Virtual Health Assistants:

Potentially the most strategically disruptive technology in my lifetime

Thomas Morrow MD
Famous (and Infamous) Virtual Assistants
Over the past decade, smartphones have radically changed many aspects of our everyday lives, from banking to shopping to entertainment. Medicine is next. With innovative digital technologies, cloud computing and machine learning, the medicalized smartphone is going to spend every aspect of health care. And the end result will be that you, the patient, are about to take center stage for the first time.

With the smartphone revolution, an increasingly powerful new set of tools—phone attachments that can diagnose an ear infection or track heart rhythms to an app that can monitor mental health—can reduce our use of doctors, cut costs, speed up the pace of care and give more power to patients. Digital avatars won't replace physicians. You will still be seen...
The Foundation:

Natural Language Understanding (NLU)

- Smart Phone/Computer/Tablet Based
- Artificial intelligence
- Understands everyday language
- Integration

Understands human intent
Facilitates resolution in a highly contextual manner.
Cognitive technologies for health plans

Using artificial intelligence to meet new market demands

New developments in cognitive technologies can help health plans use artificial intelligence to help improve cost-effectiveness, customer service, and population health.

WRITTEN BY
David Schatsky, Plamen Petrov, & Rajeev Ronanki

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## Forms of Cognitive Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Application</th>
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<tbody>
<tr>
<td>Automated Reasoning</td>
<td>Analyzing documents/guidelines</td>
</tr>
<tr>
<td>Computer Vision</td>
<td>Telehealth/skin conditions</td>
</tr>
<tr>
<td>Optical Character Recognition</td>
<td>Digitizing handwritten prescriptions, clinical notes</td>
</tr>
<tr>
<td>Machine Learning</td>
<td>Finding claim fraud/ consumer preferences</td>
</tr>
<tr>
<td>Natural Language Understanding (accompanied by speech recognition)</td>
<td>Structuring Unstructured Text Automated Prior Auth Customer Service (Ann from Aetna) Virtual Health Assistants</td>
</tr>
</tbody>
</table>
Contributors to Death

Smoking: 467,000
High blood pressure: 395,000
Excess weight: 216,000
Inadequate physical activity: 191,000
High blood sugar: 190,000
High LDL cholesterol: 113,000
High dietary salt: 102,000
Low dietary omega-3 fatty acids (seafood): 84,000
High dietary trans fatty acids: 82,000
Alcohol use: 64,000
Low intake of fruits and vegetables: 58,000
Low dietary poly-unsaturated fatty acids: 15,000

What do all of these have in common?

http://www.csdp.org/research/1238.pdf
Health and Wellbeing = Healthy Behavior

Health is the result of a complex interaction of influences both good and bad on a person’s health

- Encompass multiple dimensions
  - Genetics
  - Education
  - Socio-economic factors
  - Cultural influences
  - Interpersonal determinants
  - Age, life-stage, time
  - Societal Influences
Key to Health:

*Behaviors* of individuals are critical to health outcomes
One In 3 Adults in the US Need Intensive Behavioral Counseling

And if we do not address these issues, it will be like...
...Brushing Your Teeth While Eating Oreos
Why Don’t People Take Care of Themselves?

- Forgetfulness
- I don’t think it is working
- It causes me to have _______
- I don’t really think I need it
- I like eating and drinking and...
- I took it for a month...
- I just don’t want to deal with it now
- I cannot afford it
- I have no transportation
- It’s just a touch of _______ right?
Keep a watch...on the faults of the patients, which often make them lie about the taking of things prescribed. For through not taking disagreeable drinks, purgative or other, they sometimes die.

*Hippocrates, Decorum – more than 2,000 years ago*
Literature
Cochrane Database Systematic Review

*Interventions for enhancing medication adherence*

Conclusions:

“Current methods of improving medication adherence for chronic health problems are mostly complex and not very effective...

... the full benefits of treatment cannot be realized.”
Annals of Internal Medicine in 2012

*Interventions to Improve Adherence to Self-administered Medications in Chronic Disease in the United States*

Meera Viswanathan, PhD, et al

4,124 citations concerning the concept of “improving adherence” in published, searchable medical literature
Conclusions:

“out-of-pocket cost influenced adherence” as do “...case management, and patient education with behavioral support,”

but ...“evidence is limited on whether these approaches are broadly applicable...”
Why Current Approaches Do Not Work:
The Factors of Engagement
Healthcare Team and System Factors

- Quality of the patient-provider relationship
- Provider attitudes and communication style
- Reimbursement
- Disease management supports
- Follow-up and continuity of care
- Evaluation of adherence
- Amount of time spent with patient
Social and Economic Factors

• Patients’ competing priorities
• Socioeconomic status
• Transportation
• Social Support
• Availability and Quality
• Ability to afford healthcare services
Condition Related Factors

- Symptom severity
- Disease severity
- Condition-related disability
- Rate of progression and prognosis
- Commonly associated comorbidities
  - depression, substance abuse
Therapy Related Factors

• Complexity of regimen
  — dosing, pill burden, dosing interval

• Restrictions
  — dietary, other drugs, activities

• Duration
  — short-term vs. lifetime; “pill fatigue”

• Immediacy of beneficial effects

• Side effects
Therapy Related Factors (continued)

• Ability to follow instructions
• Knowledge of and skill with self-directed health-related behaviors
• Trust in provider and medical system
• Degree of family dysfunction and/or chaotic lifestyle
• Education and literacy
• Age and lifespan factors
• Personal and cultural beliefs regarding health and disease
Therapy Related Factors (continued)

• Motivation and perceived need for treatment
• Confidence (self-efficacy)
• Acceptance and understanding of disease and treatment efficacy
• Ability to engage in illness-management behaviors
• Perceptions, attitudes, and expectations
  — hopelessness, acceptance, fear of dependence, frustration, anxiety about regimen, disease-associated stigma
• Neurocognitive function and ability (e.g., forgetfulness, prospective memory)
• Psychological status (e.g., stress, depression, influence of substance abuse, coping mechanisms)
Could Possibly Manage

How Many Of You Are Managing All of These Factors?

Effectively?
Ways to Engage Patients

- Office Visit
- Phone Call
- Telemedicine
- Text Message
- Apps
- Other Tech/Letter
Natural Language Processing Enabled mHealth Ecosystem

- Personal Assistant
- Social Media
- Pharmacy Services
- Calendar
- Search
- Music
- Case Mgrs
- Nurses
- Physicians
- 24/7 Hotline
- ER
- EHR
- iPHR
- Member Services
- Wellness Programs
- mHealth Apps
- Adherence
- Remote Monitoring Devices
- Backend Data Systems
- Disease Management
- Preventative Health
- Health Related Web Assets
- Conversational Interface
- Patient
Categories of Engagement/Adherence Approaches

**Professionals**
- EHRs/Electronic Prescribing
- Telemedicine
- Telemonitoring

**Packaging**
- Blister Packs
- Smart Caps
- Smart Bottles
- Smart Pills

**Health Plan**
- Financial Incentives
- Predictive Modeling Risk Scoring
- DM/CM/MTM

**Other**
- Coaching Programs
- Cloud Based
- Games
- Social Platforms
- Text Messaging
- Apps

**Natural Language - Artificial Intelligence**
WHO Definition of Adherence

- The extent to which a person’s behavior-taking medicine, following a diet, and/or executing lifestyle changes, corresponds with *agreed* recommendations from a health care provider.
Behavioral Change: The Science
Most Popular Used Theories in Behavioral Health

• **Social Cognitive Theory**
  — Human behavior is a product of dynamic interplay of personal, behavioral and environmental influences

• **Trans-theoretical Model/Stages of Change**
  — Behavior change is a process that unfolds over time through a sequence of changes
    • Precontemplation, contemplation, preparation, action, maintenance, termination

• **Health Belief Model**
  — People’s actions are dependent upon their feelings of susceptibility, seriousness, benefits and barriers to behavior, triggers to action and conviction that action will produce expected outcome
Both Conscious and Unconscious Influences in Behavior

• Not every health decision is a result of a logical progression of thought
• Must take into account the unconscious determinants of health!
It’s All About the Relationship

- Interpersonal communication is one of the most critical factors in changing health behavior
  - Fosters Healing
  - Enhances Information Exchange
  - Responds to Emotion
  - Manage Uncertainty
  - Decision Making
  - Enables Patient Self Management
Motivational Interviewing

...a collaborative, person-centered form of guiding to elicit and strengthen motivation for change” Miller and Rollnick 2009

• Patient Centered
• Develops Rapport
• Allows Patients to Remain in Control
  — Open ended questions
  — Empathy
  — Affirmations
  — Reflections
  — Summaries
• Key to empowering patients to become self motivated
Why Don’t People Take Care of Themselves?

• Forgetfulness
• I don’t think it is working
• It causes me to have ____________
• I don’t think I really need it
• I took it for a month…
• I just don’t want to deal with it now
• I’m depressed
• I cannot afford it
• I have no transportation
• It’s just a touch of sugar, right

The fact is, you don’t know until they tell you!!!
“At the core of every successful conversation lies the free flow of relevant information.”
Fogg Behavior Model

Three elements must converge at the same moment for a behavior to occur:

• Motivation
• Ability
• Trigger

When a behavior does not occur, at least one of those three elements is missing.
Automated Hovering

VHA facilitates opportunity for:

- Behavior change
- Motivational Interviewing
- Patient-generated data
- Disease management
- Adherence protocols
- Side effect management
- Health literacy
- Quality of life metrics
- Virtual coaching
- Setting appointments
- Pharmacovigilance
VHA’s Are Trained To:

- Know the clinical guidelines
- Handle adverse events
- Operate within medical-legal boundaries
- Reflect your branding
- Get smarter over time
Two Questions:

Will patients embrace the digital touch?

Can a Virtual Health Assistant facilitate better outcomes?
The VHA doubled exercise activity!!!

...and no demographic is off limits

Ages
62 – 84

Low Reading Literacy
86%

Never Used a Computer
36%

Used a Computer “a few times”
27%

African-American
73%

Obese or Overweight
77%
Clinical Results

A virtual discharge nurse reduced hospital readmissions at the 30-day mark, by 30%

*Timothy Bickmore, Intelligent Caring Machines: FHTI Virtual Healthcare Workers Initiative fhti.org*
Early Proof that Consumers will Engage

Who would you rather receive discharge information from?

74% of pilot study, hospital participants would rather interact with a Intelligent Virtual Assistant, then an actual human being.

![Pie chart showing 74% for Agent, 16% for Either, and 10% for Doctor or Nurse]

- Timothy Bickmore, Intelligent Caring Machines: FHTI Virtual Healthcare Workers Initiative fhti.org

Maintaining Reality: Relational Agents for Antipsychotic Medication Adherence

“The strong correlation between perceived relationship with the agent and system use indicates the importance of establishing a therapeutic alliance in automated mental health interventions. Overall, these results indicate that relational agents may be an important technology to use for certain kinds of mental health interventions such as medication adherence.”

Timothy W. Bickmore PhD; Kathryn Puskar, DrPH, RNC; Elizabeth A Schlenk, PhD, RN; Laura M. Pfeifer, MS; Susan M. Sereika, PhD
VHA facilitated adherence

Anti-psychotic medication adherence increased to 89% from the historical rate of 50%

Without a relationship, there is no influence!

<table>
<thead>
<tr>
<th>Question</th>
<th>Anchor 1</th>
<th>Anchor 5</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much do you feel Laura cares about you?</td>
<td>Not at all</td>
<td>Very much</td>
<td>4.24 (1.08)</td>
</tr>
<tr>
<td>How much would you like to continue working with Laura?</td>
<td>Not at all</td>
<td>Very much</td>
<td>4.38 (1.06)</td>
</tr>
<tr>
<td>How easy is talking with Laura?</td>
<td>Not difficult</td>
<td>Very much</td>
<td>4.28 (0.56)</td>
</tr>
<tr>
<td>How much do you like Laura?</td>
<td>Not at all</td>
<td>Very Much</td>
<td>4.30 (1.16)</td>
</tr>
<tr>
<td>How would you characterize your relationship with Laura?</td>
<td>Complete stranger</td>
<td>Close Friend</td>
<td>3.23 (1.22)</td>
</tr>
<tr>
<td>How satisfied are you with Laura?</td>
<td>Not at all</td>
<td>Very much</td>
<td>4.49 (0.65)</td>
</tr>
<tr>
<td>How much do you trust Laura?</td>
<td>Not at all</td>
<td>Very much</td>
<td>4.44 (0.66)</td>
</tr>
</tbody>
</table>
“Virtual Agents can help overcome a significant barrier to obtaining truthful patient information.”
VHA’s, Not Just For Clinical Interactions

• A virtual HUB or Case Manager Call center
• Replicate
  – 80% of human interactions with 99% accuracy
• Integrate
  – With current contact center
  – Multiple Apps
  – Robust Digital Content
• Exponentially expand
  – Reach and frequency
  – Personalized engagement
  – Real-time behavior based discernment & interventions
  – Monitoring and tracking capabilities
  – Prior auth
  – Refills
VHAs can:

- Promote Patient Education/Adherence/Outcome
- Facilitate Adverse Drug Reaction Reporting
- Determine Reasons for Non-adherence
- Provide More Foot Traffic to Retail
- Discuss the Assistance Programs with Patients
- Produce more revenue for Pharma
- Create Increase in Rebate Dollars
- Promote Formulary Compliance
Member Services: Aetna ROI

Ask Ann- Member Services
Call Center ROI
• 29% of the calls into the relevant call center were being deflected
• 50% of first time visitors engage with Ann

Member Payment Estimator tool
• Ann can give members a transparent view of cost for planned procedures based on geographic area, provider, and benefit plan.
• Members are saving on average $170 when they use this tool.

Ask Carmen- Internal Agent
• A/B testing found there was a 65% decrease in time it took employees to find an answer. (3 mins.)
Meet The **Worlds First** Virtual Health Assistant, “Claire”

Claire is trained to help with

- Benefits Investigation
- 20mg to 40mg conversion
- Patient Education
- Injection Recording
  - Creates a rotation schedule and track injection areas, sites and depth settings
- Customized Reminders
- Tracking mood, well-being and overall therapy experience
- Creating journal entries
- Sending injection logs to personal and/or healthcare professional’s email address
What’s Next?

... Cognitive Technologies

The scope of need is well beyond our capability
  o Limited human resources versus >100,000,000 people
  o Current apps have not delivered on their promise
  o Automated real-time “hovering”

Business Side of Medicine has Rapid ROI
  o Member Services
  o Clinical
  o Billing

Imperative for Medical Care
  o Prevention, Wellness and Chronic disease
  o Lifestyle and Adherence
  o Platform for Behavior Change
So, let me ask...

Are there any other scalable, viable, affordable, acceptable options for improving behavior and adherence that has the potential of a VHA?

Questions?
References:

- http://www.pm360online.com/innovators-2014-products/?GTTabs=5
- https://www.youtube.com/watch?v=upv3EsP712U