



Moving AI to the Point of Care

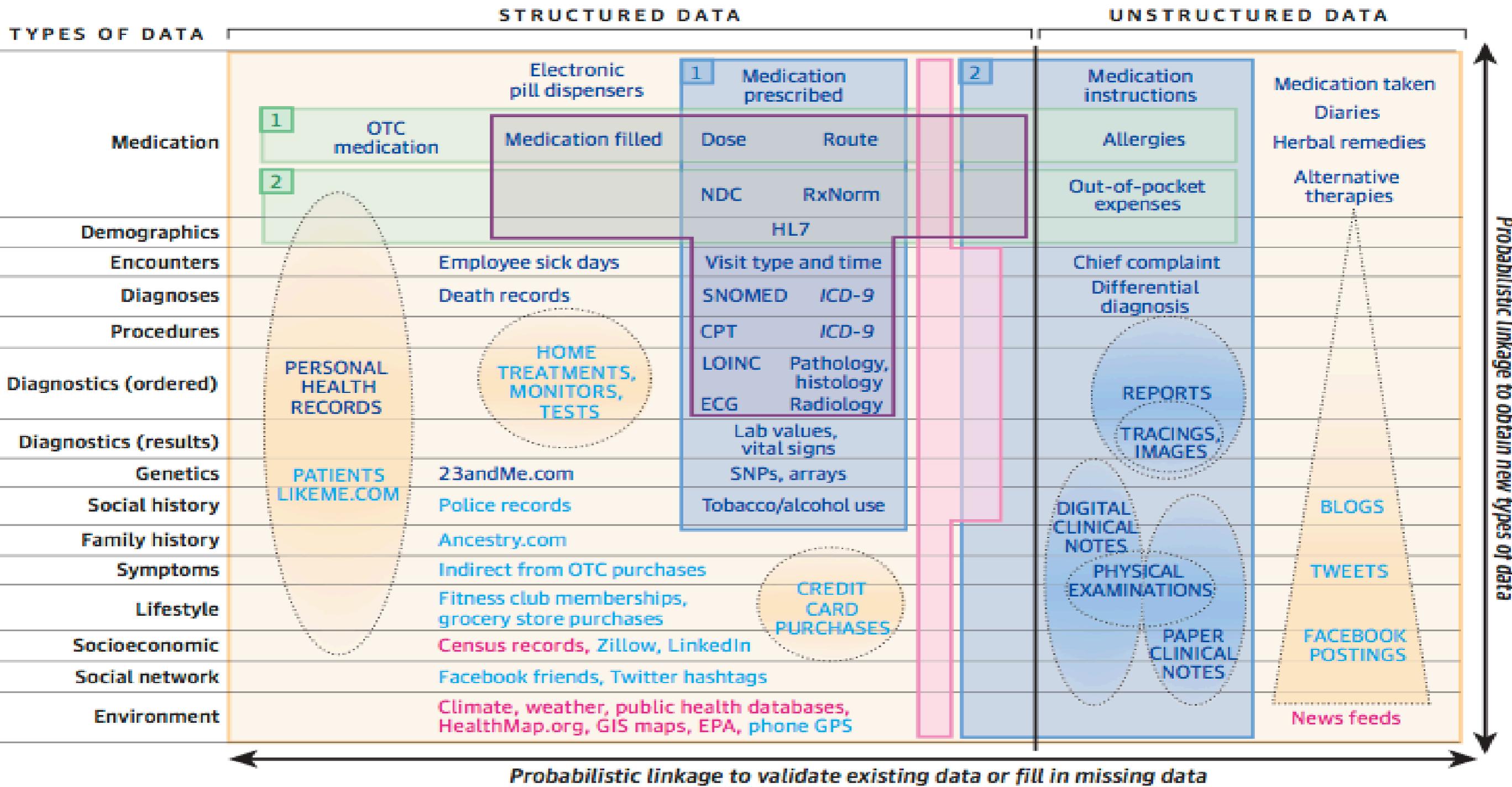
Kenneth D. Mandl, MD, MPH

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Harvard Medical School

 @mandl

The Tapestry of Potentially High-Value Information Sources That May be Linked to an Individual for Use in Health Care



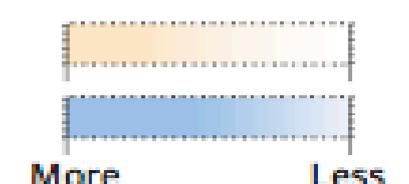
Examples of biomedical data

- 1 2 Pharmacy data
- 1 2 Health care center (electronic health record) data
- Claims data
- Registry or clinical trial data
- Data outside of health care system

Ability to link data to an individual

- Easier to link to individuals
- Harder to link to individuals
- Only aggregate data exists

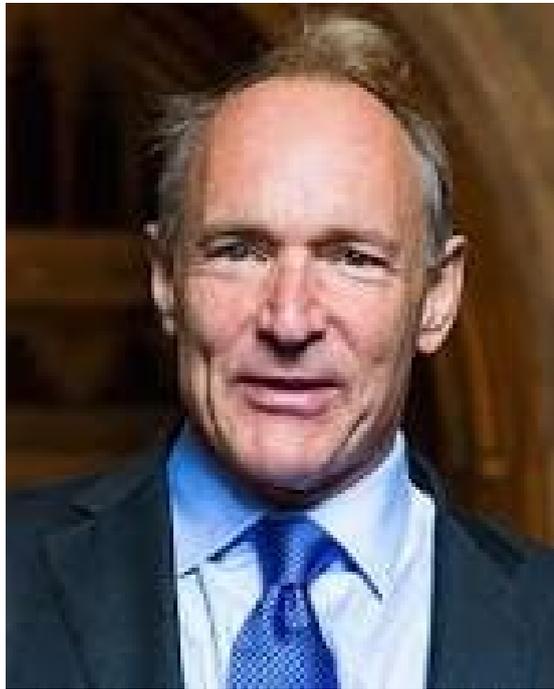
Data quantity



Despite \$48B Investment in EHRs, Point of Care is a Walled Garden



Invention of the World Wide Web



- Built over the existing TCP and IP protocols, it consisted of 4 building blocks:
- A textual format to represent hypertext documents, the *HyperText Markup Language* (HTML).
- A simple protocol to exchange these documents, the *Hypertext Transfer Protocol* (HTTP).
- A client to display these documents, the first Web browser called *WorldWideWeb*.
- A server to give access to the document, an early version of *httpd*.

Parsimonious Standards to Create Interop

1. Substitutable apps
2. Trigger-able decision support
3. Patient-generated data
4. Push button population health



The NEW ENGLAND JOURNAL of MEDICINE

No Small Change for the Health Information Economy

Kenneth D. Mandl, M.D., M.P.H., and Isaac S. Kohane, M.D., Ph.D.

The economic stimulus package signed by President Barack Obama on February 17 included a \$19 billion investment in health information technology. How can we best take advantage of this unprecedented opportunity to computerize health care and stimulate the health information economy while also stimulating the U.S. economy? A health care system adapting to the effects of an aging population, growing expenditures, and a diminishing primary care workforce needs the support

of a flexible information infrastructure that facilitates innovation in wellness, health care, and public health.

Flexibility is critical, since the system will have to function under new policies and in the service of new health care delivery mechanisms, and it will need to incorporate emerging information technologies on an ongoing basis. As we seek to design a system that will constantly evolve and encourage innovation, we can glean lessons from large-scale information-

technology successes in other fields. An essential first lesson is that ideally, system components should be not only interoperable but also substitutable.

The Apple iPhone, for example, uses a software platform with a published interface that allows software developers outside Apple to create applications; there are now nearly 10,000 applications that consumers can download and use with the common phone interface. The platform separates the system from the functional-

2009

Designing the app store for health



SMART®

Bloodwork Cardiology Result ● BACTA MEDICAL CENTRE

ORDERED BY: Dr. Francis Pulaski
Bellevue Medical Centre
lamar.d@bactamed.edu
(603) 555-54321 x1523

Patient info
NAME: John Doe
GENDER: M AGE: 49 DOB: 01/10/1961

COLLECTED: 11/02/2010, 10:40 a.m.
RECEIVED: 11/02/2010, 1:03 p.m.

1 About this test
This report evaluates your potential risk of heart disease, heart attack, and stroke.

2 Your results

CRP level test 3.3 your level of a specific protein in the blood linked to inflammation of blood vessels

Low risk 0 mg/L | Average 1-3 | High risk of cardiovascular disease 3-10 mg/L

Total cholesterol level 265

Desirable | Borderline 200-239 | High 240 | 240+

LDL "bad" cholesterol 233

Optimal 0 mg/dL | Near Optimal 100-129 | Borderline high 130-159 | High 160-189 | Very High 190 | 190+

HDL "good" cholesterol 32

Low 0 mg/dL | Normal 40-59 | High 60 | 60+

3 Your risk You show an elevated risk of cardiovascular disease

If you're a smoker with normal blood pressure (130 mm/Hg) but family history of heart attack before age 60 (one or both parents) your risk over 10 years is: 15%

Your risk would be lowered to:
12% if your blood pressure were 120mm/Hg
10% if you quit smoking
6% if you reduced cholesterol to 160mg/DL

Use your CRP results and cholesterol level to calculate your 10 risk of a cardiovascular event at ReynoldsRisk.org

4 What now?

- Diet & exercise - can improve your cholesterol levels
- Quitting smoking - can decrease your heart disease risk by 50% or more
- Ask your doctor about statins or other medications that can lower cholesterol
- Consider retesting in 1 to 2 weeks to exclude a temporary spike in blood levels

David McCandless & Stefanie Posavec for Wired Magazine // informationisbeautiful.net



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Problem #1

**AI apps don't
connect to health systems data**

21st Century Cures

Certification Requirement

HHS has published application programming interfaces and allows health information from such technology to be accessed, exchanged, and used **without special effort** through the use of application programming interfaces or successor technology or standards, as provided for under applicable law, including **providing access to all data elements of a patient's electronic health record** to the extent permissible under applicable privacy laws;



Official Website of The Office of the National Coordinator for Health Information Technology (ONC)

TOPICS | HOW DO I? | BLOG | NEWS | ABOUT ONC

regulation, and Policy > Notice of Proposed Rulemaking to Improve the Interoperability of Health Inform

Notice of Proposed Rulemaking to Improve the Interoperability of Health Information

The U.S. Department of Health and Human Services (HHS) recently proposed a new rule to support seamless and secure access, exchange, and use of electronic health information (EHI).

The proposed rule is designed to increase innovation and competition by giving patients and their healthcare providers secure access to health information and new tools, allowing for more choice in care and treatment. It calls on the healthcare industry to adopt standardized application programming interfaces (APIs), which will help allow individuals to securely and easily access structured EHI using smartphone applications.

The proposed rule places a strong focus on a patient's ability to access their health information through a provision requiring that patients can electronically access all of their EHI (structured and/or unstructured) at no cost. Finally, to further support access and exchange of EHI, the proposed rule implements the information blocking provisions of the Cures Act. The rule proposes seven exceptions to the definition of information blocking.

The public comment period is now open for the proposed rule. We value all of your feedback – both positive and negative as it helps inform the rulemaking process. Below are the steps to submitting your comments:

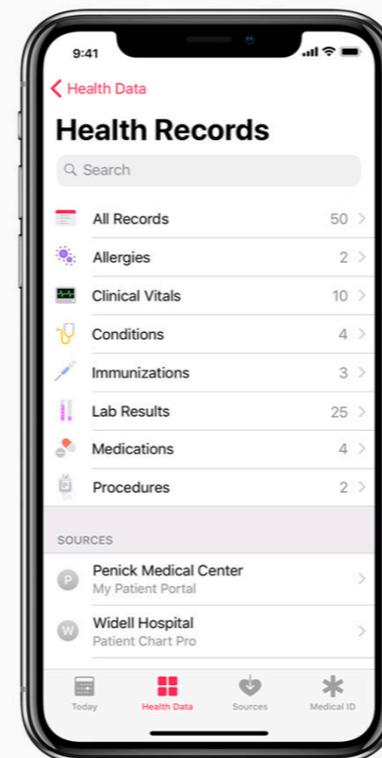
[Download the Proposed Rule \[PDF - 3.2 MB\]](#)

[Comment on the Proposed Rule](#)

Comments on the proposed rule are due by 11:59 pm ET on May 3, 2019.

Fact Sheets on the Proposed Rule

- [Implementation of Cures Act and Executive Orders \[PDF - 1.4 MB\]](#)
- [Conditions and Maintenance of Certification Requirements \[PDF - 805 KB\]](#)
- [Information Blocking – Summaries of the 7 Exceptions \[PDF - 578 KB\]](#)



A commercially viable app

meducation 27ZWENTX Demos | Tutorial | Feedback

Med List | Calendar | Next Dose Add Med | Print PMI | Hmong: White | Regular | Options

Drug Name	SIG Instructions	Links	Med Type	Category	Cal	PMI
Aspirin Tablet 81mg	1 once daily [morning] for preventing blood clots in the legs		Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Carvedilol Tablet 25mg	1 twice daily		Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fish Oil Capsule 1000mg	2 once daily		Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Flovent 100mcg/inh	1 puff every 12 hours		Inhalant	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Irbesartan Tablet 300mg	1 once daily		Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Metamucil Sugar-Free	1 teaspoon three times daily		Oral Liquid	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Omeprazole Delayed Release Tablet 20mg	1 once daily		Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ProAir HFA	2 puffs every 4 hours for asthma		Inhalant	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Synthroid Tablet 50mcg	1 once daily		Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Systane ophthalmic solution	1 drop each eye twice daily		Ophthalmic	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Vitamin D3 Capsule 5000 iu	1 once daily		Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Zetia Tablet 10mg	1 once daily		Oral Pill	Daily	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Blue SIG: SIG not recognized

Edit unrecognized data

View PMI (Personal Med Instructions)

View demonstration

Blue Drug: Medicine not recognized

Clarify SIG instructions

Med detail unavailable

View FDA Med Guide

The App Gallery

meducation

First Databank

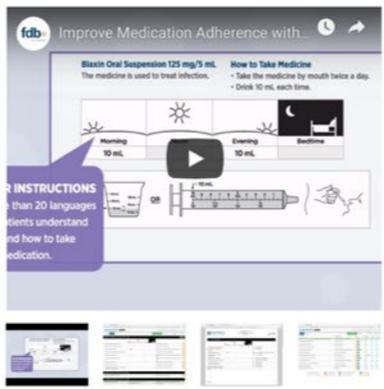
Website
Try App
Contact
Edit

Meducation® is accessed from within EHR workflow and converts patients' complex medication instructions into plain language for low health literate and limited English proficient patients. Low health literate individuals are more likely to take their medicines incorrectly, be hospitalized, mismanage chronic conditions and visit the emergency room.

Meducation reduces medication errors and improves medication adherence by providing actionable Sig-based instructions. Meducation is not static patient education material (PEM). Meducation uses the patient's drug and SIG information from Integrated with your EHR or Pharmacy system, Meducation uses a patient's medication and SIG information to create personalized medication instructions that can be delivered to patients printed, or as part of their discharge documents, without interrupting clinical workflow. Meducation has proven to increase medication adherence, improve patient satisfaction and reduce hospital readmission rates, particularly for Low Health Literate and Limited English Proficient patients.

Meducation instructions and summaries:

- Are at a 5-8th grade reading level for patients with literacy issues
- Summarize patients' complex medication regimens in a single page
- Provide detailed instructions for 5000+ medications and more than 150,000 NDC codes
- Offer 6 font size choices, for the elderly or vision-impaired
- Unambiguously depict the patient's specific SIG (prescription dose and frequency) using the "Universal Medication Schedule"
- Include pictograms depicting usage, to reduce dosing errors.
- Link to a library of multilingual videos that demonstrate proper use of particularly difficult devices or medications.
- Are all available in 20+ languages for limited English proficient patients
- Present information in research-based, engaging and intuitive formats that reduce cognitive overload



Designed for
Clinicians & Patients

Categories
AMIA 2018, Patient Engagement, Medication

FHIR Compatibility
DSTU 2, STU 3

Licensing & Pricing
Other, Site-Based, Per User

Call (800) 633-3453 and select option #8 to speak with a sales consultant.

EHR Support: Epic Cerner Athena Health Allscripts

OS Support: Web

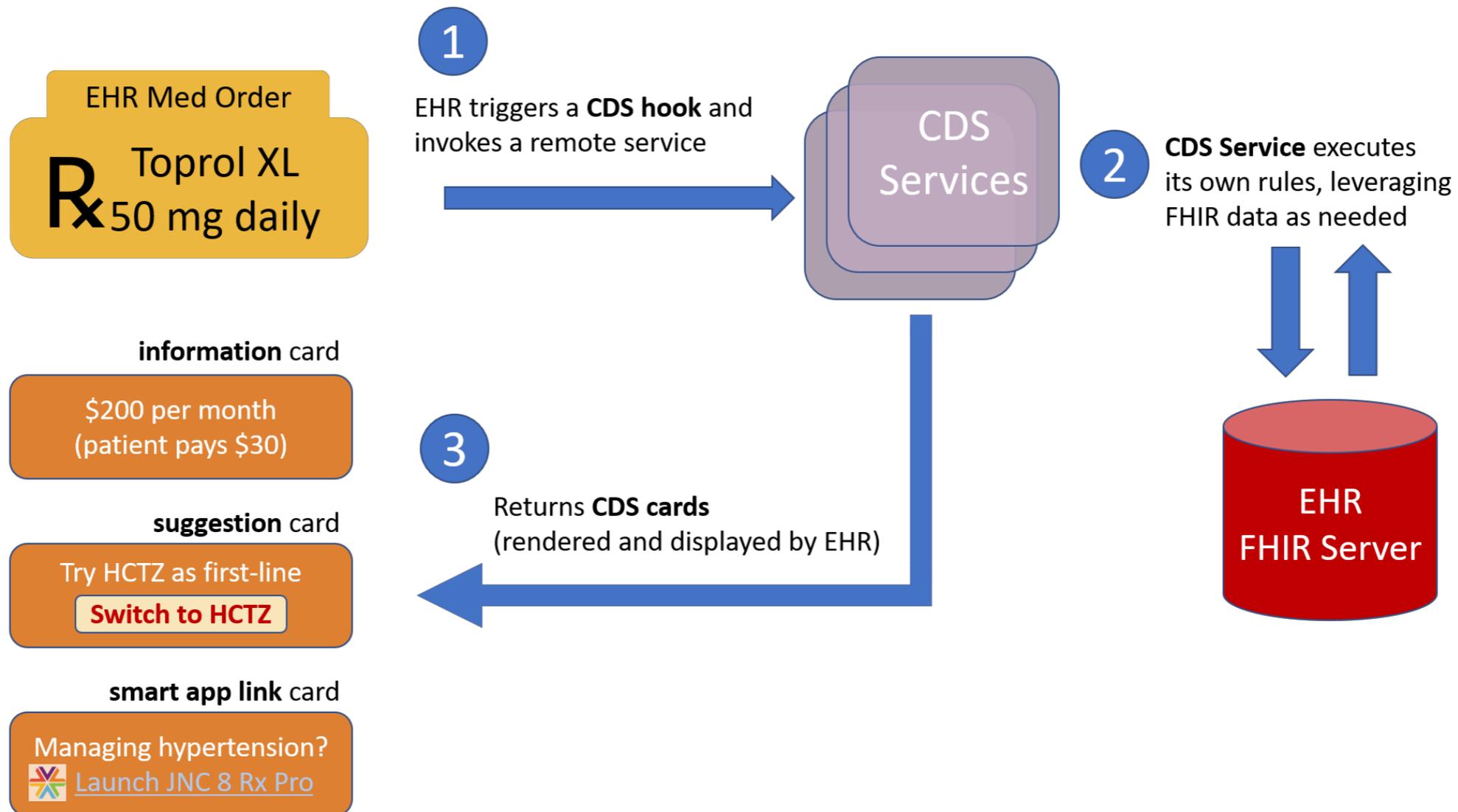
JMIR 2019

Problem #2

**Can't launch apps
at just the right moment
during the decision process**

Triger-able decision support

CDS HOOKS[®]

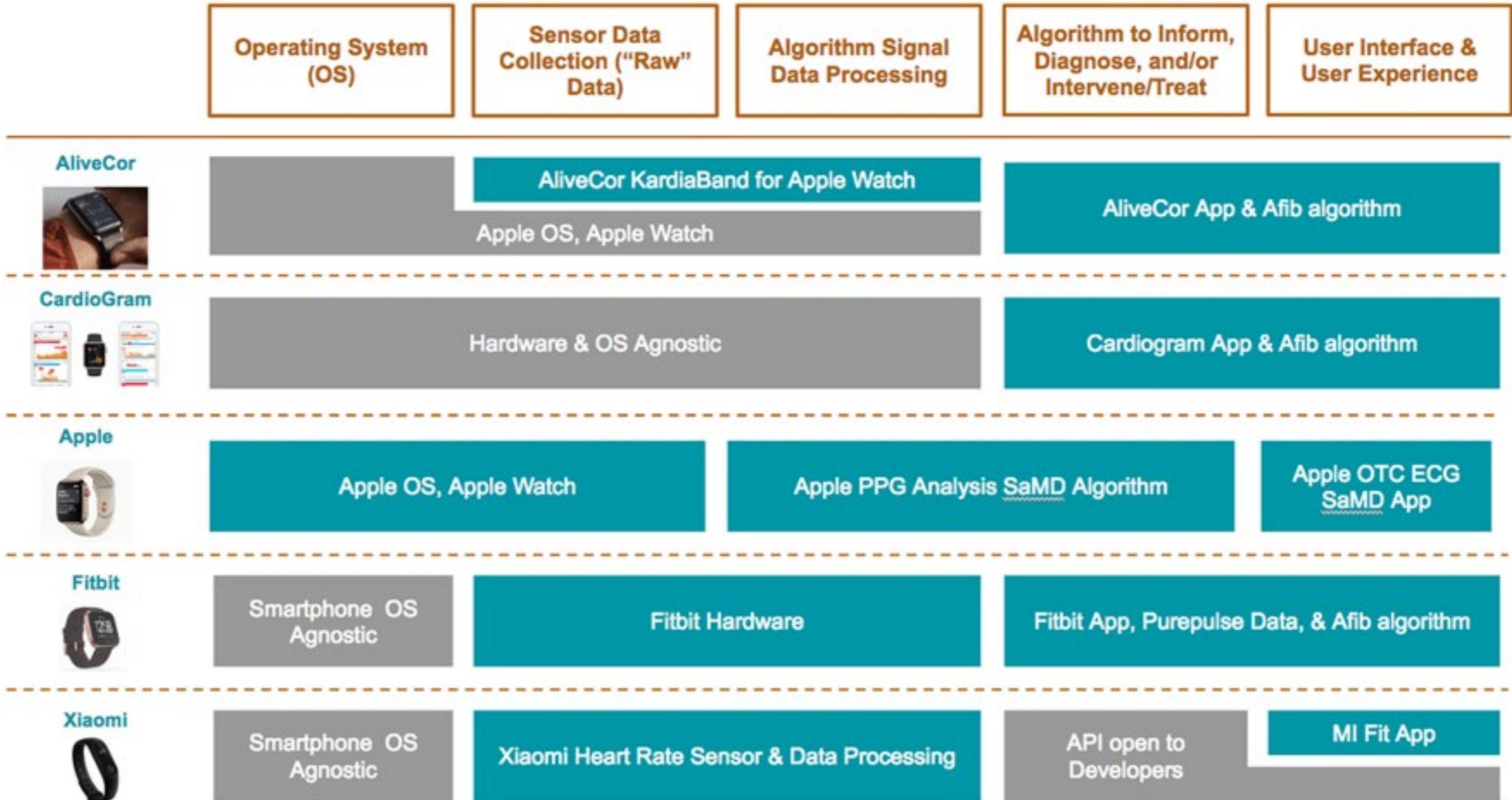


Problem #3

Patient generated data are non-standardized and in a separate silo

Modularity of software and sensor products to detect atrial fibrillation through connected technologies

Software built and maintained by listed manufacturer
 Software built and maintained by third party



NPG Digital Medicine 2019

Problem #4

Getting reference population data (for model building, updating) out of EHRs into analytic platforms is really hard

Push button population health /FLAT FHIR

- Enhancing FHIR to
- Support Bulk Data access



The cover of a report titled "The Intersection of Technology and Policy: EHR Population Level Data Exports to Support Population Health and Value". The cover is primarily dark red with a teal horizontal band. It features logos for chip, Harvard Medical School, and Boston Children's Hospital. The title is in white and pink text. Below the title, it says "EXECUTIVE SUMMARIES" in white on the teal band. At the bottom, it lists the date "December 15, 2017" and mentions funding from the Office of the National Coordinator for Health Information Technology and the chip program at Boston Children's Hospital. Logos for SMART and the Office of the National Coordinator for Health Information Technology are at the bottom.

Establish your independent research program at
Harvard and Boston Children's

**Harvard Medical
School Instructor,
Assistant, or Associate
Professor**

in the

**Computational
Health Informatics
Program**

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