Importance of wearable MetaData in care orchestration

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ARM, world’s leading semiconductor IP company

Billions of chips with ARM IP shipped in 2015: 15
ARM IP Across the Healthcare spectrum

- ARMs Low-Power, High Efficient Cortex™ CPUs, MCUs, power modern medical wearable devices
- ARM Cordio™ Bluetooth IP for radios
- ARM TrustZone™ for securing data from sensor→phone→cloud

ARM HPC and Server SoCs offer diverse range of compute for genomics workloads from ARM based FPGAs to Server chips with crypto, compression accelerators providing increased performance

- ARMs Low-Power, High Efficient Cortex™ CPUs, MCUs powering EEG, EMG ASICs
- Diverse partner SoC ecosystem offering DSPs and FPGAs for signal processing
- ARM Cordio™ Bluetooth IP for radios
- ARM TrustZone™ for securing data from sensor→phone→cloud
Chronic Illnesses
Rising + Aging population

Diabetes to grow 2.5x by 2025 to 228M people*

2020 Chronic Diseases → ¾ of deaths*

Cancer deaths grow 8M→13M by 2030**

$3.2 Trillion spent on healthcare in US

Projected US healthcare spend increase 3%

~$290B → non-adherence to meds

* Source: World health organization

** Source: cancer.org
Not everyone sees their health in the same light

HEALTH CONSUMER SEGMENTATION

Source: Parks Associates
When it comes to health we typically only see the tip
By 2020 there will be have been 1.15 Billion connected health & fitness devices cumulatively shipped

Source: Gartner IoT Device Forecast
Tsunami of connected medical devices coming
Medical device innovations also coming bottom up

College student 3D prints his own braces

by Hope King @flashhopeking
March 20, 2016, 4:26 PM ET

DIY Braces On A College Student's Budget

Amos Dudley wears his skills in his smile.

The digital design major has been straightening his top teeth for the past 16 weeks using clear braces he made himself.

Tired of waiting for a monitor for his diabetes, Tim Omer made his own. He is one of a growing number of patients circumventing medical companies in favour of a homemade healthcare revolution.

Tim Omer is a 31-year-old diabetic. Rolling up his sleeve, he reveals a small box, about half the size of a cigarette packet, taped to his upper arm. From the box, a sensor runs under his skin, delivering a readout of his blood glucose level to his mobile phone.

This is something to which few Type 1 diabetics in Britain have access - the monitors cost around £4,000 a year to buy and maintain and are too expensive for the NHS.
Medical Sensors are integrating directly into the Phone

**Medically-accurate** (FDA, CE etc.) Vital Signs:

- Blood Pressure
  - Heart Rate
  - Respiration Rate
  - Blood Oxygen
  - Body Temperature
  - One-lead ECG

- Small and cheap enough to be incorporated in all smartphones
- Absolute: No calibration required
- SBPS is a regulated medical device. Smartphone is **not** regulated

Hardware: Compact Blood Pressure Module™ (CBPM)

Software – App:
Instructions, control, analysis, display, communications

Service – Server:
Analysis, storage, sharing
In 5 years there will be more data outside EHR than in it

Clinical Observations

EHR Data

Patient Generated Data: Physiological & Psycho-social (2314 Exabyte's in 2020)

Doctor’s observations and thoughts

Historical diagnosis, labs, EMRs, imaging, radiology and billing codes

Physiological
- Biometrics (BP, BG, Spo2..)
- Environment (air, water, food, exercise...)

Psycho-Social
- Pain
- Emotion
- Energy
Telemedicine to the rescue

Traditional – FTF Care

Telehealth via video & phone → 80% efficacy for common ailments*

Add Remote Monitoring & Diagnostics → 95%+ efficacy for common ailments*

Direct Clinical Care

Clinical Dash boarding for managing patient populations

** Source: Goldman Sachs

TAM: $32.4B → $305B SAVINGS

Remote Monitoring  Telehealth  Behavioral Modification

18%  45%  37%

*Source: Dr. Dan Davis, CEO Healthcare Interactive Care technologies

** Source: Goldman Sachs
Medical data: Quantity vs. Quality

Volume of Data / per day

- Multiple times a day: Smartphone, Smartwatch
- Once or twice a day: Multifunction Sensor
- Continuous data capture: Medical grade patches and wearables, Bespoke Sensor

Accuracy

- Behavioral Decision making & Change: Every few days
- Clinical Decision: Every few months

Medical Grade in-clinic/hospital
Care orchestration & workflow automation

driving towards better health outcomes at a lower cost
Why should we care about security & health?

### Financial Loss

**Cost Per Record**

<table>
<thead>
<tr>
<th>Region</th>
<th>Cost Per Record</th>
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<tbody>
<tr>
<td>India</td>
<td>$0</td>
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<td>Healthcare US</td>
<td>$300</td>
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</tbody>
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*Source: Ponemon Institute Sponsored by IBM*

### Matter of Life and Death

- **Black Hat hacker details lethal wireless attack on insulin pumps**
- **Researchers hack pacemaker, kill a man(nequin)**
- **Hacking the Heart**
Fraud Prevention: Insurers require data + identity

Great job getting >10k steps yet again, here is your $5 rebate
Misdiagnosis: data + identity are critical

I'm terribly sorry to say that you have mono

Patient w/Symptoms Who received medical test kit in mail

Patient’s son’s friend who found the kit laying around the house whilst visiting
Congratulations, I’m going to send your pre-natal prescription now.

Wow, drone delivery of my pre-natal after the test – this sure beats the old way of doing it!
Today’s model for health data acquisition........
Pre-Requisites for acquiring remote medical data

1. Device attestation & application layer encryption
2. Patient Identity
3. Consent to share

Elderly Monitoring
Wellness
Care Giver
Phone
Gateway
Sensors
THANK YOU!

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