The Future of Healthcare: Humans and Machines Partnering for Better Outcomes

EMMANUEL FOMBU, MD, MBA
Diabetes Rates in China

- 1980: 0.67%
- 1994: 2.50%
- 2002: 5.50%
- 2011: 9.70%
Complex chronic conditions – trillion dollar problem

GLOBAL economic burden for chronic diseases
47 trillion dollars

MORE THAN
50%

OF THE WORLD LIVES
WITH CHRONIC DISEASES

5 major chronic diseases
Cardiovascular Disease | Chronic Respiratory Disease
Cancer | Diabetes | Mental illness

In the US alone 59% of the adult population have 1 or more chronic diseases. They take up 90% of the healthcare spending and are:

- 20% more likely to be re-hospitalized within 30 days post discharge
- 400% more likely to have an emergency room visit
- Cost 550% more for annual care

99% Of disease management is in the hands of individuals and their families
FIGURE I: Value in Healthcare

VALUE = QUALITY / COST = Outcomes + Patient Experience

Direct Costs + Indirect Costs
Current healthcare

Life quality

Development of pathologies

appearance of symptoms

therapy
I still can hear my doctor saying: ‘That’s harmless. You’ll be well in no time!’
Desirable healthcare

Life quality

Development of pathologies

predictive diagnosis & prevention
Measuring Health Related Quality of Life

Limitations of traditional questionnaire-based patient reported outcomes

• Subjective
• Long recall periods
• Subject to patient recall and reporting bias
Breakup, as captured by my fitbit. #breakup #Fitbit
AWAKE-HF: Rationale and Design of a Study Using a Wearable Biosensor to Objectively Evaluate the Effect of Sacubitril/Valsartan Initiation on Measures of Physical Activity, Symptoms, and Sleep, as Health-Related Life Functions in Subjects with Heart Failure

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Apple Watch Series 4 can detect AFib and perform an ECG

Matt Burns  @mjburns /  1:27 pm EDT  •  September 12, 2018
THE FUTURE OF MEDICINE:

PREDICTIVE
PERSONALIZED
PREVENTIVE
PARTICIPATORY
Managing Chronic Diseases by Targeting Physiological Signs

RAW SENSOR DATA

- Electrocardiogram (ECG)
- Photoplethysmogram (PPG)
- Accelerometer/Gyro
- ... N

Noninvasive FDA/CE mark medical grade wearables

PHYSIOLOGY PARAMETERS

- Heart rate (& HRV)
- Respiration Rate
- Electrocardiogram (ECG)
- Inter-beat-interval
- Blood Saturation (SpO2)
- ... N

PHYSIOLOGY DERIVATIVES

Using ML to build Personalized Physiology Signatures

Leads the correlates between multivariate biosignals and evaluates changes from baseline

RULE-BASED DISEASE MODELS

Rules-based decision tree which correlated dynamically varying multi-variate physiology changes to identify clinically meaningful alerts precursor of patient's health decompensation

BIOVITALS™ INDEX

Integrated into a composite score (ranging from 0-1) which indicates subtle physiology changes

CONTRIBUTING PARAMETERS

CLINICAL INTERVENTION

“Predicting and Preventing Serious Medical Events using Artificial Intelligence”
$2000 vs $115,000
Rodgers Ssekwoko Muhumuza, left, checked Owamani Bruce for pneumonia with a portable ultrasound scanner in the Kabale district in western Uganda.

GLOBAL HEALTH

In African Villages, These Phones Become Ultrasound Scanners
What if I?

eat less meat
excercise 2x a week
don’t sleep for 3 nights
climb Kilimanjaro
drink more wine
LONGER & HEALTHIER LIVES