Perspectives on the development of a sustainable digital health curriculum

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Plenary – PharmEd 2019 – Prato, Italy. Tuesday 9/7/19
“Digital health is about **electronically connecting up the points of care so that health information can be shared securely.** This is the first step to understanding how digital health can help deliver safer, better quality healthcare”

- Ref - ADHA Website – “What is digital health ?” - 1/10/2017
WHAT IS DIGITAL HEALTH (DH) 2?

“Digital health is the convergence of the digital and genomic revolutions with health, healthcare, living, and society…… empowering us to better track, manage, and improve our own and our family’s health, live better, more productive lives, and improve society. …… helping to reduce inefficiencies in healthcare delivery, improve access, reduce costs, increase quality, and make medicine more personalized and precise.”

- Linked In “Digital Health Group” - 1/10/2017; Similar version …. US FDA Website – 1/10/2017

... or put much more simply – the use of digital tools and interventions in wellness and healthcare (ie – its applied !!)
WHAT ARE THE HALLMARKS OF DH?

- At least for a start ……
  - Apps
  - Mobile phone
  - Sensors
  - Digital biomarkers
  - Augmented intelligence
  - Patient and consumer empowerment

- (OOOHHH …. AN ACRONYM !!! ……S.A.M.P.A.D. …. )
WHY ARE APPS AND MOBILE PHONES IMPORTANT?
The REHEARSE-AF Study at the ESC congress

- 2 groups x 500 older adults
- 1 year
- Routine care vs 2 x ECGs per week
- **4 times better at picking up AF**
Comparison of a smartphone-based ECG recording system with a standard cardiac event monitor in the investigation of palpitations in children.

Macinnes M¹, Martin N¹, Fulton H¹, McLeod KA¹.

RESULTS: Median patient age was 11 years in the smartphone monitor group compared with 10 years in the conventional group. Seventy-nine of 80 (96%) patients with a smartphone monitor sent an ECG recorded during symptoms, compared with 62/100 (62%) from the conventional group. A total of 836 ECG recordings were sent from the smartphone monitors compared with 752 from the conventional group. Eight per cent of ECG recordings in each group were of inadequate quality for analysis. Twenty of 80 (25%) patients with a smartphone monitor had documented tachyarrhythmia compared with 6/100 (6%) patients with the conventional monitor (p<0.001). On comparison with the conventional approach, the smartphone monitor outperformed with respect to diagnostic yield and patient satisfaction.
WHAT DO WE MEAN BY SENSORS IN DH?
A TSUNAMI OF SENSORS (COURTESY OF TMF)
SENSORS WITH END USER DEVICES

ViCardio device on action taking continuous blood pressure measurement. Curious? Come to our booth in @MEDICATradeFair in the @WearableTech Hall15 to see our innovative technology in action.

#Wearables #BloodPressure #DigitalHealth #Medica2018

Ref - ViCardioBP Twitter Feed 13/11/18
Propeller Health uses a Bluetooth-enabled sensor that attaches to inhalers and spirometers for people with asthma or COPD.

The company tracks the environmental conditions at sensor locations and sends reports to patients’ phones, so they can better understand the causes of their symptoms and take measures to prevent attacks. The company also sends reminders about when to take medications.

With 20 + peer-reviewed articles to date, Propeller reports patients are experiencing up to 79 percent fewer asthma attacks and are enjoying up to 50 percent more symptom-free days.

WHAT ARE DIGITAL BIOMARKERS?
DIGITAL BIOMARKERS - A DEFINITION

Digital biomarkers are defined as objective, quantifiable physiological and behavioral data that are collected and measured by means of digital devices such as portables, wearables, implantables or digestibles.

The data collected is typically used to explain, influence and/or predict health-related outcomes. Digital biomarkers also represent an opportunity to capture clinically meaningful, objective data.

# DIGITAL BIOMARKERS - AN OVERVIEW

<table>
<thead>
<tr>
<th>Reference</th>
<th>Sample size</th>
<th>Patient population/condition</th>
<th>Technology</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urwyler et al. [1]</td>
<td>20</td>
<td>elderly adults with dementia and age-matched controls</td>
<td>passive sensors which monitor temperature, humidity, light, and movement</td>
<td>behavior patterns in individuals with dementia are significantly more disorganized than in controls</td>
</tr>
<tr>
<td>Silva de Lima et al. [2]</td>
<td>953</td>
<td>Parkinson disease</td>
<td>smartwatch paired with a smartphone application</td>
<td>positive feedback overall indicated that large-scale wearable sensor studies in individuals with Parkinson disease demonstrated that such studies are feasible</td>
</tr>
<tr>
<td>Adams et al. [3]</td>
<td>56</td>
<td>Parkinson disease, Huntington disease, prodromal Huntington disease, and controls</td>
<td>wearable accelerometer</td>
<td>Individuals with Huntington disease spend significantly more time lying down than individuals with Parkinson disease and healthy controls</td>
</tr>
<tr>
<td>Chai et al. [4]</td>
<td>10</td>
<td>acute pain due to bone fracture</td>
<td>digital pills</td>
<td>digital pills provide an efficient means by which to track medication intake</td>
</tr>
<tr>
<td>Frías et al. [5]</td>
<td>109</td>
<td>uncontrolled hypertension and type 2 diabetes</td>
<td>digital pills paired with a wearable sensor and a smartphone application</td>
<td>Individuals whose care was informed by the digital health system reported lower blood pressure than those receiving standard care</td>
</tr>
</tbody>
</table>

Evaluation of smartphone-based testing to generate exploratory outcome measures in a phase 1 Parkinson's disease clinical trial

Florian Lipsmeier PhD, Kirsten I. Taylor PhD, Timothy Kilchenmann MSc, Detlef Wolf MSc, Alf Scotland MSc, Jens Schjodt-Eriksen PhD, Wei-Yi Cheng PhD, ... See all authors

First published: 27 April 2018 | https://doi.org/10.1002/mds.27376 | Cited by: 1
WHAT IS “AUGMENTED INTELLIGENCE”?

(it’s better than “artificial intelligence” !!)
IDx-DR - DIABETIC RETINOPATHY (AUTONOMOUS)

Introducing IDx-DR, your new partner in diabetes care

The first and only FDA authorized AI system for the autonomous detection of diabetic retinopathy

Learn More

IDx-DR is intended for use to automatically detect more than mild diabetic retinopathy (mtmDR) in adults ages 22 years of age or older diagnosed with diabetes who have not been previously diagnosed with diabetic retinopathy. IDx-DR is indicated for use with the Topcon NW400.
Diagnosing Fractures With AI

Rebecca Voelker, MSJ


An artificial intelligence (AI) algorithm that can help clinicians detect wrist fractures in adults has received FDA approval.

The Imagen OsteoDetect is a type of computer-aided detection and diagnostic software that uses machine learning techniques to identify signs of distal radius fracture during reviews of posterior-anterior and medial-lateral x-ray images of the wrist. The software marks the location of a fracture on the image to aid clinicians with their diagnoses.

Ref - https://jamanetwork.com/journals/jama/article-abstract/2686776  12/11/18
The Artificial Intelligence Clinician learns optimal treatment strategies for sepsis in intensive care

Matthieu Komorowski, Leo A. Celi, Omar Badawi, Anthony C. Gordon and A. Aldo Faisal

Sepsis is the third leading cause of death worldwide and the main cause of mortality in hospitals, but the best treatment strategy remains uncertain. In particular, evidence suggests that current practices in the administration of intravenous fluids and vasopressors are suboptimal and likely induce harm in a proportion of patients. To tackle this sequential decision-making problem, we developed a reinforcement learning agent, the Artificial Intelligence (AI) Clinician, which extracted implicit knowledge from an amount of patient data that exceeds by many-fold the life-time experience of human clinicians and learned optimal treatment by analyzing a myriad of (mostly suboptimal) treatment decisions. We demonstrate that the value of the AI Clinician’s selected treatment is on average reliably higher than human clinicians. In a large validation cohort independent of the training data, mortality was lowest in patients for whom clinicians’ actual doses matched the AI decisions. Our model provides individualized and clinically interpretable treatment decisions for sepsis that could improve patient outcomes.
AI Clinician recommended lower doses of intravenous fluids and higher doses of vasopressors than the clinicians’ actual treatments. The proportion of time the eRI patients received vasopressors was only 17%, but this would have been 30% if the AI Clinician’s recommendation was followed.

Blood infections kill millions—but AI could help

Sepsis is a potentially life-threatening complication of a bacterial infection—it kills one in five of the 30 million people who contract it worldwide every year. But a new study in Nature suggests a system built using reinforcement learning could significantly reduce that number.

What is reinforcement learning? It’s a machine-learning technique inspired by the way animals learn through positive feedback. It’s the same technique DeepMind used to create a program that taught itself to play Go.
COMPUTATIONALLY AUGMENTED COLONOSCOPY …..

ORIGINAL ARTICLE

Real-time automatic detection of colonoscopic polyp and adenoma: a prospective randomised controlled trial

Pu Wang, Tyler M Berzin, Jeremy Rennick, Aymeric Becq, Xun Xiao, Peixi Liu, Lian Zhang, Guangre Xu, Mengtian Tu, Xiaogang Lin

What are the new findings?

- This represents the first prospective randomised controlled trial examining an automatic polyp detection during colonoscopy and shows an increase of ADR by 50%, from 20% to 30%.
- This effect was mainly due to a higher rate of small adenomas found.
- The detection rate of hyperplastic polyps was also significantly increased.

How might it impact on clinical practice in the foreseeable future?

- Automatic polyp and adenoma detection could be the future of diagnostic colonoscopy in order to achieve stable high adenoma detection rates.
- However, the effect on ultimate outcome is still unclear, and further improvements such as polyp differentiation have to be implemented.
WHAT DO WE MEAN BY PATIENT AND CONSUMER EMPOWERMENT?
PERSONALLY CONNECTED – PERSON CENTRED HEALTHCARE

Cancer survivor "e-Patient Dave" is an international keynote speaker on healthcare who consistently earns extraordinary ratings by understanding each audience and working closely with each client to define their unique "nurse run." Audiences have ranged from the Institute for Healthcare Improvement to the Danish Patient Safety Association and the Israel Internat. Society. His compelling TEDx Talk, "Let Patients Help," was for years in the top half of most-watched TED talks of all time.

Standard Topics:

- Patient Engagement / Patient Empowerment
- Healthcare Transformation
- Facing Death (book: "Facing Death – With Hope")
PT AND FAMILY EMPOWERMENT – WHO OWNS THE DATA THEN? 1

27,316,000 patients have online access to their notes.
Visit our MAP to see who’s sharing.
Watch our FILM to learn about the movement.

40,012,000 patients have online access to their notes.
Tackling Ambulatory Safety Risks Through Patient Engagement: What 10,000 Patients and Families Say About Safety-Related Knowledge, Behaviors, and Attitudes After Reading Visit Notes

Bell, Sigall K., MD; Folcarelli, Patricia, RN, PhD; Fossa, Alan, MPH; Gerard, Macda, BS; Harper, Marvin, MD; Levellie, Suzanne, PhD, RN; Moore, Caroline, MPH; Sands, Kenneth E., MD, MPH; Sarnoff Lee, Barbara, LICSW; Walker, Jan, RN, MBA; Bourgeois, Fabienne, MD


doi: 10.1097/PTS.0000000000000494
WHAT ARE THE IMPLICATIONS OF DH FOR THE FUTURE OF PHARMACY?

(You will know as well as anything I can tell you ....)
NEW “ROLES” FOR THE PROFESSION AND FOR THE COMMUNITY PHARMACY ??

• Will it mean ..... ?

• For Pharmacists
  ➢ Moving “up the value chain” ?? …. an awkward term but universally true in automation .... Including “re-humanising” us all as HCPs (remember IDxDR !!)
  ➢ Augmented role as first line practitioners supported by technology – specially for the “isolated” (single issue) unwell
  ➢ Health coaches / navigators ?

• For the Community Pharmacy
  ➢ Front-line digital health and wellness hubs supported by a bigger range of staff and technology
  ➢ The “JB HiFi” for health and wellness (was going to say “Dick Smith Electronics” or “Radioshack”)

[MONASH University]
But not everyone will be a “doer” ??? …. Currently this is quite true across many HCP disciplines

So what about the “knowers” ???