OPPORTUNITIES AT THE INTERSECTION OF
INNOVATION, ENTREPRENEURSHIP,
AND PATIENT CARE

Bimal R. Desai, MD, MBI • Chief Medical Informatics Officer
The Children's Hospital of Philadelphia • January 7th, 2016
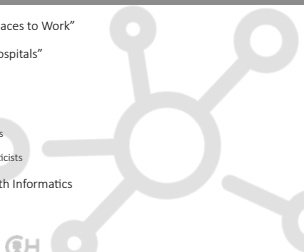

Disclosure

- I have commercial interests with the following:
  - Compensated lecturer, American Medical Informatics Association
  - Co-founder, Haystack Informatics, Inc.

- I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.
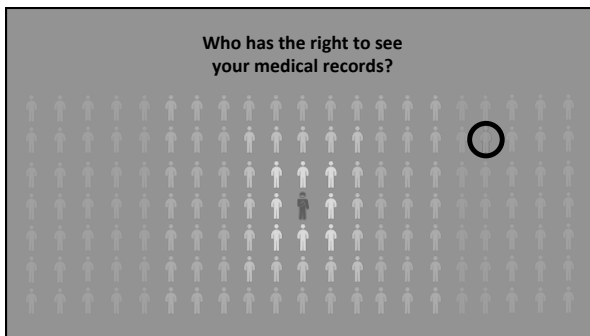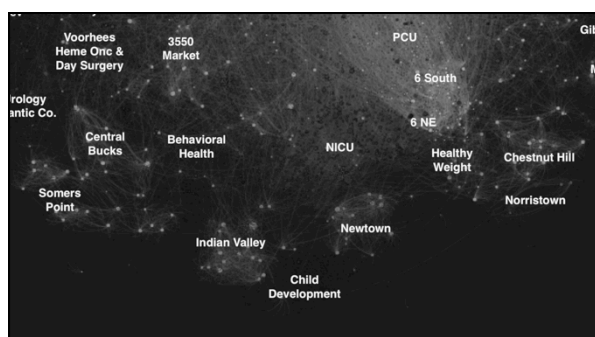

About Informatics@CHOP

- 2015 Computerworld "Best 100 Places to Work"
- 2015 Healthcare's "Most Wired Hospitals"
- HIMSS EMRAM Stage 6
- Clinical Informatics Program
  - 24 embedded provider informaticists
  - 16+ Board-Certified Clinical Informaticists
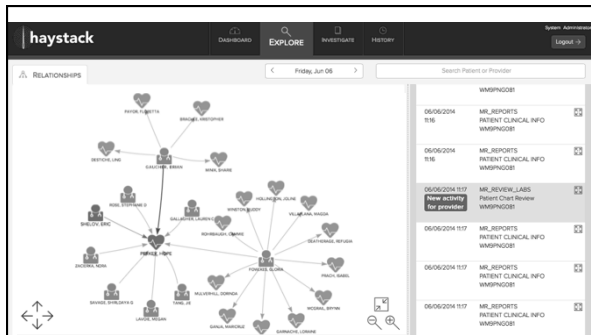- Department of Biomedical & Health Informatics

Who has the right to see your medical records?

Provider   Patient   Computer   Role   Date   Time   Action

Data, data everywhere…

Good luck with that.

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

haystackinformatics.com
info@haystackinformatics.com
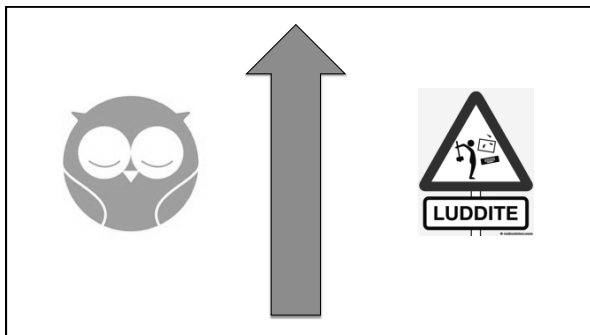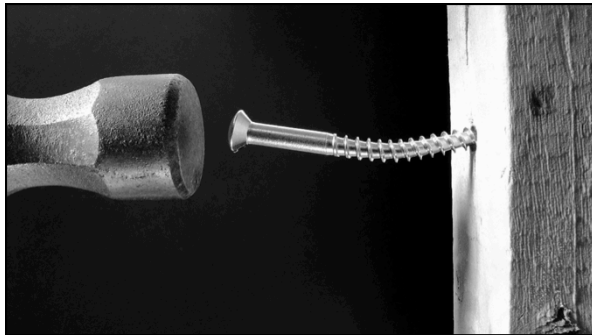@haystackhealth

Innovation must address a problem

"Chant no more your old rhymes about bold Robin Hood,

His feats I but little admire,

I will sing the Achievements of General Ludd

Now the Hero of Nottinghamshire"

LUDDITE

① Innovation must address a problem

There's a difference between ideas, inventions, and innovation.

- **"Idea"** is a novel thought or insight, but without form.
- **"Invention"** is the creation of something new, but without application.
- **"Innovation"** is a product or process applied to solve a problem.

Innovation in medicine is the same, but different

Why can't we innovate in medicine?

- We can, it's called **Research**
  - Human subjects, requires IRB
  - Contribute to generalizable knowledge
  - May result in licensable IP
  - Systematic testing of a hypothesis
  - Typically an external funding source, such as a grant from public or private agency with no fiduciary expectation

Why can't we innovate in medicine?

- We can, it's called **Quality Improvement**
  - Desire to improve a process, protocol, or program
  - Uses a standard QI methodology, such as Plan-Do-Check-Act
  - Aimed at producing change in a process
  - Typically internal operational funding source

Why can't we innovate in medicine?

- We can, it's called **Entrepreneurship**
  - Shared goals of improving health but also demonstrating return on investment
  - For your investors, the latter is most important
  - Subject to same restrictions as rest of healthcare
  - Some very important differences, latitudes, affordances

Risks of innovation in medicine

- **Mission**
  - If you're a not-for profit hospital, is this really aligned with your mission?
- **Financial**
  - Who is paying for this and what (if anything) do they expect in return?
- **Clinical**
  - Be sure the risk to patients is minimal, or else this is "research"
  - There's a reason why the FDA must approve medical devices
- **Professional**
  - Credibility
  - Conflict of interest

THERAC-25: a cautionary tale

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PATIENT NAME   : JOHN DOE
TREATMENT MODE : FIX    BEAM TYPE: X    ENERGY (MeV): 25

                    ACTUAL    PRESCRIBED
    UNIT RATE/MINUTE   0         200
    MONITOR UNITS    50  50      200
    TIME (MIN)       0.27        1.00

GANTRY ROTATION (DEG)     0.0        0      VERIFIED
COLLIMATOR ROTATION (DEG) 359.2      359    VERIFIED
COLLIMATOR X (CM)         14.2       14.3   VERIFIED
COLLIMATOR Y (CM)         27.2       27.3   VERIFIED
WEDGE NUMBER              1          1      VERIFIED
ACCESSORY NUMBER          0          0      VERIFIED

DATE : 84-OCT-26   SYSTEM : BEAM READY   OP.MODE: TREAT AUTO
TIME : 12:55. 8    TREAT  : TREAT PAUSE        X-RAY 173777
OPR ID : T25V02-R03  REASON : OPERATOR    COMMAND:
```

- Radiation therapy machine
- Responsible for 6 accidents, 3 deaths due to massive radiation overdose from 1985-1987
- Attributed to failure to detect a "race condition" in software
- Poor design of error messages ("MALFUNCTION" followed by a number from 1 to 64)
- Personnel didn't believe patient's complaints

What else is different?

- Healthcare is <u>heavily</u> regulated
  - IRB / Human Subjects
  - FDA
  - HIPAA
  - Institutional COI policies
  - Institutional consulting policies
- HIPAA
  - All vendors who use PHI must have a Business Associates Agreement (BAA) in place
  - Often require their own data-loss liability insurance

Haystack experience

Client 1: Behind the Firewall
- Haystack employees had to undergo CHOP background checks, as do all "contractors"
- Assigned a named user account
- Created a secure FTP port

Client 2: Outside the Firewall
- Amazon AWS HIPAA-compliant private cloud server
- Amazon will execute a BAA with clients (available whitepaper)

Google's nine pillars of innovation

- Innovation should come from everywhere
- Focus on the user
- Aim to be 10-times better
- Bet on unique insights
- **Launch and iterate**
- **Give your employees 20% time to create**
- Default to open (platform, not solution)
- **Fail well**
- Have a mission that matters

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② Innovation in healthcare is necessarily different

- Must balance innovation with risk to patients.
- Medical devices requires a different level of testing rigor.
- People tolerate buggy software, but not in healthcare. So "launch and iterate" doesn't translate the same way.
- "Failing well" means different things to Google and to a hospital.
- I don't know about you, but nobody is giving me 20% time to tinker!

"Derisking" is Not a Made Up Word

derisk

verb [I or T] (ALSO **de-risk**) /ˌdiːˈrɪsk/

*to make something safer by reducing the possibility that
something bad will happen and that money will be lost.*

Challenge Implicit/Explicit Assumptions

- Positioning / differentiation
- Demand
- Market size
- Feature set
- Competition
- Pricing / business model
- Sales / adoption cycle
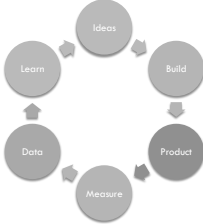
Credit: Steve Barsh, DreamIt Ventures

Goals of Derisking

□ Convert assumptions into knowledge
  ◘ At low cost
  ◘ As quickly as possible
□ Decrease assumptions to increase value
□ Consume intellectual capital <u>before</u> outside capital
□ Know when to proceed and when to pivot

Credit: Steve Barsh, DreamIt Ventures

Validate assumptions, iterate frequently

□ **Customers**
  ◘ Who are they?
  ◘ What do they think?
  ◘ What do they like/dislike?
□ **Investors**
  ◘ Who will fund this and why?
□ **Talent**
  ◘ Who do you need to bring this to market?
□ **Time**
  ◘ How can we shorten the time to market and how do we get there?

Credit: Patrick Fitzgerald, CHOP OIE
& The Lean Startup Book by Eric Ries

Examples of Derisking

- **Target market:** you see rare diseases a lot, but does your target market?
- **Dollars:** is the group that would benefit the group that would pay for it?
- **Sales cycle:** hospital enterprise software sales cycle is 1-2 years!
- **What does it solve:** do others agree this is a big enough problem to warrant a special solution?
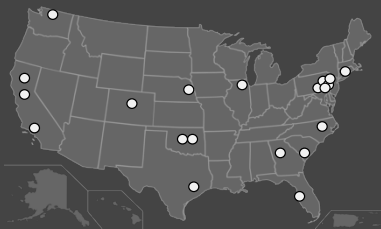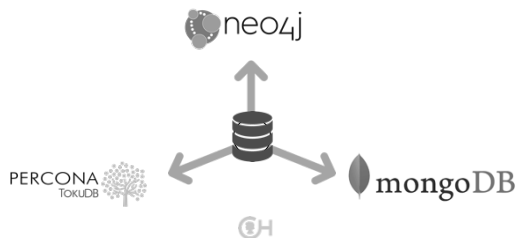
MedCity News

5 healthcare startup pitches that got it wrong (and why)

http://medcitynews.com/2015/10/healthcare-startup-pitches/

Credit: Steve Barsh, DreamIt Ventures

Market Validation

Pivot when necessary

neo4j

PERCONA
TOKUDB

mongoDB

③ Derisk early: challenge every assumption

- Nine out of ten startups fail (worse than restaurant industry!)
- Be aware of your own confirmation bias: of course you think it's a great idea, it was your idea!
- Choosing to change early is easier than being forced to change late.

Build a strong team and seek out expertise
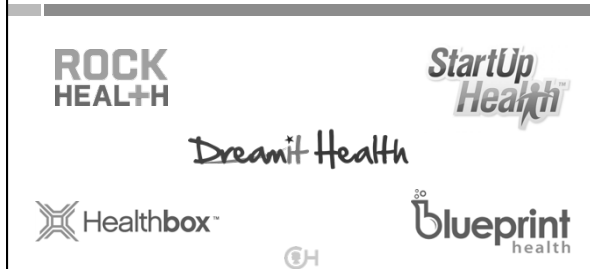

Raise your hand if you can answer yes...

- ☐ Your hospital has a device fabrication / prototyping facility?
- ☐ Your hospital has a mobile apps development shop?
- ☐ Your hospital understands modern web technology?
- ☐ Your hospital has a formal structure to support innovation?
- ☐ Your hospital can introduce you to innovators, investors, and entrepreneurs?
- ☐ You have personal experience with starting a company?

Some hospital examples

TMC | INNOVATION

Boston Children's Hospital
Until every child is well

The Children's Hospital of Philadelphia

Penn Medicine
CENTER FOR HEALTH CARE INNOVATION
Accelerating Ideas to Transform Health Care

Stanford MEDICINE X
THE INTERSECTION OF MEDICINE AND EMERGING TECHNOLOGIES

Cincinnati Children's
Hospital Medical Center

Healthcare accelerators / incubators

ROCK HEAL+H

StartUp Health

Dreamit Health

Healthbox

blueprint health

What to look for

- Do they prefer early or late stage companies?
- What do they offer?
  - Space
  - Resources
  - Mentorship
  - Speakers / Tutorials
  - Connections / Introductions
- Track record? Alumni network?

Experience with Haystack

- DreamIt identified a startup veteran, Adrian Talapan, as CEO
- We were the marketing, branding, product development, technical, sales, and HR team all rolled into one. Startups are impressively nimble.
- We hired our first 2 developers via Craigslist!
- Web stack is entirely open source
- Took a "mini-sabbatical" for 40% effort x 4 months
- Built the minimum viable product "MVP"
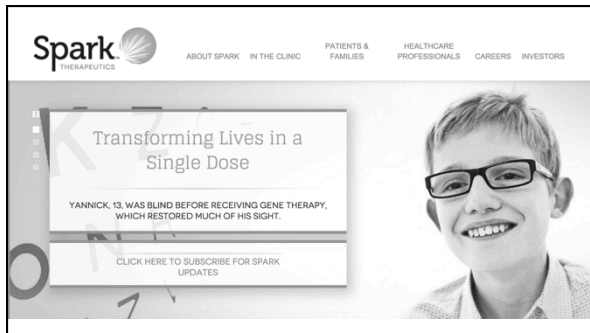
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④ Build a strong team and seek out expertise

- Defer to expertise where you can find it.
- Accelerators/Incubators offer a specific value – see if it's right for you.
- When given an opportunity to network, pay it forward.

Innovation comes in all shapes and sizes

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

□ Clinical go-live this month!

□ Built on Qlikview analysis platform

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
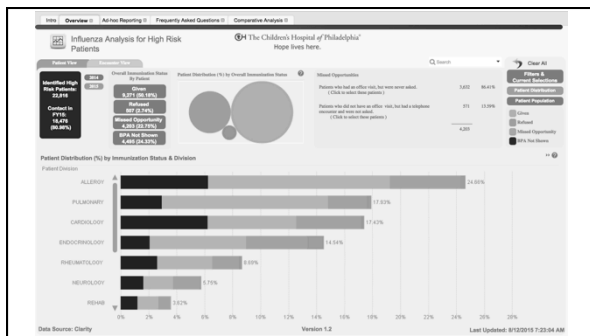
Care Assistant & Epic Integration

- 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

Credit: Jeff Pennington, CHOP DBHI
*Funded by various grants & CHOP support.*
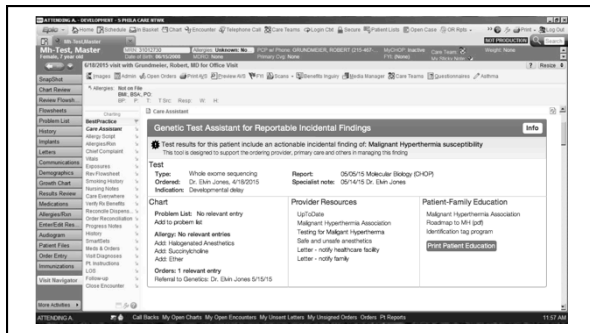
ProBand: Digital Pedigree & Algorithmic Risk Prediction

- 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.
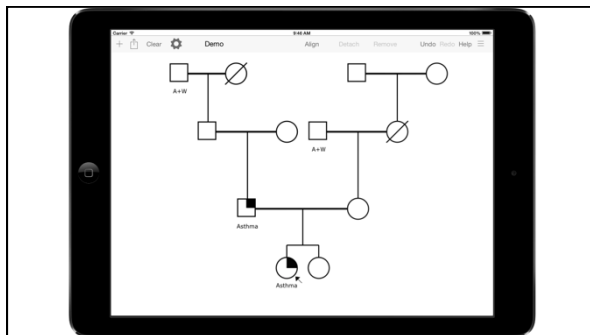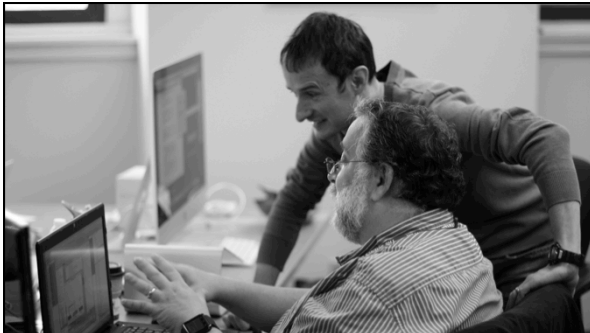
PediCrisis

Available for iOS and Windows 8

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⑤ Innovation comes in all shapes and sizes

- From "Big I" innovation all the way to "little i" process innovation.
- There is value in developing a culture and process for innovation.
- Identify the correct patron up front and make sure incentives are aligned: what's in it for A to pay you to build B?
- Learn to "pitch" your ideas – big or small - for traction.

Most of all, have fun!

Photo credit: Bryan Karl Lathrop • bklphoto.com

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⑥ Most of all, have fun!

- Some of the most creative and exciting work I've done in years.
- Startups are very different from hospitals, and the differences are enlightening.
- Valuable and portable skillset.
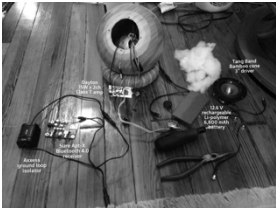- Incredibly rewarding experience, enduring relationships.

Product
Tang Band W3-1364SA 3" Bamboo Cone Driver Part # 264-844
Speaker Cabinet Port Tube 1-3/8" ID Adjustable Part # 260-386
Dayton Audio BPA-38SN HD Binding Post Pair Satin Nickel Part # 091-1247
Bluetooth Audio Receiver Board v2.1+EDR 12 VDC Part # 320-351
Dayton Audio DTA-2 Class T Digital Audio Amplifier Module Part # 300-385
Axxess AGL3.5 3.5mm Ground Loop Isolator Part # 266-009
SPST Round Push Button Switch Click On/Click Off Part # 060-620
3.5mm Stereo Panel Mount Jack Part # 090-317
Panel Mount Metal DC Power Jack 2.1 x 5.5 mm Part # 090-495

Office of Innovation & Entrepreneurship

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

Patrick FitzGerald
VP of Innovation & Entrepreneurship
fitzgeraldp@email.chop.edu

Thank You!

desai@email.chop.edu