2003 OrthoT
- 08Dec2003 76092
- 08Dec2003 sPtLetter
- 21Nov2003 E-mail
- 20Nov2003 OrthoT
- 20Nov2003 Foot 3
- 10Nov2003 Internt
- 30Oct2003 NeuroT
- 14Oct2003 Internt
- 14Oct2003 Phone
- 10Oct2003 sXray
- 10Oct2003 sBoneScan
- 07Oct2003 PAP
- 06Oct2003 Internt
- 06Oct2003 Internt

1 / 1

MASSACHUSETTS GENERAL HOSPITAL **HARVARD MEDICAL SCHOOL**

Department of Orthopaedic Surgery
101 Merrimac Street, 2nd floor
Boston, Massachusetts 02114
Tel: 617 726-1344, Fax: 617 724-7062

ORTHOPAEDIC OFFICE REPORT

NAME OF PATIENT:
MGH UNIT NUMBER:
DATE OF VISIT:
CHIEF COMPLAINT: year-old woman with left foot pain and deformity

HISTORY OF THE PRESENT ILLNESS: At least three months of which she localizes to the second toe She developed sudden pain at foot, and then notice a hammertoe. Her symptoms : tory includes multiple joint p; takes . xxx. She denies any drug alle history, and review formed and documented as pi

PHYSICAL EXAMINATION: On physical examination she is alignment of the left hindfoot. Painless passive motion of the tibio There is a second which is partially cor

Show Audit Show invalid items

New Note... New Task... Invalidate Verify Sign... Print... Fax... Copy Open

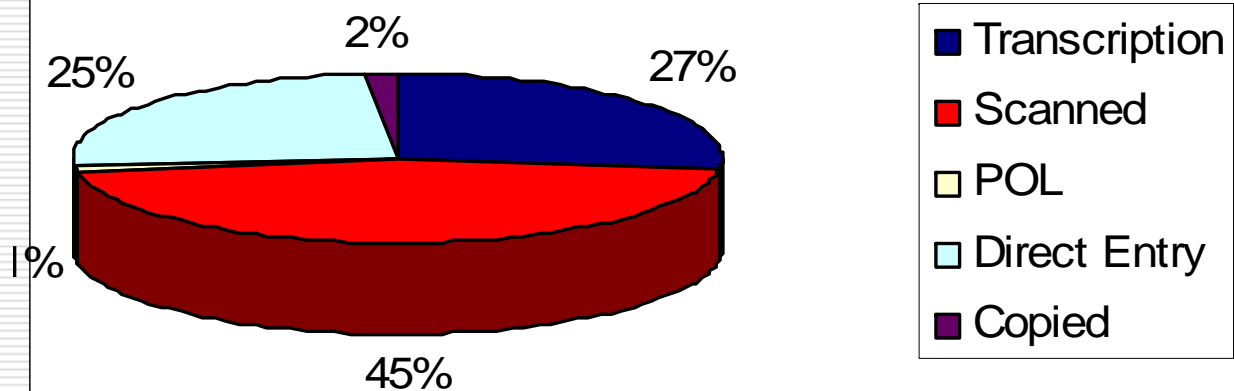
The Remaining Paper Charts Are Much Thinner



Note Types in MIT Medical EHR



299,535 Notes entered into MIT Medical EHR in 2006



Remote Access Not Possible with 1980's High Technology



Further Innovation 2005 Forward

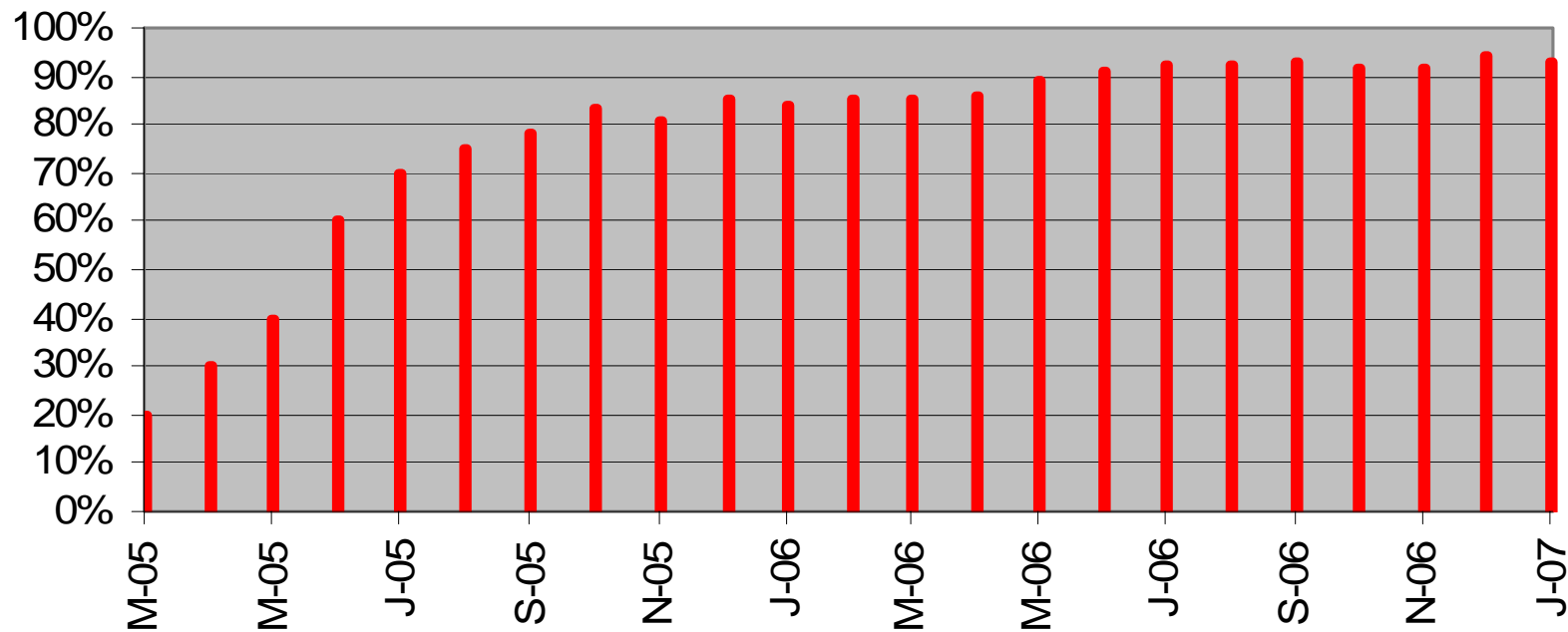


- Problem List becomes more important
 - Orders go mainstream with the addition of Laboratory and Radiology interfaces.
 - Patient Portal comes into operation
 - Significant improvements in dictation procedure
 - Mental Health Department begins using the EHR
-

Direct Order Interface with MIT Laboratory



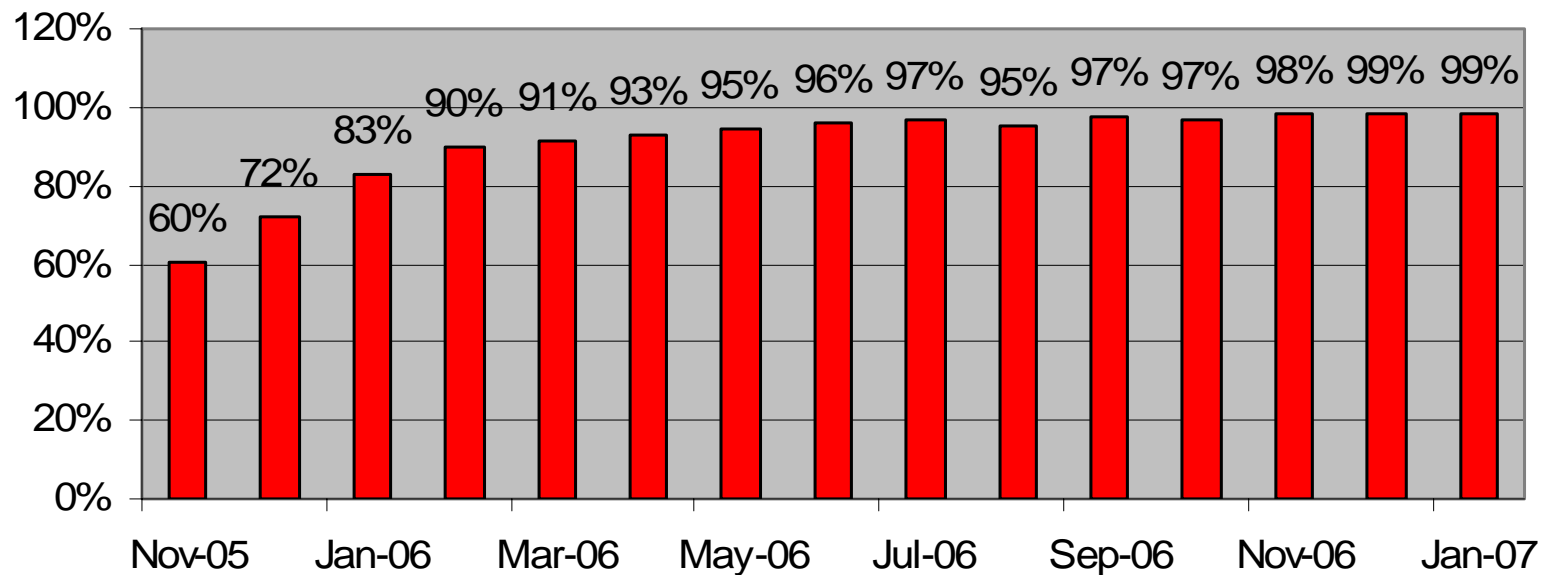
Electronic Laboratory Orders



Direct Order Interface to MIT Medical Radiology System



Electronic Radiology Orders



MIT Medical Patient Portal



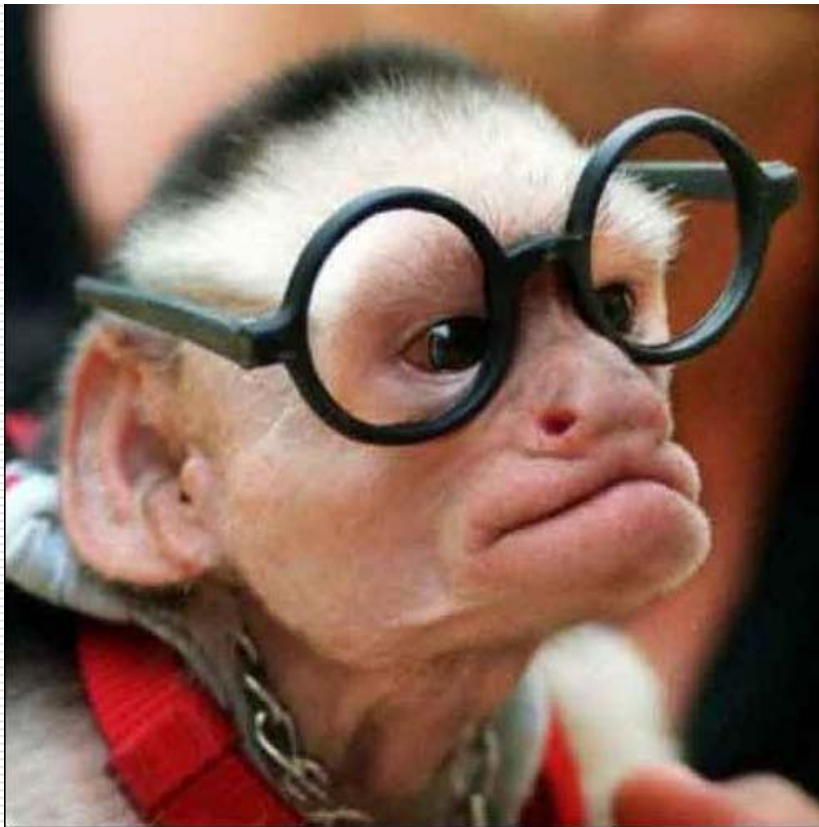
Using our portal patients are able to:

- Exchange secure, encrypted messages with their providers
 - Request new appointments, view past and upcoming appointments
 - Receive automated appointment reminders
 - Request updates to personal information
 - View certain clinical information including:
Allergies, Immunization History and Medications
-

Introducing the "Talking Mouse"



Desktop Dictation has improved clinician satisfaction

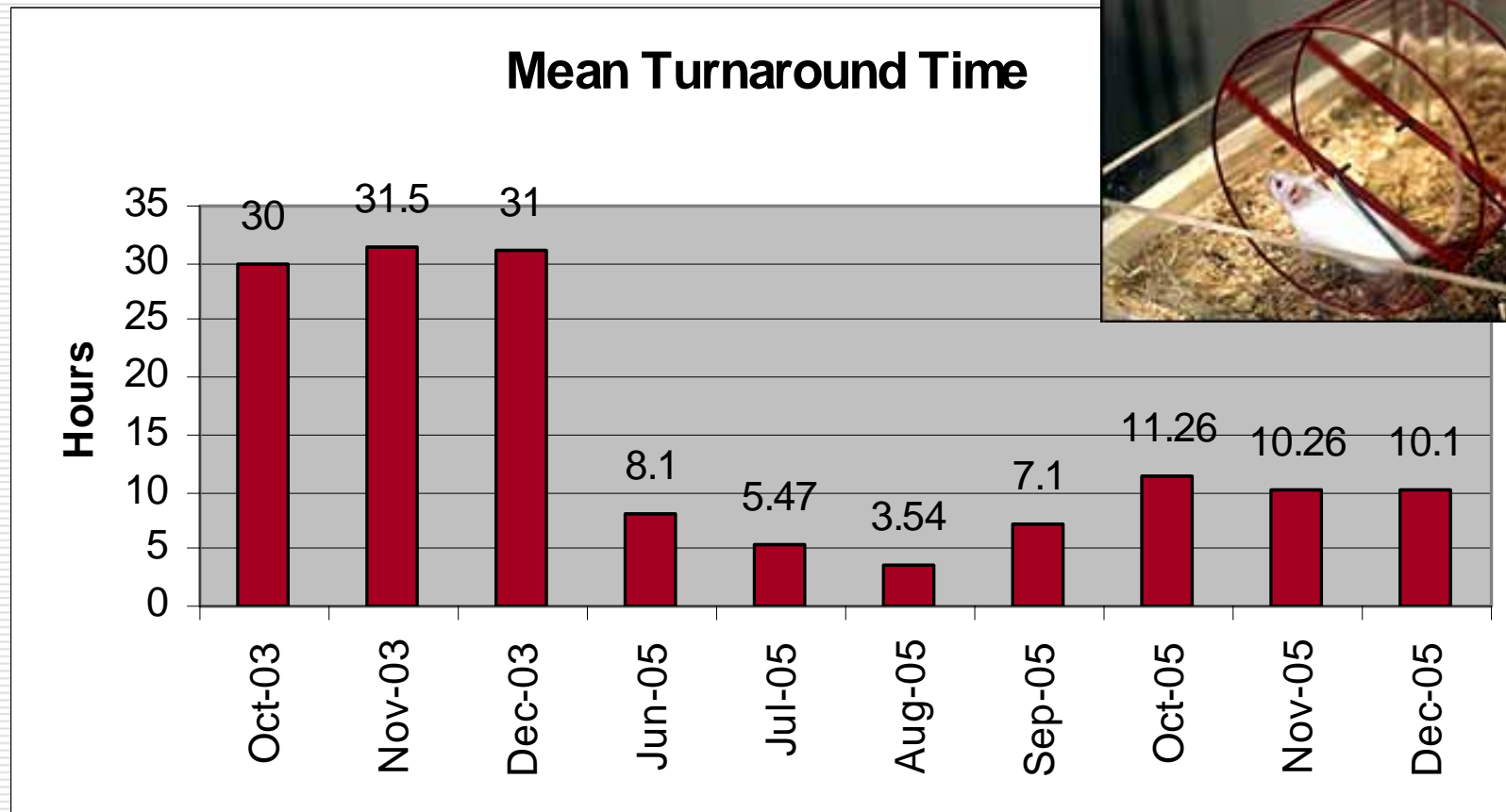


- ❑ No longer chained to a telephone.
- ❑ No need to identify yourself, dictate patient demographics, or punch in work types.
- ❑ Can easily pause for interruptions.
- ❑ Saves about 30 seconds per dictation over using the telephone.
- ❑ Learning is a snap!

A Video Representation of Our Dictation System



Drastic Improvement in Transcription Turnaround Time

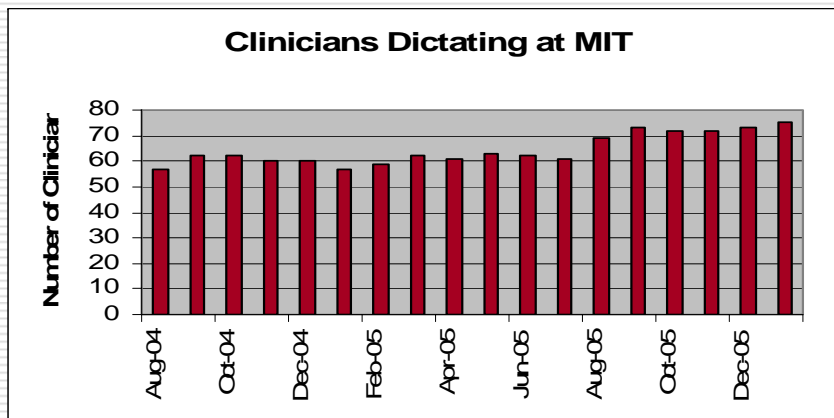
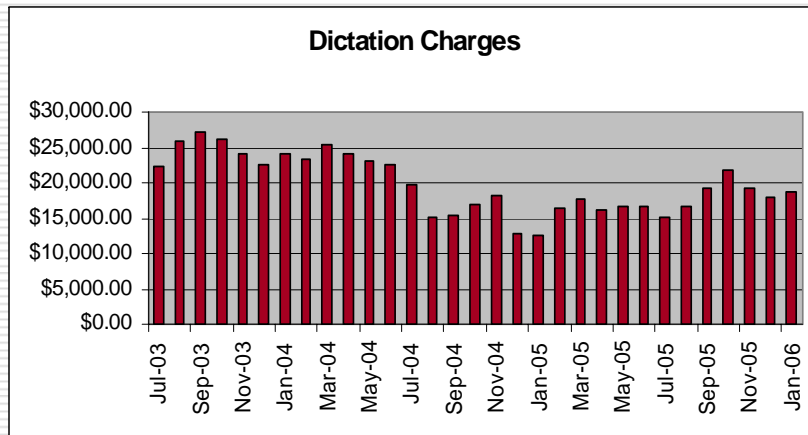


Mice can keep secrets!



- ❑ MIT Medical requires all 27 Mental Health clinicians to put their notes into TouchWorks as of September 2005.
 - ❑ Ability to segregate Mental Health notes with added security.
 - ❑ 7 of 27 Mental Health clinicians use dictate, the rest use direct note entry.
-

MIT Medical has saved a lot of cheese.





Transformation Sneaks Up On You

- Anticoagulation Clinic
 - Diabetes Care Group
 - Referrals entered into EHR
 - Disease Management
 - Enhanced role of Triage Nurses
 - Fantastic reporting capacity
 - And we got a grant to look at potential safety issues with electronic prescribing!
-



Anticoagulation Clinic

- ❑ 120 patients taking coumadin are managed via protocol by triage nurses
 - ❑ Nurses verify PT / INR results, contact patient, change dosage if necessary, and inform Attending MD.
 - ❑ Within the first 3 months a much higher percentage of patients are within therapeutic range than before.
-



Diabetes Care Group

- ❑ Triage Nurses also participate in the care of approximately 550 Diabetic patients
 - ❑ Monitor orders and results of HBA1C, ensure that patient has had yearly eye and foot exams, and is scheduled to see Attending MD.
 - ❑ All functions done through the EHR
-

Flow Sheets Allow for Better Disease Management



MIT Clinical | Snapshot | Outline | Problems | Note | Demographics | Appointments | Meds | New Rx | Immun | Results | Vitals | **Flowsheets**

Flowsheet Vitals Units: As Personalized U.S. Metric

Name: **Diabetes Care** Time Range: **All** Sort: **Rev Chrono**

	23 Sep 2003 08:57 AM	16 Sep 2003 04:59 PM	16 May 2003 04:58 PM	16 May 2003 09:02 AM	22 Apr 2002 04:29 PM	22 Apr 2002 09:06 AM	26 Jul 2001 09:19 AM	05 Aug 2001 04:30 AM
<input type="checkbox"/> Systolic	116 mm Hg			110 mm Hg		128 mm Hg		
<input type="checkbox"/> Diastolic	72 mm Hg			80 mm Hg		70 mm Hg		
<input type="checkbox"/> Height				64 IN				
<input type="checkbox"/> Weight	176 LB			172 LB		166 LB		
<input type="checkbox"/> GLYCOHEMOGLO		8.7 %	7.5 %		8.1 %		8.7 %	8.4 %
<input type="checkbox"/> CREATININE.					73 MG/DL			
<input type="checkbox"/> MICROALBUMIN			63		32			
<input type="checkbox"/> MICROALBUMIN			73 UG/ML		23 UG/ML			
<input type="checkbox"/> CALCULATED M		210 MG/DL	172 MG/DL		191 MG/DL		204 MG/DL	194
<input type="checkbox"/> CHOLESTEROL			301 MG/DL		208 MG/DL			189
<input type="checkbox"/> TRIGLYCERIDE					183 MG/DL			
<input type="checkbox"/> CHOL/HDL RAT			4.49		3.16			
<input type="checkbox"/> HDL			67 MG/DL		66 MG/DL			
<input type="checkbox"/> LOW DENSITY					106 MG/DL			
<input type="checkbox"/> DIRECT LDL			217					

Graph ... Print New Task ... New VS ... Cite Report ... Detail ...

Reporting Allows Us To Know Our Patients and Clinicians



SONR: Allergy.All (- 23645)

File Edit Data Sources Sets Queued Sets Recent Sets Report Special Help

0 Recs 23723 Recs ALL 23723/23723 A...Z No jobs

EnterpriseM...	EntryName	AllergenDE.EntryName	RecordedDTM	StatusDE.Entry...	MedAllergyCode	WhoDidItID
00021136	No Known Drug Allergy		2007-02-12	Active	130	33
00121174	No Known Drug Allergy		2007-02-12	Active	130	15027
00126601	Penicillins		2007-02-12	Active	070	227613
00098747	Benzoyl Peroxide LIQD		2007-02-12	Active	68752040508	228089
00064893	No Known Drug Allergy		2007-02-12	Active	130	178375
00071293	No Known Drug Allergy		2007-02-12	Active	130	200762
00126862	No Known Drug Allergy		2007-02-12	Active	130	178375
00037372	No Known Drug Allergy		2007-02-12	Active	130	227613
00103838	No Known Drug Allergy		2007-02-12	Active	130	178372
00129475	No Known Drug Allergy		2007-02-12	Active	130	56
00068323	No Known Drug Allergy		2007-02-12	Active	130	219732
22661567	No Known Drug Allergy		2007-02-12	Active	130	56
00105497	Dilantin CAPS		2007-02-12	Active	54868148600	200350
00112466	No Known Drug Allergy		2007-02-12	Active	130	178462
00119419		Shrimp	2007-02-12	Inactive		178462
00098195	No Known Drug Allergy		2007-02-12	Active	130	226251
00125963	No Known Drug Allergy		2007-02-12	Active	130	178462
83706210	No Known Drug Allergy		2007-02-12	Active	130	178372
00075251	No Known Drug Allergy		2007-02-12	Active	130	226251
00048831		No Known Allergies	2007-02-12	Active		200762
00109804		No Known Allergies	2007-02-12	Active		200762
28628391	No Known Drug Allergy		2007-02-12	Active	130	178372
00092880		No Known Allergies	2007-02-12	Active		200762
43424591	No Known Drug Allergy		2007-02-12	Active	130	200762
00128929		No Known Allergies	2007-02-11	Active		220850
00113914	No Known Drug Allergy		2007-02-11	Active	130	56
00126210	No Known Drug Allergy		2007-02-11	Active	130	56
00106050	No Known Drug Allergy		2007-02-11	Active	130	56
00123326	No Known Drug Allergy		2007-02-09	Active	130	178462



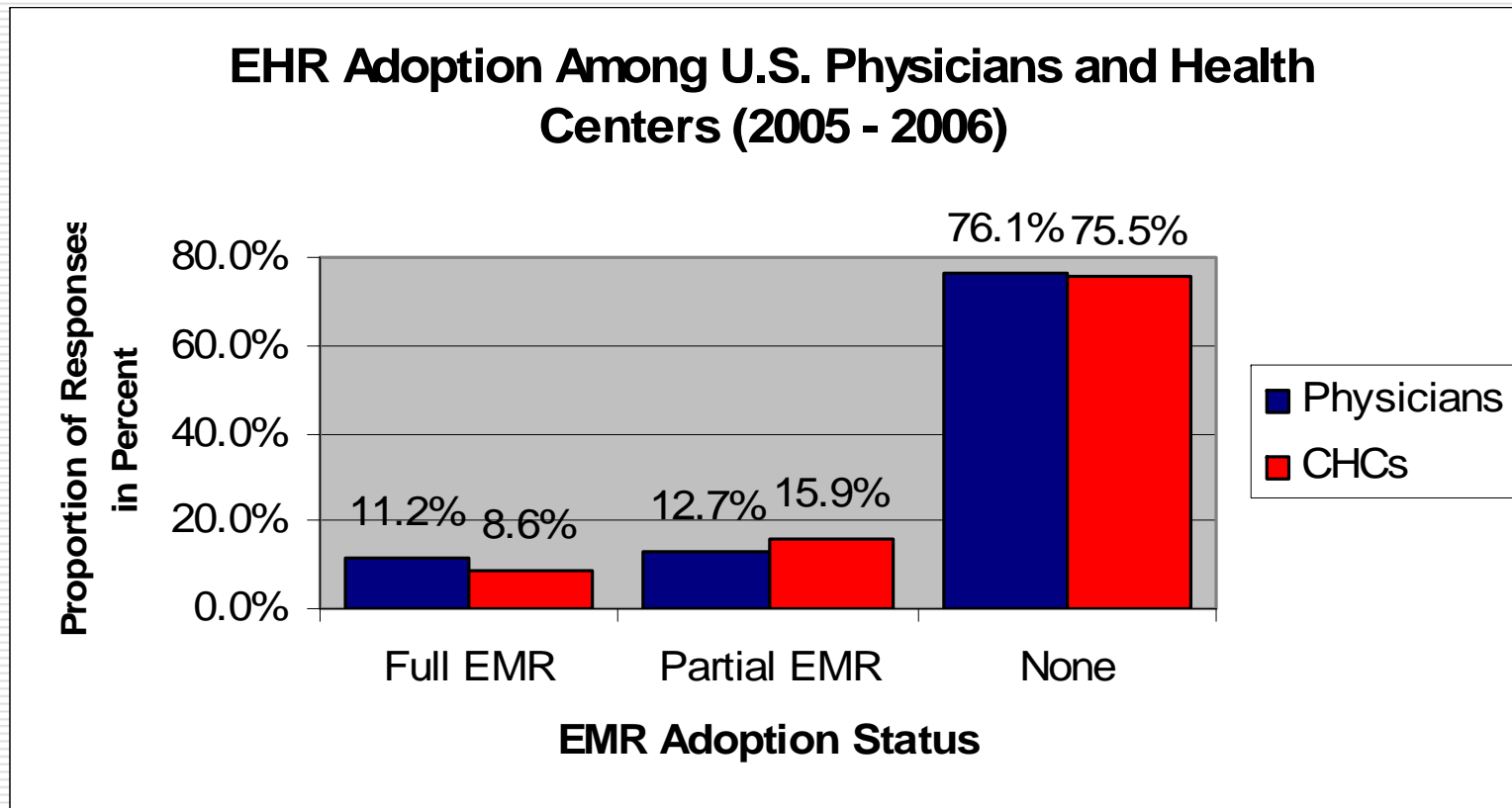
Medication Safety Grant

- ❑ MIT Pharmacy error rate is well below the industry average of 1.6%
 - ❑ Electronic Prescribing poses new opportunities for errors.
 - ❑ We are using a Human Factors Engineer to review the whole process
-

Lots of Interest In EHRs But...



Slow EHR Adoption Rate in U.S.



Health Information Technology in the United States: *The information Base for Progress*, Robert Wood Johnson Foundation, 2006

Benefits of the EHR at MIT



- ❑ Patient care has improved with the availability of information.
- ❑ Reduction of 5.5 FTE in Medical Records
- ❑ Credit from Medical Liability Insurance Carrier
- ❑ Time savings for ancillary staff
- ❑ Expanded role for Triage Nurses
- ❑ Clinicians are more satisfied
- ❑ Patients like the availability of information in our portal
- ❑ Improved HIPAA and JCAHO compliance
 - ❑ *Specific* positive feedback from reviewers
- ❑ A collection of solo clinicians becomes a Group Practice

the Pot-o-Gold revealed...

