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Digital Phenotyping

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With Personalised Medicine we can develop new treatments through the use of knowledge and new technologies. By using genetic knowledge about the disease and the individual patient, we can diagnose diseases more precisely and target treatment more accurately.

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THE PRECISION MEDICINE INITIATIVE

PRECISION MEDICINE | INITIATIVE | PRINCIPLES | STORIES
GO TO TOP

"Doctors have always recognized that every patient is unique, and doctors have always tried to tailor their treatments as best they can to individuals. You can match a blood transfusion to a blood type — that was an important discovery. What if matching a cancer cure to our genetic code was just as easy, just as standard? What if figuring out the right dose of medicine was as simple as taking our temperature?"

- President Obama, January 30, 2015

The White House
Office of the Press Secretary

For Immediate Release

FACT SHEE
Precision Me

Building on President Obama
today the Administration is u
Initiative, a bold new researc
treat disease. Launched with
Budget, the Precision Medicine Initiative will pioneer a new model of patient-powered research that promises to accelerate biomedical discoveries and provide clinicians with new tools, knowledge, and therapies to select which treatments will work best for

Most medical treatments hav
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Advances in precision medici
and several new treatments t
individuals, such as a person'
individual's tumor. This is lea

Most medical treatments have been designed for the "average patient." As a result of this "one-size-fits-all-approach," treatments can be very successful for some patients but not for others. This is changing with the emergence of precision medicine, an innovative approach to disease prevention and treatment that takes into account individual differences in people's genes, environments, and lifestyles. Precision medicine gives clinicians tools to better understand the complex mechanisms underlying a patient's health, disease, or condition, and to better predict which treatments will be most effective.

- Creation of a voluntary national research cohort: NIH, in collaboration with other agencies and stakeholders, will launch a national, patient-powered research cohort of one million or more Americans who volunteer to participate in research. Participants will be involved in the design of the Initiative and will have the opportunity to contribute diverse sources of data —including medical records; profiles of the patient's genes, metabolites (chemical makeup), and microorganisms in and on the body; environmental and lifestyle data; patient-generated information; and personal device and sensor data. Privacy will be rigorously protected. This ambitious project will leverage existing research and clinical networks and build on innovative

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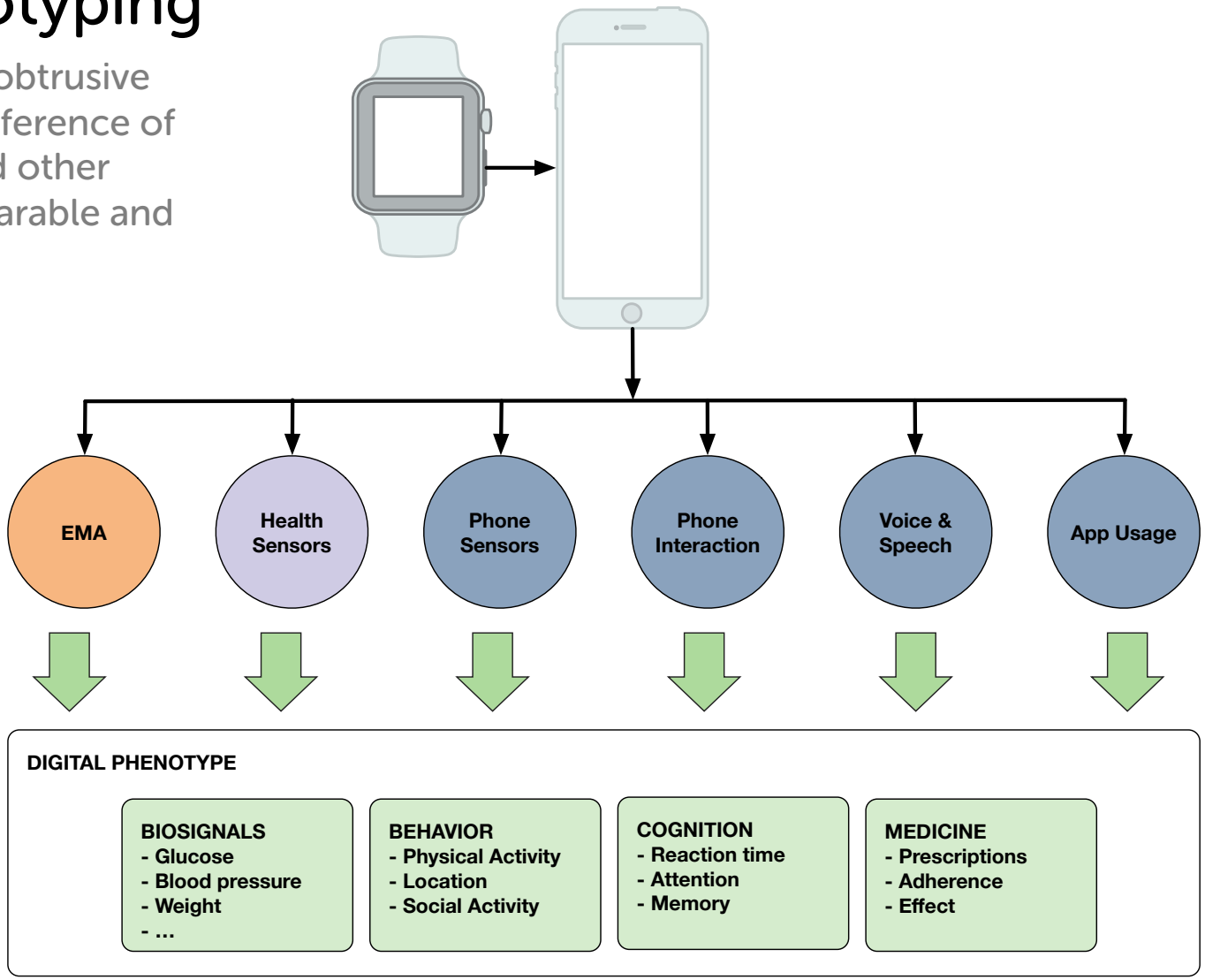
Digital Phenotyping

"Continuous and unobtrusive measurement and inference of health, behavior, and other parameters from wearable and mobile technology"



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Digital Phenotyping : What?

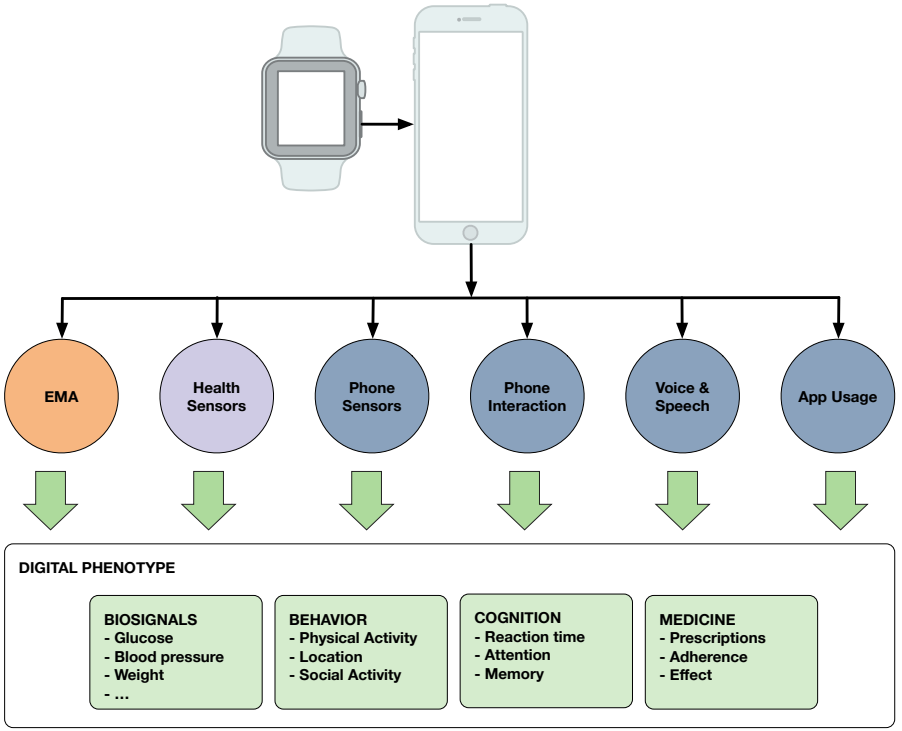
Diet

Smoking

Alcohol

Exercise

Adherence to treatment



KRAM

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Digital Phenotyping : When?

Preventive

- promoting healthy lifestyle
- early detection
- preventive measures

Diagnostics

- symptom detection & correlation
- prediction of illness

Treatment

- continuous monitoring
- context-aware treatment

Rehabilitation

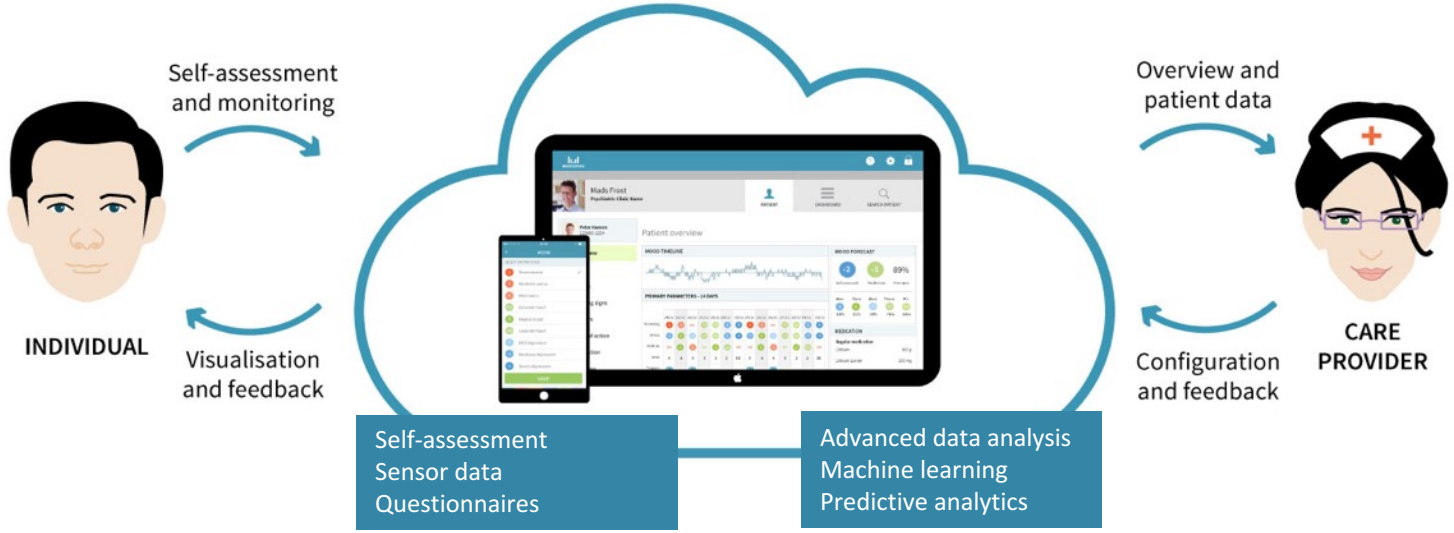
- proactive monitoring
- early warning signs
- just-in-time treatment

Chronic Disease Management

- early warning signs
- self-care (“empowerment”)
- treatment adherence

Patient trajectory

Digital Phenotyping in Mental Health



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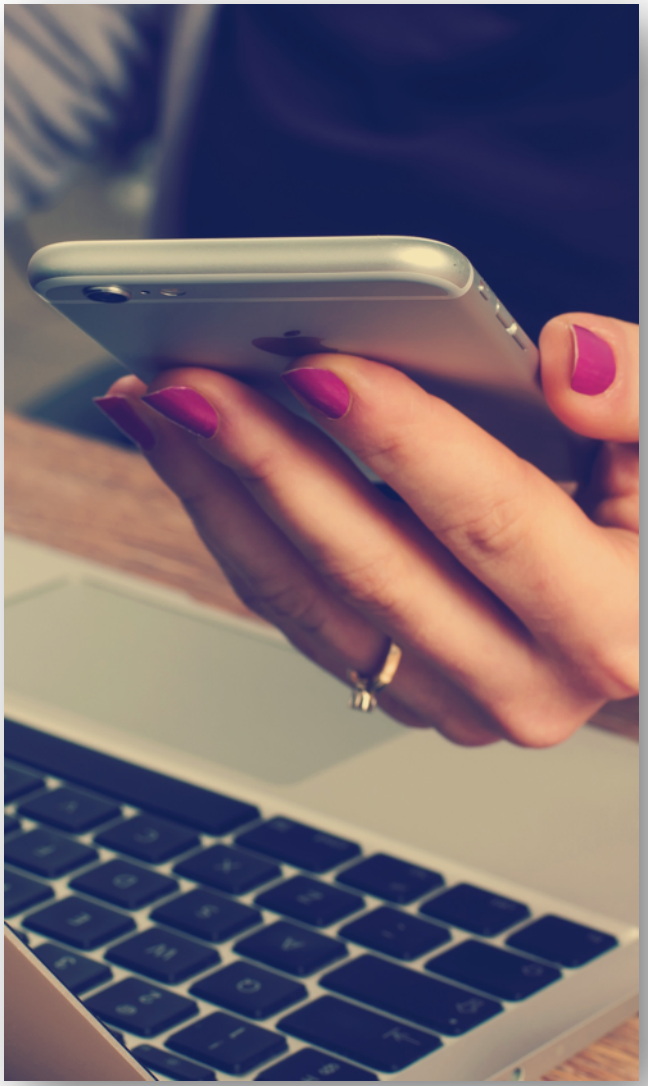
RADMIS

- Background
  - Mental health is becoming the leading burden of disease (WHO)
- Aim
  - Reducing the rate and duration of re-admission among patients with unipolar and bipolar disorder
- Partners
  - Psychiatric Center Copenhagen
  - DTU Compute
  - Monsenso
- Supported by the Innovation Fund Denmark (IFD)
- Technology development
  - Data collection
  - Mood forecasting
  - Cognitive Behavioral Therapy (CBT)
- Randomized Clinical Trial (RCT)
  - blinded randomized trial (N= 200+200)
  - primary : rate of re-hospitalization and duration of hospitalizations.
  - secondary: severity of depression (HDRS) and mania (YMRS) & functional assessment (FAST)



InnovationsFonden
FORSKNING, TEKNOLOGI & VÆKST I DANMARK

MONSENSO

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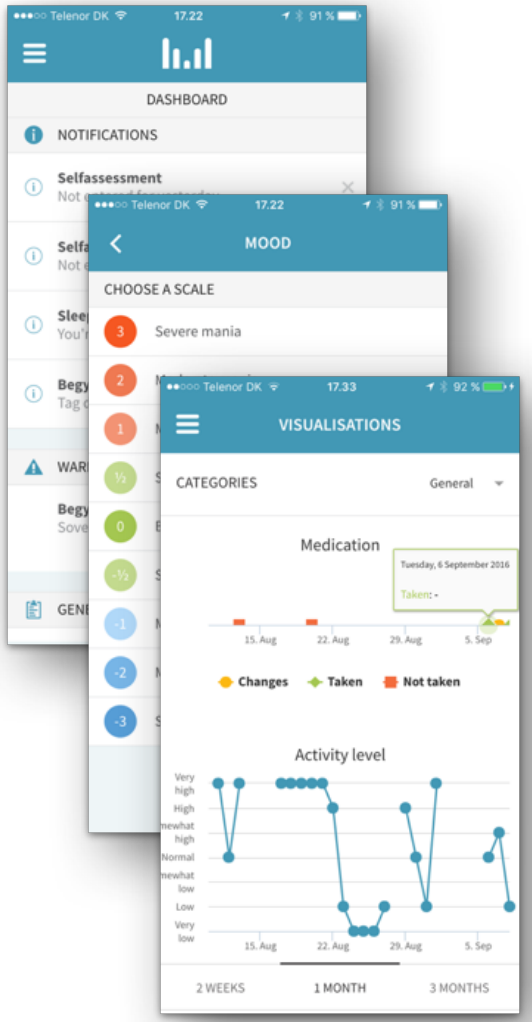
RADMIS

- Smartphone-based monitoring & cognitive behavioral treatment (CBT)

- Monitoring
  - self-assessment – mood | sleep | stress | medicine | …
  - sensor data – physical activity | mobility | social activity | phone usage | voice features
- Predicting
  - mood forecast
  - relapse of depression
- Intervention
  - visualizations | medication | actions-to-take | triggers | early-warning-signs
  - psycho-education
  - context-aware CBT | behavioral activation | thought parking



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Voice & Mood

Collection of voice features in naturalistic setting

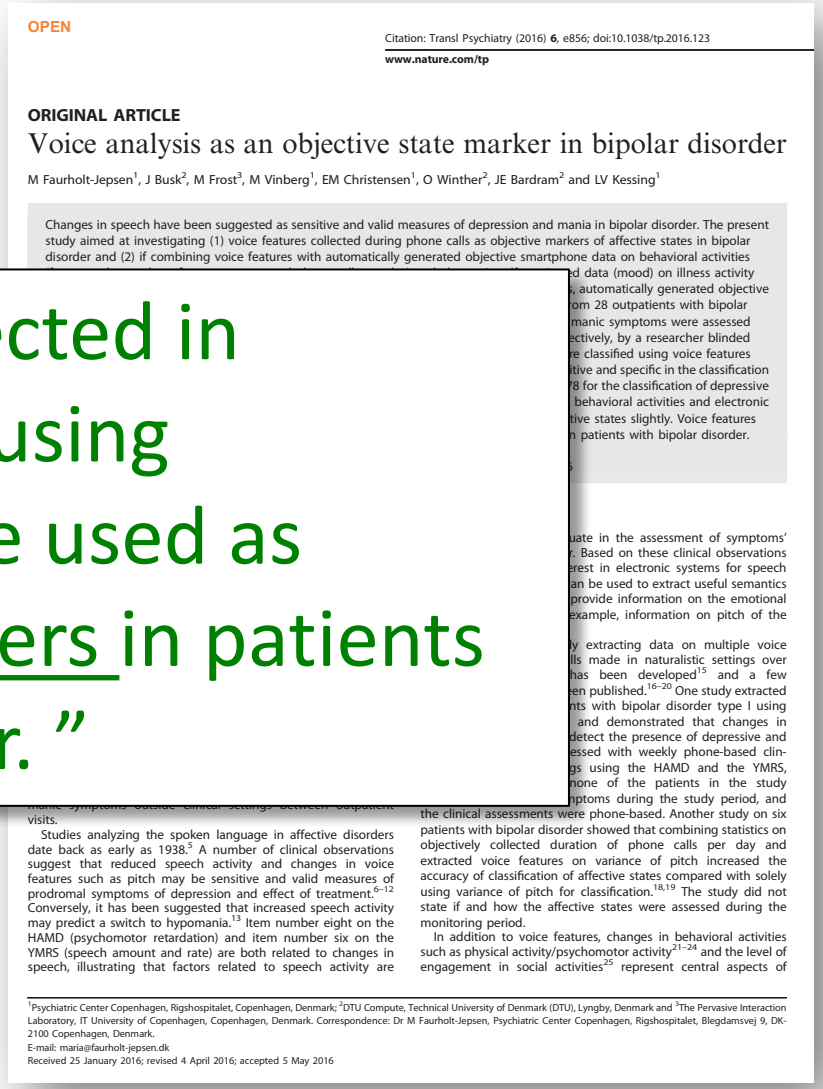
- N=28 | 12 weeks
- HDRS YMRS
- 179 c (fortr
- oper

Classific specific

- depr
- manic state : 61% (0.64)

Classification accuracy were not significantly increased when combining voice features with automatically generated objective data

"Voice features collected in naturalistic settings using smartphones may be used as objective state markers in patients with bipolar disorder."



OPEN

Citation: Transl Psychiatry (2016) 6, e856; doi:10.1038/tp.2016.123
www.nature.com/tp

ORIGINAL ARTICLE

Voice analysis as an objective state marker in bipolar disorder

M Faurholt-Jepsen[1], J Busk[2], M Frost[3], M Vinberg[1], EM Christensen[1], O Winther[2], JE Bardram[2] and LV Kessing[1]

Changes in speech have been suggested as sensitive and valid measures of depression and mania in bipolar disorder. The present study aimed at investigating (1) voice features collected during phone calls as objective markers of affective states in bipolar disorder and (2) if combining voice features with automatically generated objective smartphone data on behavioral activities

Studies analyzing the spoken language in affective disorders date back as early as 1938.[5] A number of clinical observations suggest that reduced speech activity and changes in voice features such as pitch may be sensitive and valid measures of prodromal symptoms of depression and effect of treatment.[6–12] Conversely, it has been suggested that increased speech activity may predict a switch to hypomania.[13] Item number eight on the HAMD (psychomotor retardation) and item number six on the YMRS (speech amount and rate) are both related to changes in speech, illustrating that factors related to speech activity are

the clinical assessments were phone-based. Another study on six patients with bipolar disorder showed that combining statistics on objectively collected duration of phone calls per day and extracted voice features on variance of pitch increased the accuracy of classification of affective states compared with solely using variance of pitch for classification.[18,19] The study did not state if and how the affective states were assessed during the monitoring period.

In addition to voice features, changes in behavioral activities such as physical activity/psychomotor activity[21–24] and the level of engagement in social activities[25] represent central aspects of

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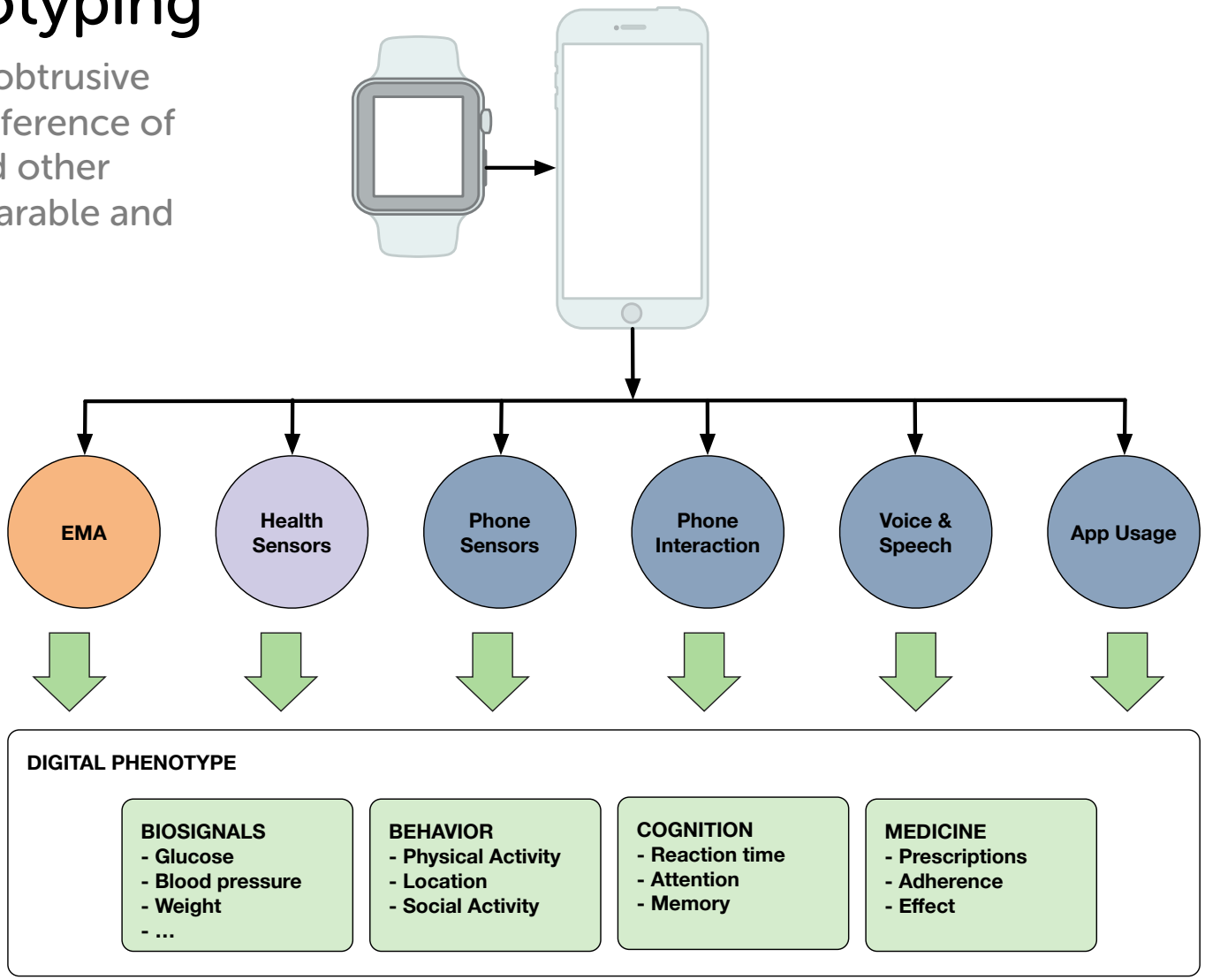

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Healthcare Challenges

Chronic diseases management
Accounting for 2/3 of all healthcare spend worldwide – and increasing – chronic disease management is and will be the main focus of health.

Preventive and predictive health
Obesity, lack of physical activity and unhealthy lifestyle are the major factors for health problems and needs to be addressed early

Regulatory
Legal and regulatory demands for protecting patient privacy, data, and safety will be enforced heavily as digital and personalized health emerge

Evidence & outcome-based health
New business models both for suppliers and vendors will be tied to clinical evidence and real-world patient outcome (efficiency)

Technology Opportunities

Personalized technology
Engaging, patient-centric, and participatory technology can deliver interventions tailored to the individual and sustain engagement “beyond-the-pill” outside traditional care settings.

Digitalization
The ubiquity of digital health and communication technology drive new models for virtual and semi-automated doctor-patient contact.

Health IoT
Pervasive, mobile and wearable technology for sensing and engaging with patients create a unique platform for personalized health delivery

Big data analytics
Computing power and advanced analytics and learning algorithms drive insight and prediction of patient behavior, treatment, and care costs

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