By 2020, 40% of healthcare providers globally will find their EHR will not support their care delivery needs.
Digital Care Delivery — A Fusion of All Care Delivery Technologies

The Digital Care Platform Is ...
- A Clinical Colleague and Mentor
- A Patient Advisor and Health Coach
- A Virtual Assistant
- A Virtual Patient Connection
E-Health Requires Scale and Maturity on Two Levels

Adoption Curve No. 1 — All HDOs Are Digitally Enabled (e.g. EHR)
E-Health Requires Scale and Maturity on Two Levels

Adoption Curve No. 2 - Digital Ecosystem Capabilities

Ecosystem Maturity

National E-Health Maturity

Health Org. Maturity

Ecosystem Pace

Time t(1) t(2)
Definitions

DEFINITIONS

A platform business is an organization that enables value-creating interactions between people, businesses and things.

A platform business model is a design that consummates matches among providers and consumers (both also referred to as users) and/or facilitates the creation and/or exchange of goods, services and social currency, so that all participants are able to capture value.

A platform is the combination of technologies that enables platform business models. Platforms share assets such as data, algorithms and transactions (both monetary and nonmonetary) with business ecosystems to match, create and exchange services.
# Reason No. 1: Financial

The Most Valuable Companies Are Platform Businesses

<table>
<thead>
<tr>
<th>Company</th>
<th>Market Capitalization {U.S.$ Billion}</th>
</tr>
</thead>
<tbody>
<tr>
<td>ExxonMobil</td>
<td>362.5</td>
</tr>
<tr>
<td>GE</td>
<td>348.5</td>
</tr>
<tr>
<td>Microsoft</td>
<td>279.0</td>
</tr>
<tr>
<td>Citi</td>
<td>230.9</td>
</tr>
<tr>
<td>BP</td>
<td>225.9</td>
</tr>
<tr>
<td>Royal Dutch Shell</td>
<td>203.5</td>
</tr>
<tr>
<td>P&amp;G</td>
<td>197.1</td>
</tr>
<tr>
<td>HSBC</td>
<td>193.3</td>
</tr>
<tr>
<td>Pfizer</td>
<td>192.1</td>
</tr>
<tr>
<td>Wai-Mart Stores</td>
<td>188.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Company</th>
<th>Market Capitalization {U.S.$ Billion}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>586.0</td>
</tr>
<tr>
<td>Alphabet</td>
<td>500.1</td>
</tr>
<tr>
<td>Microsoft</td>
<td>407.0</td>
</tr>
<tr>
<td>ExxonMobil</td>
<td>363.3</td>
</tr>
<tr>
<td>Berkshire Hathaway</td>
<td>360.1</td>
</tr>
<tr>
<td>Facebook</td>
<td>314.8</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>312.6</td>
</tr>
<tr>
<td>Amazon</td>
<td>292.6</td>
</tr>
<tr>
<td>GE</td>
<td>285.6</td>
</tr>
<tr>
<td>Wells Fargo</td>
<td>256.0</td>
</tr>
</tbody>
</table>


**Source: Fortune 2000 (www.forbes.com/#!/headermarketValue_sortreverse.true)
Platform Business:
1. Lets business ecosystems create/exchange value
   and/or
2. Matches producers/consumers
Digital Care Delivery Building Blocks

- Engage
- Interact
- Sense
- Run
Ecosystem Capabilities for a Digital Care Platform

Transformational and High Value:
- Semantic Interoperability (via Increasing Open API Capability)
- Healthcare Algorithmic Marketplace
- Orchestration Capabilities

Future "Must-Have" Capabilities:
- External Clinical Decision Support
- Enterprise Virtual Care Platform
Consumer Capabilities for a Digital Care Platform

Transformational and High Value:
- Digital Clinical Encounter, E-Visits
- AI Healthcare Advisors (Healthcare VPAs)

Future "Must-Have" Capabilities:
- Patient Decision Aids
- Medication Compliance Management
- Automated Informed Consent
- On-Demand Virtual Visits

THINK Consumer Hub – BEWARE of standalone EHR portals
More virtual care than office visits at Kaiser Permanente by 2018

By NEIL VERSEI

By 2018, Kaiser Permanente will perform more virtual visits than in-person office visits.

This bombshell of sorts came to us from Dr. Robert Pearl, executive director and CEO of the Perruanente Medical Group and president and CEO of the Mid-Atlantic
Internet of Healthcare Things

Transformational and High Value:
- Remote Patient Monitoring

Future "Must-Have" Capabilities:
- Critical Condition Surveillance Systems
- Robotics-Assisted Telesurgery
- Eldercare-Assistive Robots
With more than a decade of experience in telehealth, Mercy has demonstrated that remarkable people are the power behind advanced technology.

Delivering Care Wherever It's Needed

For nearly 200 years, the caregivers of Mercy have provided care where it is needed most. Today, technology allows us to fulfill this mission literally as well as figuratively.

Mercy Virtual is transforming health care 24 hours a day, seven days a week, 365 days a year by creating new care models supported by tclchealth teams and technology. Patients no longer have to physically seek out care or entirely reorient their lives to gain access to specialists. Virtual technology brings care to them.
Components of the Digital Business Technology Platform

Customers
- AI Healthcare Advisors
- Virtual Visits
- Remote Patient Monitoring
- Critical Condition Surveillance
- Assistive Robots
- Digital Clinical Encounters

Customer Experience Platform
- Genomics Assessment
- Speech Analysis Diagnosis

Data & Analytics Platform
- Algorithmic Medicine
- Precision Medicine

IoT Platform
- Consumer Wearables for Monitoring

Ecosystems Platform
- Algorithmic Marketplace
- External Clinical Decision Support
- Healthcare Interoperability

Partners
- Clinical Automation
- PHI Consent Management
- Next-Generation Nurse Call

Employees
- EHR
- EHR Support for Virtual Care

Things
Evidence Based Medicine

‘Scientific evidence’

‘Clinical experience’

‘Patient preference’

Digital Care Platform — Intelligence and AI-Driven Care Processes

Transformational and High Value:
- Algorithmic Medicine
- Genomics Medicine
- Precision Medicine
- Population Health Management
- AI-Enabled Diagnostic Imaging Interpretation
- Speech Analysis for Clinical Diagnoses
# Machine Learning and Evidence-Based Medicine

Ann Intern Med. Published online May 01, 2018. doi:10.7326/M18-0115

<table>
<thead>
<tr>
<th>Evidence-Based Medicine</th>
<th>Machine Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis-driven experimentation based on well-defined, sequential protocols</td>
<td>Data-driven discovery that uses no protocols and operates in parallel or concurrently</td>
</tr>
<tr>
<td>Examines relationships between a limited number of prespecified variables of low diversity (dimensionality)</td>
<td>Examines relationships between many variables that are not prespecified and have high diversity (dimensionality)</td>
</tr>
<tr>
<td>Uses structured data of lower volumes (megabytes or gigabytes), fewer participants (hundreds to thousands), and a smaller range of sources (controlled trials or prospective cohort studies)</td>
<td>Uses data, often unstructured, of higher volumes (terabytes or petabytes), more participants (thousands to hundreds of thousands), and a larger range of sources (EHRs, administrative data sets, wearable sensors, genomic and proteomic databanks, and social media)</td>
</tr>
<tr>
<td>Analytic methods based on theory, with declared or confirmed assumptions around data completeness, accuracy, classification, and independence</td>
<td>Algorithms are agnostic and data-driven, with few assumptions around data completeness, accuracy, classification, and independence</td>
</tr>
<tr>
<td>Relies on comparisons between groups to infer causation</td>
<td>Relies on correlations between variables within data sets to infer causation</td>
</tr>
<tr>
<td>Uses an evidence hierarchy that reflects risk of bias of specific study designs</td>
<td>Uses no hierarchy to assess risk of bias of different algorithms</td>
</tr>
<tr>
<td>Confidence in evidence increases with results consistently replicated in multiple studies</td>
<td>Confidence in algorithms developed in training sets increases with results consistently replicated in multiple testing sets</td>
</tr>
</tbody>
</table>

EHR = electronic health record.
# Evolution from a Data Warehouse to Data Operating System for Clinicians

<table>
<thead>
<tr>
<th>EHR</th>
<th>Data Operating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contains EHR data.</td>
</tr>
<tr>
<td>2</td>
<td>Designed for data entry.</td>
</tr>
<tr>
<td>3</td>
<td>Each EHR is an island.</td>
</tr>
<tr>
<td>4</td>
<td>Apps are not portable.</td>
</tr>
<tr>
<td>5</td>
<td>No access to machine learning.</td>
</tr>
<tr>
<td>6</td>
<td>No reusable logic.</td>
</tr>
<tr>
<td>7</td>
<td>Each integration requires making changes in the EHR.</td>
</tr>
<tr>
<td>8</td>
<td>Information overload for clinicians.</td>
</tr>
</tbody>
</table>
Center of Excellence Platform

The heart is an Hadoop platform which decreases storage cost by 90%, aggregates data sources, enables enhanced security and the flexibility to answer unanticipated questions.
Sepsis

• Annually, more than 1.5 million Americans experience sepsis

• 1 in 3 patients who die in a hospital have sepsis\(^1\)

• Cost of $24 billion/year\(^2\)

• Early identification is key to saving lives

• Time sensitivity of SEP-1 bundle compliance from time zero\(^3,4,5\)

*Dignity Health.*
Sepsis Bio-Surveillance Program

Paper describes our efforts to alert clinicians to the risk of sepsis as early as possible through CDS.

• Goals
  - Save 400 lives/year
  - Reduce ICU length of stay by 10%
  - Reduce unnecessary costs

• Strategy
  - Identify Key Performance Indicators (KPI's) that are the levers to increase effectiveness
  - Optimize Sepsis alert algorithm
  - Automate Sepsis Time Zero in real-time
  - Accelerate improvement in SEP-1 Bundle Compliance

* Dignity Health.
Sepsis Bio-Surveillance Tools

Dignity Health.
Measure Results- Meet or Exceed Goals

We use data across the continuum of care to improve outcomes of patients, increase knowledge worker productivity, enable self-service access, and markedly increase calculation speed and insights to decision makers.

- Average 4% decline in mortality per year over two consecutive years
- Improvement in bundle compliance (goal 90%) (34% to 51% overall, ED only > 60%)

Dignity Health.
Determine Your Capability Roadmap for Digital Care

Era 1: New Generation

- AI Healthcare Advisors
- Consumer Wearables for Monitoring
- E-Visits
- Critical Condition Surveillance
- Remote Patient Monitoring
- Pop. Health Management

Era 2: Integration Foundation

- G3 EHR
- Precise Medicine
- Speech Analysis Diagnosis
- Genomics Medicine
- Algorithmic Medicine
- Healthcare Interoperability
- External Clinical Decision Support

Era 3: Helper

- Enterprise Virtual Care Platform
- Clinical Automation
- Next-Generation Nurse Call
- Stand-Alone Telehealth
- EHR Support for Virtual Care

Era 4: Colleague

- Assistive Robots
- Algorithmic Marketplace
- Semantic Interoperability
- Enterprise Virtual Care Platform
- Clinical Automation

Era 5: Mentor

- Digital Clinical Encounters
- Patient Decision Aids
- Assistive Robots
- Algorithmic Marketplace
- Semantic Interoperability

<2 Yrs.
2 to 5 Yrs.
5 to 10 Yrs.
10 Yrs.+