

DIGITAL HEALTH & INNOVATION

Bimal Desai, MD, MBI

AVP & Chief Health Informatics Officer



ABOUT CHOP



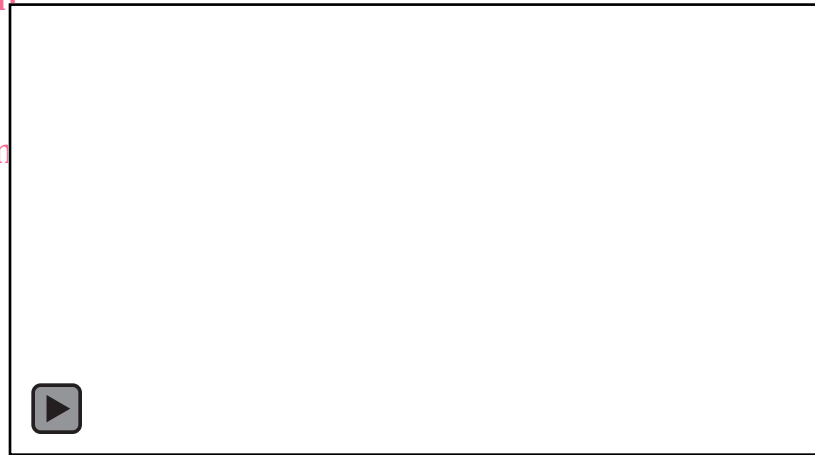
- 560 bed urban 3°/4° care center
- \$2.4 billion revenue
- \$290 million research budget
- 1.2 million ambulatory visits annually
- 86 thousand ED visits annually
- 50+ locations for primary care, specialty care, urgent care, and affiliated hospitals
- 397 trainees in 6 departments
- **ACGME-accredited Fellowship in Clinical Informatics**

INFORMATICS@CHOP

- 2017 Computerworld “Best 100 Places to Work”
- 2017 Healthcare’s “Most Wired Hospitals”
- HIMSS EMRAM Stage 6
- Clinical Informatics Program
 - 30 embedded physician informaticists
- Enterprise Data Warehouse
- Advanced Analytics – IBM Pure Data – Hadoop
- Department of Biomedical & Health Informatics

HAYSTACK INFORMATICS

- Graduate of CHOP & DreamIt
2014 “Open Canvas” program
- CHOP innovators partnered with
entrepreneurs
- Four month accelerator program
- Patient privacy monitoring
software
- Social network analysis and
machine learning to identify
EHR “snooping” events

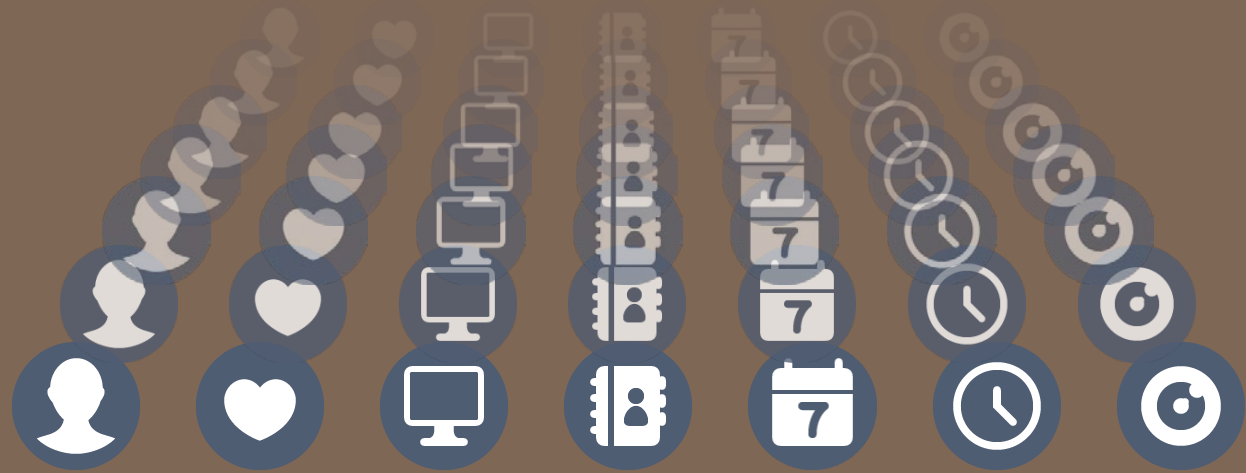




\$5.6 billion national problem

Up to \$1 million per breach

10-20x more valuable than credit card



Provider

Patient

Computer

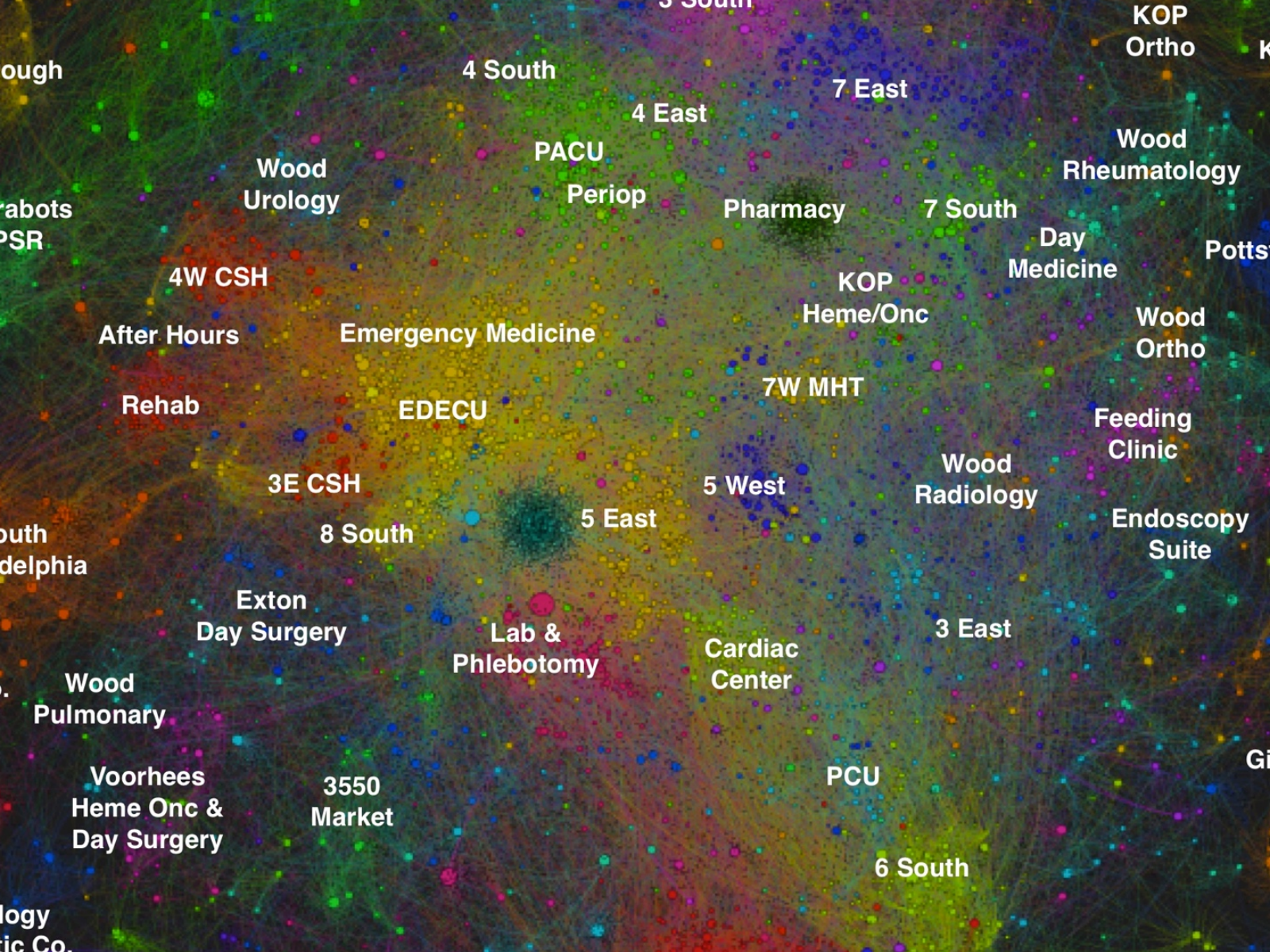
Role

Date

Time

Action

Data, data everywhere...





Behavioral and Social Analysis Engine





Lenses



Relationships



Behavior



Geography

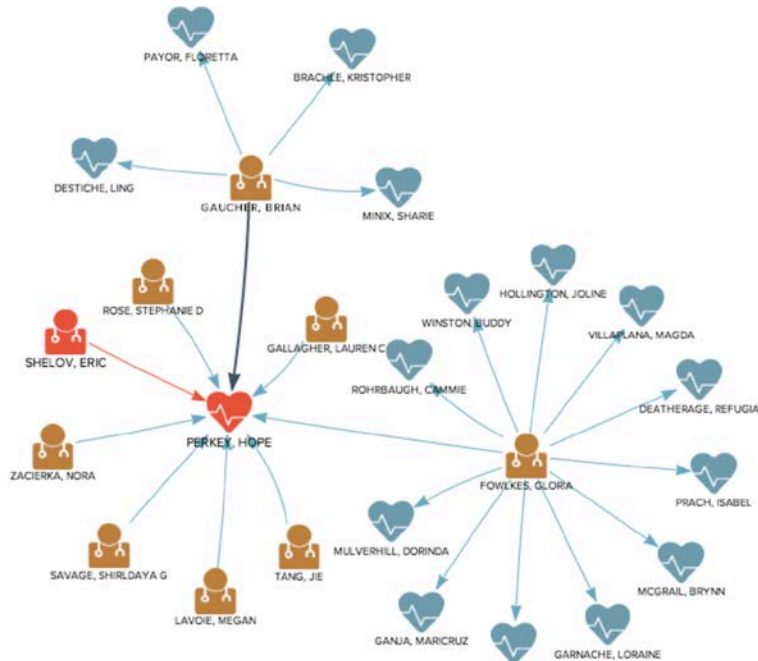


Relationships

RELATIONSHIPS

< Friday, Jun 06 >

Search Patient or Provider



WM9PNG081

06/06/2014 11:16 MR_REPORTS
PATIENT CLINICAL INFO
WM9PNG081



06/06/2014 11:16 MR_REPORTS
PATIENT CLINICAL INFO
WM9PNG081



06/06/2014 11:17 MR_REVIEW_LABS
Patient Chart Review
WM9PNG081



06/06/2014 11:17 MR_REPORTS
PATIENT CLINICAL INFO
WM9PNG081



06/06/2014 11:17 MR_REPORTS
PATIENT CLINICAL INFO
WM9PNG081



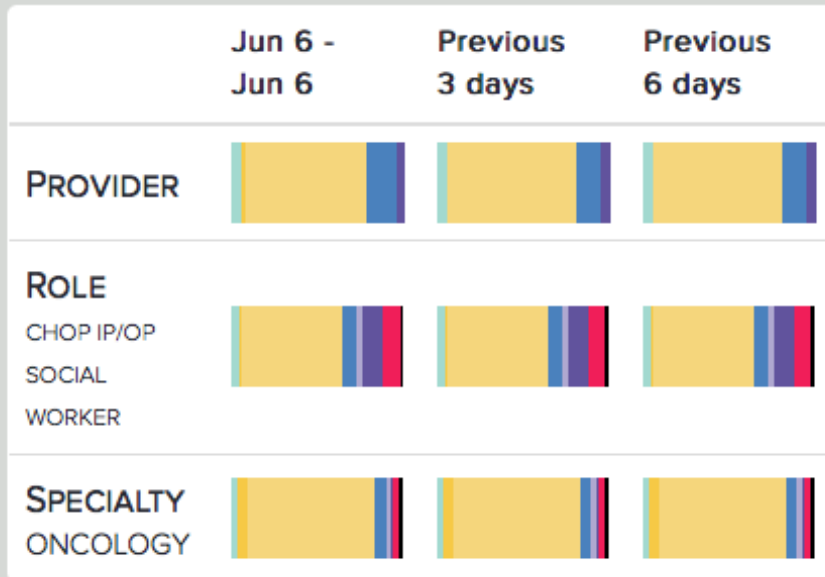
06/06/2014 11:17 MR_REPORTS
PATIENT CLINICAL INFO
WM9PNG081





Behavior

Provider Behavior Map



Edit Behavior

☐ Unlocked

Provider

☐ Normal

Role

☒ Abnormal

Specialty

☒ Abnormal

Add Note

Save



Geography



DASHBOARD

EXPLORE

INVESTIGATE

HISTORY

System Administrator

Logout →

RELATIONSHIPS

TIMELINE

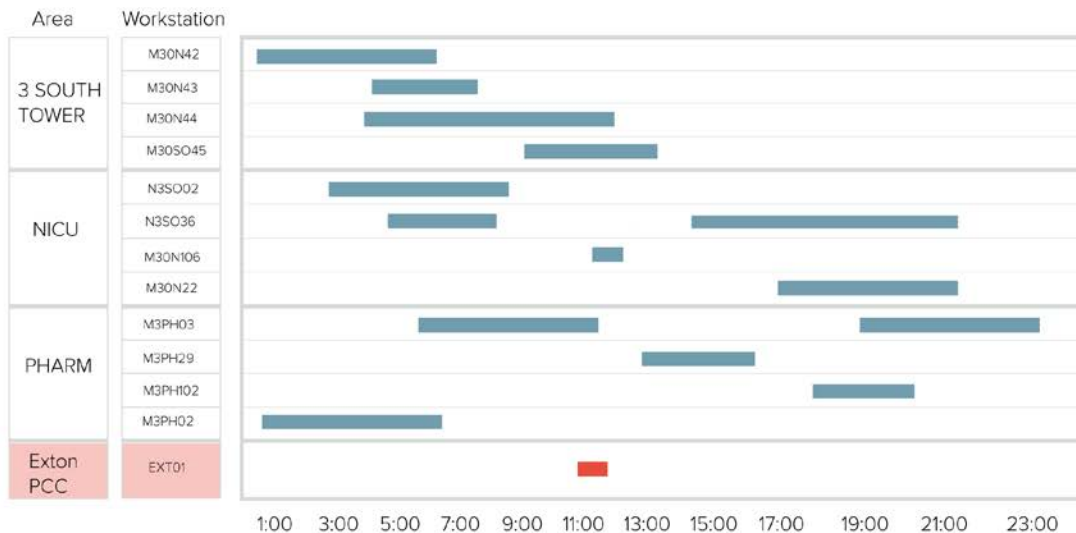
GEOGRAPHY

< Friday, Jun 06 >

Search Patient or Provider



SMITH, JOHN



HAYSTACK TODAY

- Expanded to two distinct products:
 - **Haystack Shield** – Privacy Monitoring
 - **Haystack Intelligence** – Operational Efficiency
- Live at health systems across the country
- Exploring collaborations with health advisory / consulting companies
- Ten employees at Science Center, 34th & Market
- Completed our second round of VC funding

A young boy with short dark hair, wearing a white shirt, is shown in profile from the chest up. He is looking down at a smartphone held in his right hand. The background is a bright, out-of-focus window with vertical bars. Two green horizontal bars are overlaid on the left side of the image, containing white text.

ENTERPRISE

ANALYTICS & REPORTING

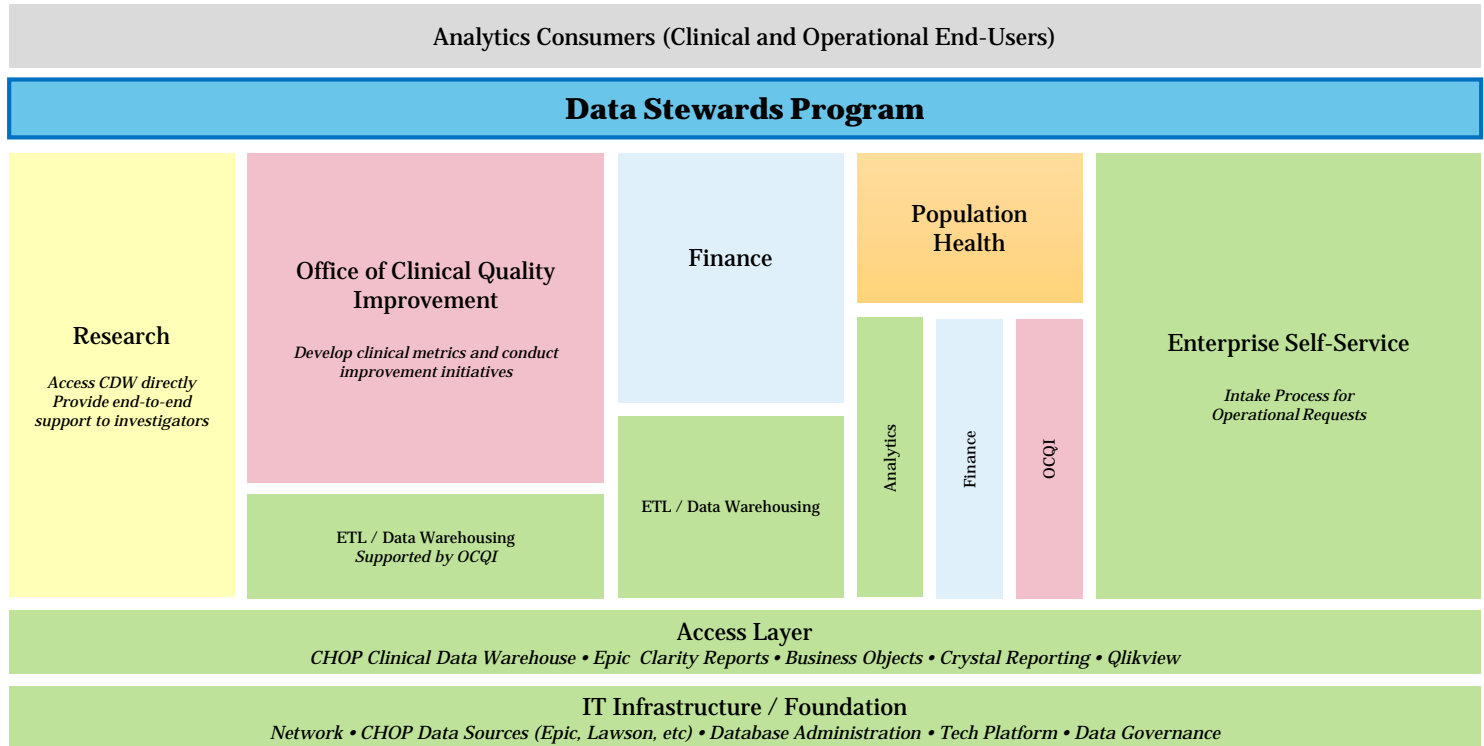




Past Observations Report - °F °C							Based on raw METAR data from (KPHL)		
Date/Time	Temp	Dew Point	Relative Humidity	Pressure	Visibility	Ceiling	Wind	Gust	Weather
10:31 PM, Mon 18 September 2017	73°	65°	76%	30.07in	10mi	2000ft	NE 12mph	NA	Overcast
9:54 PM, Mon 18 September 2017	73°	65°	76%	30.06in	10mi	2300ft	NE 12mph	NA	Overcast
8:54 PM, Mon 18 September 2017	72°	65°	78%	30.07in	10mi	2900ft	NE 9mph	NA	Broken Clouds
7:54 PM, Mon 18 September 2017	72°	65°	78%	30.06in	10mi	15000ft	ENE 8mph	NA	Broken Clouds
6:54 PM, Mon 18 September 2017	75°	65°	71%	30.05in	10mi	4200ft	ENE 12mph	NA	Broken Clouds
5:54 PM, Mon 18 September 2017	77°	65°	66%	30.05in	10mi	Unl	ENE 9mph	NA	Scattered Clouds
4:54 PM, Mon 18 September 2017	79°	65°	62%	30.05in	10mi	Unl	ENE 12mph	NA	Scattered Clouds
3:54 PM, Mon 18 September 2017	77°	67°	71%	30.05in	10mi	3200ft	NE 12mph	NA	Broken Clouds
2:54 PM, Mon 18 September 2017	79°	67°	66%	30.06in	10mi	Unl	ENE 8mph	NA	Scattered Clouds
2:04 PM, Mon 18 September 2017	80°	68°	67%	30.07in	10mi	Unl	NNE 12mph	NA	Scattered Clouds
1:54 PM, Mon 18 September 2017	79°	67°	66%	30.08in	10mi	2700ft	E 6mph	NA	Broken Clouds
1:13 PM, Mon 18 September 2017	77°	67°	71%	30.09in	10mi	2100ft	NE 9mph	NA	Broken Clouds



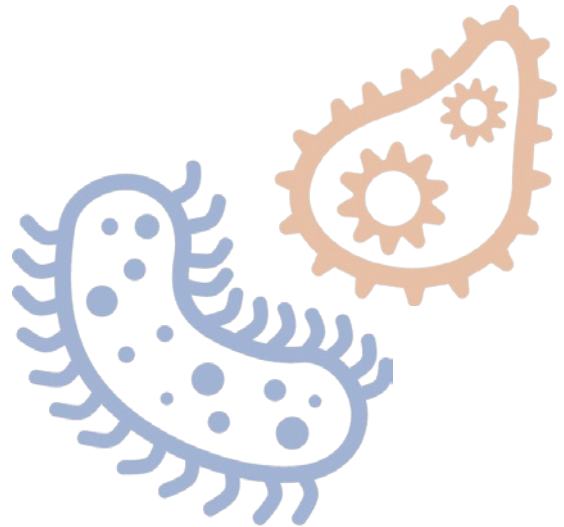
ANALYTICS SERVICE MODEL



** Not all “verticals” are pictures*

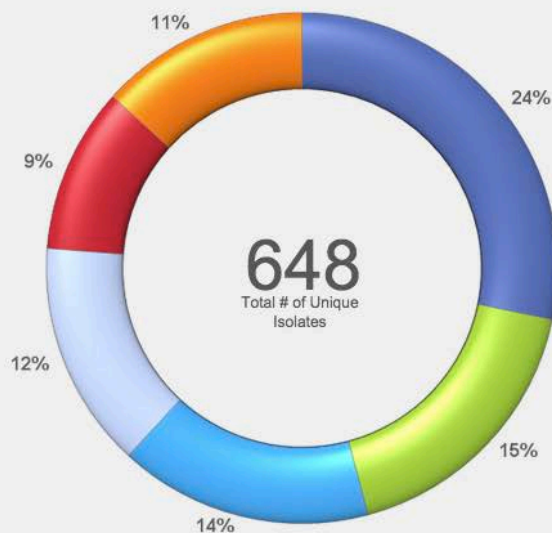
CHOP ELECTRONIC ANTIBIOGRAM

- ID research suggests **stratified antibiograms** are most appropriate when choosing empiric therapy
- Epic/Meditech lab data allows us to automatically generate these and apply IDSA filtering rules
- Traditional antibiograms are time-intensive to generate manually
- Drs. Jeff Gerber and Bea Larru worked with Enterprise Analytics team
- Built on Qlikview analysis platform



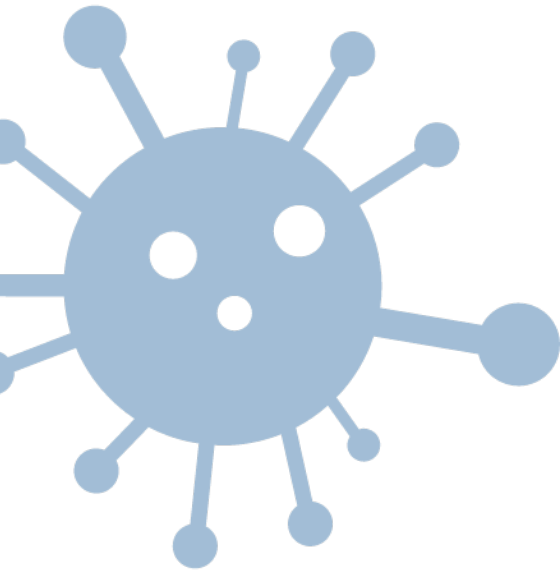


Pathogen Distribution



- E. coli
- Klebsiella spp.
- Enterococcus spp.
- P. aeruginosa
- Enterobacter spp.
- Others

HIGH-RISK INFLUENZA DASHBOARD



- AAP recommends influenza vaccination for all children, especially those with certain chronic illnesses
- Department of Pediatrics undertook a project to improve vaccination for high-risk specialty-care patients
- Epic alerting & workflow was supplemented with an analytics tool to understand end-user behavior
- Also allowed us to provide QI-style metrics
- Between FY13 and FY14, saw **20% improvement**
- Between FY14 and FY15, saw another **50% improvement**



Influenza Analysis for High Risk Patients

The Children's Hospital of Philadelphia®
Hope lives here.

Patient View

Encounter View

Search



Clear All

Filters & Current Selections

Patient Distribution

Patient Population

- Given
- Refused
- Missed Opportunity
- BPA Not Shown

» ?

Identified High Risk Patients: 22,816

Contact in FY15: 18,476 (80.98%)

2014

2015

Overall Immunization Status By Patient

Given 9,271 (50.18%)

Refused 507 (2.74%)

Missed Opportunity 4,203 (22.75%)

BPA Not Shown 4,495 (24.33%)

Patient Distribution (%) by Overall Immunization Status



Missed Opportunities

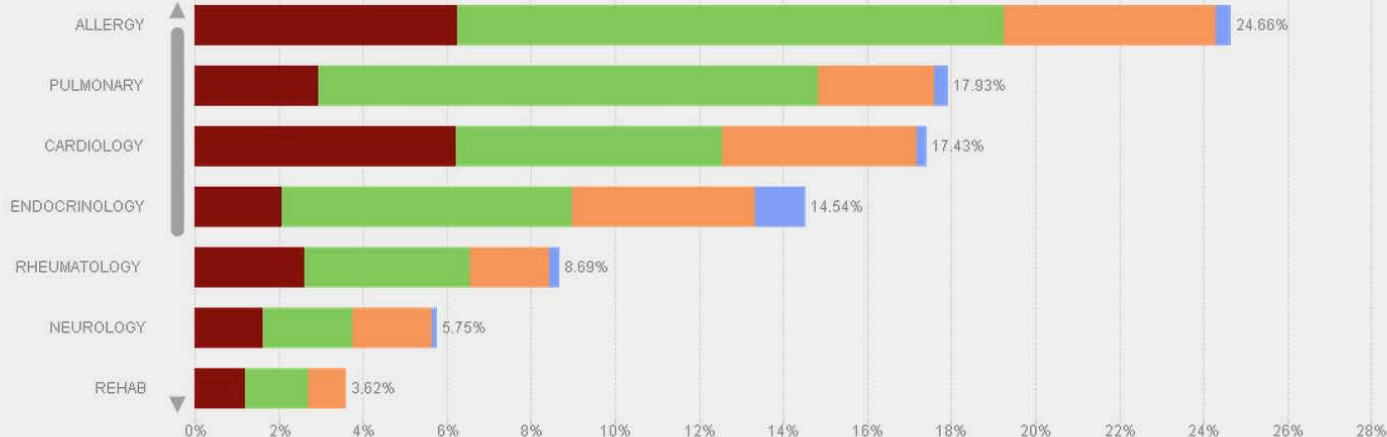
Patients who had an office visit, but were never asked. 3,632 86.41%
(Click to select these patients)

Patients who did not have an office visit, but had a telephone encounter and were not asked. 571 13.59%
(Click to select these patients)

4,203

Patient Distribution (%) by Immunization Status & Division

Patient Division



Data Source: Clarity

Version 1.2

Last Updated: 8/12/2015 7:23:04 AM



DEPARTMENT OF

BIOMEDICAL & HEALTH

INFORMATICS



Children's Hospital
of Philadelphia™

DIGITAL HEALTH

CARE ASSISTANT & EPIC



- EHR built to document. Digital health data can mean digital intervention!
- R&D Technologists + Clinical Informaticians + HCI Analysts = Software framework and portfolio of ten decision support apps
- Improved outcomes e.g. immunization rates, preemie care coordination, asthma management.
- Vision: real-time predictive decision support

Funded by various grants & CHOP support.

Green Zone
Yellow Zone
Red Zone
Follow-Up Care
Triggers

Green Zone

Everyday Medications

Give these controller (anti-inflammatory) medicines everyday, to prevent problems.

Medication
Select a medication

Add Everyday Medication

☐ No Everyday Medications Must be selected if no medications are required.

Before Exercise Medication

Use this medication for trouble breathing during exercise or sports.

Medication
Select a medication

☐ No Before Exercise Medications Must be selected if no medications are required.

Special Instructions (limit 225 characters)

Back
Next
Print Preview/File to Chart
English

TRUDE H. - The Children's Hospital of Philadelphia ACRP - MARKET ST CARE NTWK
Encounter
Telephone Call
Care Teams
Login Cdt
Secure
Patient Lists
Epic Help
LIN

Allergies: Aspirin, Fava...
PCP: HAECKER, TRUDE
MyChart: Inactive
MDRO: None
Primary Crg: KEYSTONE MERCY HEALTH PLANK...
FYI: FYI

Care Assistant

Snapshot
Chart Review
Flowsheets
Doc Flowsheets
Problem List
History
Letters
Communications
Demographics
Growth Chart
Results Review
Medications
Allergies/Res
Enter/Edit Res...
Audiogram
Patient Files
Order Entry
Immunizations
FYI
Visit Navigator
Care Assistant

EDUCATION MODULES

☒ basic asthma facts (PFE [English](#) [Spanish](#)) 11/09/2012
☐ roles of controller medications
☒ roles of quick-relief medications 11/09/2012
☐ school, sports and physical activity issues

SKILLS CHECK

☐ inhaler use (spacer & mask PFE [English](#) [Spanish](#))
(spacer & mouthpiece PFE [English](#) [Spanish](#))
(diskus PFE [English](#) [Spanish](#))
☒ spacer use 11/09/2012
☐ symptom monitoring
☐ peak flow monitoring (PFE [English](#) [Spanish](#))
☐ recognizing early signs of deterioration
☐ when and where to seek care
☒ when and how to take rescue actions 11/09/2012
☒ use of asthma care plan (PFE [English](#)) 11/09/2012

COCKROACH/PEST AVOIDANCE (PFE [English](#))

☐ keep trash closed
☐ keep food in closed containers
☐ use roach/mice bait-keep out of child's reach

ENVIRONMENTAL CONTROL (PFE [English](#) [Spanish](#))

Pet Avoidance Measures (PFE [English](#))

☐ give furry pet or bird to family member/friend who does not live in your home
☐ keep pets off furniture, wipe furniture with wet cloth every week
☐ keep pets out of child's bedroom

Dust Avoidance Measures (PFE [English](#))

☐ place dust mite covers on mattress/pillows 11/18/2011
☐ remove fabric window coverings, feather or wool bedding 11/18/2011
☐ vacuum at least once a week
☐ dust with damp cloth

Mold Avoidance Measures (PFE [English](#))

☐ fix leaks
☐ remove visible mold from home
☐ use air conditioner and dehumidifier if possible 11/18/2011
☐ remove indoor plants

Secondhand Smoke Avoidance (PFE [English](#))

☐ don't allow smoking in the house
☐ don't allow smoking in the car

Mh-Test, Master

Mh-Test, Master

Female, 7 year old

MRN: 31012730

Allergies: Unknown: No...

PCP w/ Phone: GRUNDMEIER, ROBERT (215-467-...

MyCHOP: Inactive

Care Team

Weight: None

Date of Birth: 06/15/2008

MDRO: None

Primary Cvg: None

FYI: (None)

My Sticky Note

Weight: None

6/18/2015 visit with Grundmeier, Robert, MD for Office Visit

SnapShot

Chart Review

Review Flowsh...

Flowsheets

Problem List

History

Implants

Letters

Communications

Demographics

Growth Chart

Results Review

Medications

Allergies/Rxn

Enter/Edit Res...

Audiogram

Patient Files

Order Entry

Immunizations

Visit Navigator

More Activities

Images Admin Open Orders Print A/S Preview A/S FYI Scans Benefits Inquiry Media Manager Care Teams Questionnaires Asthma

Allergies: Not on File

BMI: BSA: PO:

BP: P: T: T Src: Resp: W: H:

Care Assistant

Genetic Test Assistant for Reportable Incidental Findings

Info

Test results for this patient include an actionable incidental finding of: Malignant Hyperthermia susceptibility

This tool is designed to support the ordering provider, primary care and others in managing this finding

Test

Type: Whole exome sequencing

Report: 05/05/15 Molecular Biology (CHOP)

Ordered: Dr. Elvin Jones, 4/18/2015

Specialist note: 05/14/15 Dr. Elvin Jones

Indication: Developmental delay

Chart

Problem List: No relevant entry

[Add to problem list](#)

Allergy: No relevant entries

[Add: Halogenated Anesthetics](#)[Add: Succinylcholine](#)[Add: Ether](#)

Orders: 1 relevant entry

[Referral to Genetics: Dr. Elvin Jones 5/15/15](#)

Provider Resources

[UpToDate](#)[Malignant Hyperthermia Association](#)[Testing for Malignant Hyperthermia](#)[Safe and unsafe anesthetics](#)[Letter - notify healthcare facility](#)[Letter - notify family](#)

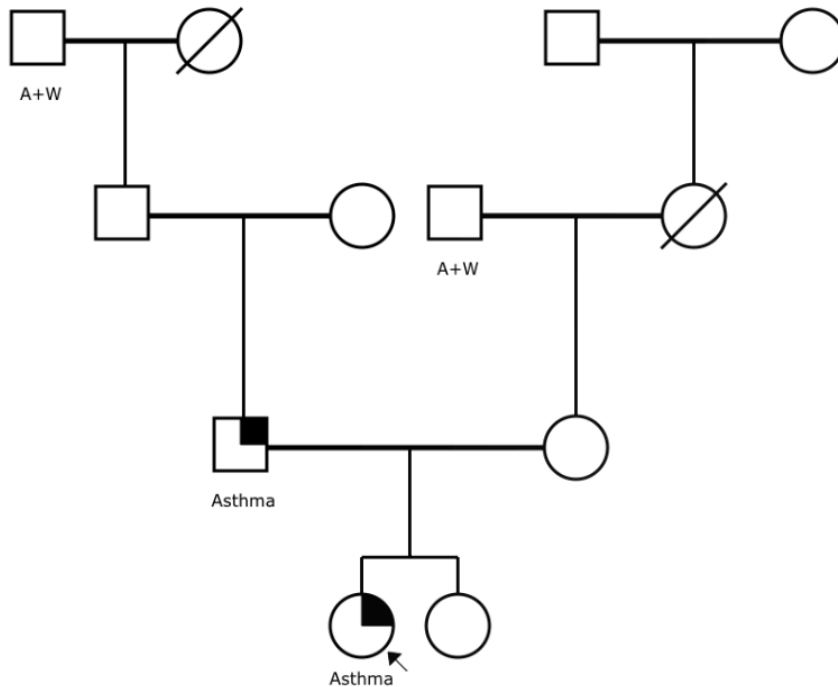
Patient-Family Education

[Malignant Hyperthermia Association](#)[Roadmap to MH \(pdf\)](#)[Identification tag program](#)[Print Patient Education](#)

PROBAND: DIGITAL PEDIGREE APP

- Digital family history
 - Key to diagnosing congenital and other genetic conditions
 - State of the art is still hand drawing on paper, scanned into EHR
- Jeff Miller + Genetic Counselors = Multi-touch iOS app & enterprise server
- 1000's of families in Center for Fetal Diagnosis and Treatment, Genetics
- Over 1K downloads from App Store
- Piloting at Johns Hopkins University

Funded by NHGRI Clinical Sequencing Exploratory Research program grant.



A young boy with short dark hair, wearing a white shirt, is shown in profile, looking down at a smartphone held in his hands. The background is a bright, out-of-focus window with vertical bars. Two green horizontal bars are overlaid on the left side of the image, containing white text.

DIGITAL HEALTH

PROGRAM PORTFOLIO

PROGRAM PORTFOLIOS

SENIOR IS DIRECTOR, DIGITAL HEALTH • Gayle Stidsen Smith

01. CARE ANYWHERE • Kate Fuller
Supporting Scale & Growth

Extending our scale through telemedicine and connected health platforms

02. ENGAGE + CONNECT • David Whitaker
Clinical + Operational Experience

Using digital tools to rethink patient engagement, communication, and care coordination

03. RESEARCH EXCELLENCE • Diana Friou
Innovative Research Programs

Accelerating research discovery through technology

04. ENHANCED PARTNERSHIPS • Tracey Haines
Mission Sustainability

Fostering relationships with communities, donors, and tech innovators

PROGRAM STRATEGY

WE ARE
HERE

Phase 0: FY'17 Build Foundation

- Establish governance and core team
- Plan Phase 1
- Staff augmentation with external contractors
- Initiate “quick win” projects
- Fill portfolio leader roles
- Transition eHealth team to Digital Health

Phase 1: FY'17-'18 Launch & Accelerate

- Launch telemedicine video-visit platform in non-reimbursable areas
- Explore payer reimbursement for telemedicine
- Launch IPX pilot
- Work with Strategy group re: role for DH in hospital partnerships

Phase 2: FY'19 Scale & Impact

- Scale DH team and expertise
- Expand telemedicine to reimbursable areas
- Advance DH projects into novel areas (ex: schools, public health, home nursing)

Phase 3: FY'20-'21 Transform

- National leaders in Digital Health, IPX, mHealth Research, Telemedicine, clinical transformation through technology
- Make digital care as accepted, mainstream, and easy as face-to-face care

“ANGEL EYE” NICU CAMERA SOLUTION



“ANGEL EYE” NICU CAMERA SOLUTION

My Cameras

My Family Members

Parent Education

Tech Support

powered by
ANGELeye
Camera Systems

Signed in as Demo M. Father 

Viewing Camera: BB 08/09/2017 - DO NOT REMOVE Demo Camera 8


 Camera donated by St. Mary's Philanthropy




 permission settings


begin audio recording

end audio recording

 send audio message

 Camera is Currently Broadcasting

MYCHOP VIDEO VISITS




Appointment Details

General Information

What: Telemedicine with [Adam Martin, MD](#)
When: Friday April 03, 2015 4:30 PM (15 minutes)
Department: Harbor Prairie East - Family Practice
Phone: 608-271-9000

Video Visit



When you are ready to talk to your doctor, click the button below to begin your video visit.

[Begin Video Visit](#)

Questionnaires

Fill out the following questionnaires before your video visit:

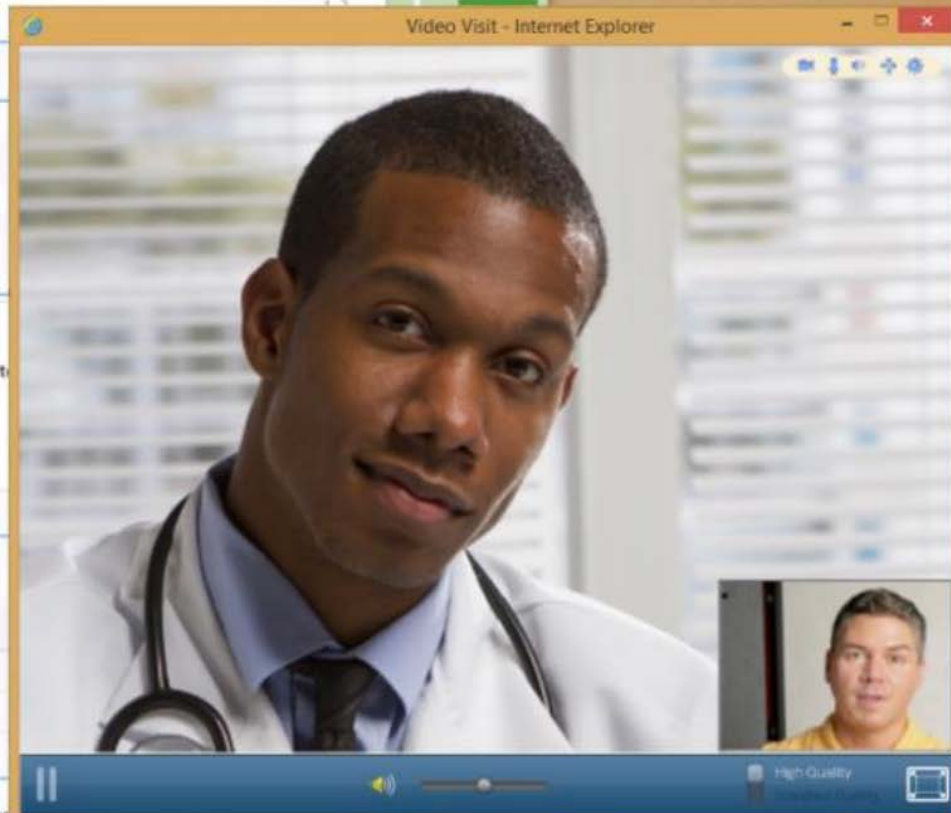
Questionnaire

☐ Basic History Questionnaire

☐ Sleep Questionnaire

Cancellation

Please be courteous to our staff and to other patients: if you must cancel an appointment, please call 608-271-9000 at least 24 hours in advance.



MYCHOP MOBILE VIDEO VISITS



MYCHOP VIDEO CONSULTATION

8/19/2015 visit with Adam Martin, MD for Telemedicine

Images Questionnaires Admin Benefits Inquiry References Scans Dictations Open Orders Care Teams Print A/S Preview A/S Pt Declined A/S Media Manager Connect to Video

VIDEO Connect Diagnoses Meds & Orders Problem List

Visit Media Send Chart SmartSets Follow-up Goals

Connect

Connect to video You are currently connected with Karen Burns.

Diagnoses (View Only)

1. Asthma
 2. Hypertension
- [Diagnosis Entry](#)

Medications & Orders

Search for new order New Order

Name

Medications

- albuterol (PROVENTIL) (2.5 MG/3ML) 0.083% nebulizer solution
- rosuvastatin (CRESTOR) 10 MG tablet

☒ Mark All Taking ☒ Mark as Reviewed

[Click here to select a pharmacy](#)

Associate

Problem List

Create Patient Care Coordination Note

Add a new problem Add

Diagnosis

[Asthma](#)

[Hypertension](#)

☒ Mark as Reviewed


Waters, Bill


Disconnect Hold Capture Image


MYCHOP BEDSIDE – MAIN SCREEN

iPad 2:16 PM 68%


Log out Settings


 Home

 Welcome

 Happening soon

Around 2 PM Medications
Afternoon Appointment
Around 4 PM Medications
Around 6 PM Medications
Around 6 PM Walk around the unit


 Taking care of me

 I would like ...

Good afternoon, Mike. Today is

Tuesday, September 15

Glen's discharge date isn't set yet.

 **Epic**
Medical Center
EPIC MEDICA...

Day 3

Glen is here for...

Community acquired pneu... ⓘ
and we're also treating ...

Bleeding disorder due to co... ⓘ
Nutritional disorder ⓘ
Respiratory failure ⓘ
Stress hyperglycemia ⓘ

Glen's medications

Humulin, Novolin ⓘ
Intropin ⓘ
Levaquin ⓘ
levothyroxine ⓘ
sodium chloride ⓘ
sodium chloride ⓘ
Zantac ⓘ
and, if needed ...

108/63
Blood Pressure

82
Pulse

37.8
Temperature

20
Respirations

MYCHOP BEDSIDE – MEDS & SCHEDULE

iPad 2:19 PM 66%

Log out

Home

Welcome

Happening soon

- Around 2 PM Medications
- Afternoon Appointment
- Around 4 PM Medications
- Around 6 PM Medications
- Around 6 PM Walk around the unit

Taking care of me

I would like ...

Yesterday September 14 Today September 15 Tomorrow September 16

Medications

Around 2 PM

Zantac ⓘ

50 mg intravenously every eight (8) hours

Ordered by Pat Cooper, MD

Mec

Around

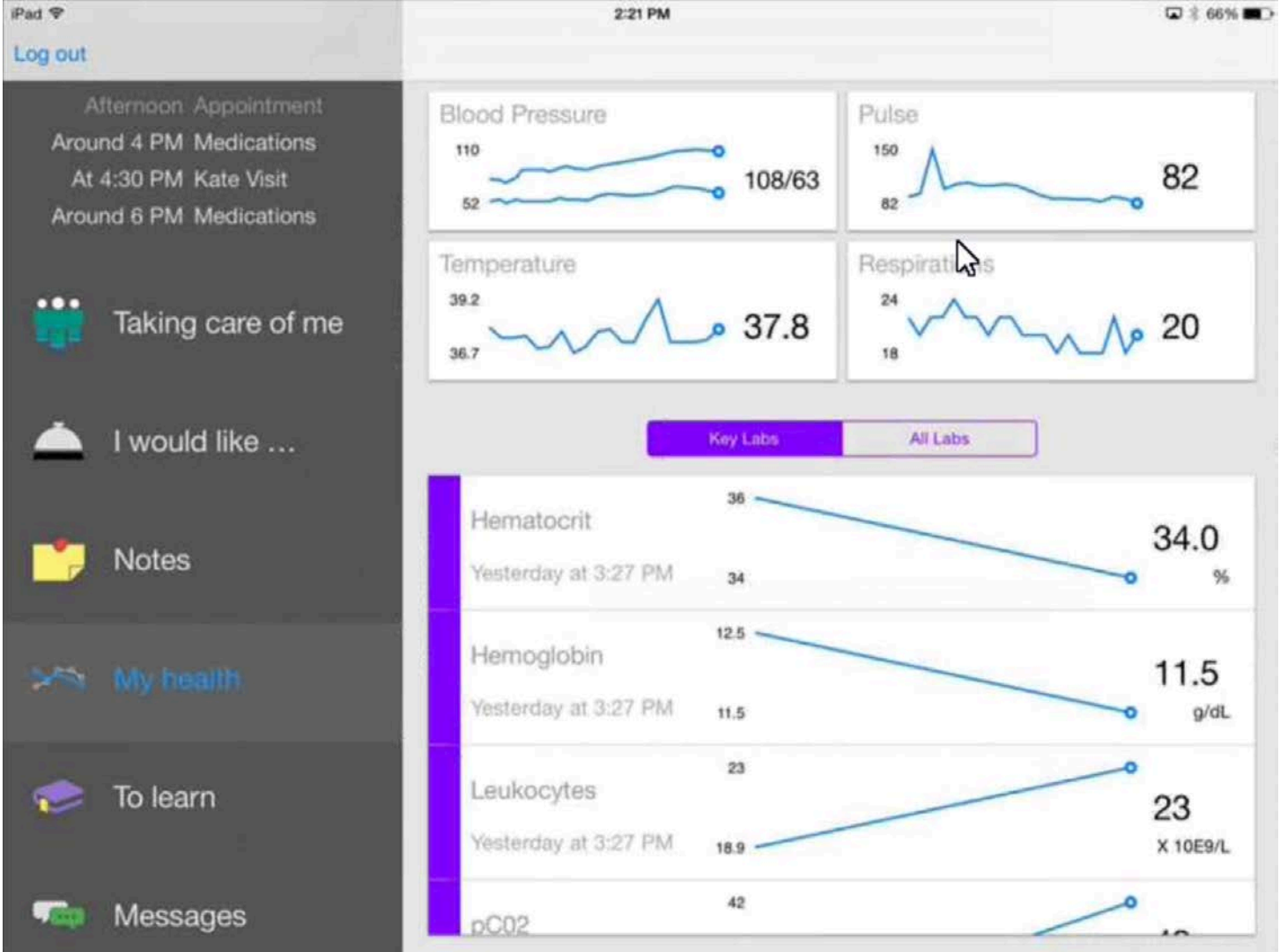
Humu

2-10 L

Order

Add something new to Glen's schedule


MYCHOP BEDSIDE – LAB RESULTS




MYCHOP BEDSIDE – CARE TEAM


iPad


Log out


 Home


 Happening soon


Tomorrow Bloodletting and Leech Therapy

 Taking care of me

 I would like ...

 Note to self

 My health

 To learn

3:20 PM

Not Charging

[Back](#)


Provider Details

Karen H.

Attending Provider



About Me

My first job was a night charge nurse on a surgical floor at the Vancouver General Hospital. I also worked at several small rural hospitals. In one hospital I was an RN in the first Intensive/Cardiac Care Unit in the area. I also worked in staff education at a Children's Hospital. I have worked as a supervisor of a Public Health Department and several Home Care Agencies. I served as the chair of the nursing department at Sacred Heart for 4 years.



Caring for you since February 13.

How is Karen doing?



Comment

My Goal For You

The best bit of wisdom I received from a patient in a Cardiac Care Unit. He told me he could always tell which were the best nurses when they walked into his room. The best ones looked at him first, then the monitors, the worst ones looked at the monitor only. My goal is to make your stay as pleasant as possible.



PHYSICIAN

OPPORTUNITIES



Children's Hospital
of Philadelphia™

DIGITAL HEALTH

OPPORTUNITIES AT CHOP

- Department of Biomedical & Health Informatics
- Clinical Informatics
- Analytics
- Innovation & Entrepreneurship

CHOP DBHI

- ACGME-accredited fellowship in Clinical Informatics
- Research Collaboration
- DBHi Internship
- DBHi Seminar Series
- DBHi Annual Symposium

CLINICAL INFORMATICS & DIGITAL HEALTH

- Research opportunities for medical students
- Residency Rotation in Clinical Informatics
- Residency Quality Improvement Curriculum
- Fellowship Rotation in Applied Informatics
- Clinical Decision-Support Committee
- Clinical Champion & EHR SuperUser Program

IS & ENTERPRISE ANALYTICS

- Partnership with Clinical Stakeholders
- CHOP IS Internship (Drexel U.)
- Application development for QI, Analytics
- Advanced / Streaming Analytics
- IS Web Application Team

INNOVATION & ENTREPRENEURSHIP

- Educate, Elevate, & Expand
- Open Canvas → "insourcing"
- SPRINT Program
- Provide entrepreneurial support at any stage of development
- Penn Hackathon, Philly Codefest





**Children's Hospital
of Philadelphia™**

DIGITAL HEALTH