When Digital Health means Behavior Change

Paul Upham

Senior Principal, Smart Device Technology Center

Roche / Genentech

1

Objectives

- Understand when our goals for digital tools require an understanding of behavior
- Understand the evidence for and against digital health solutions
- See how you can incorporate behavior design into your digital health solutions
- Learn from examples
- Access resources for behavior design

2

When does behavior change apply?

- Remote monitoring
- Medication adherence
- Engagement
- Clinical decision support

3

The HeartStrong clinical trial showed no improvement in medication adherence or outcomes using a digital solution

JAMA Internal Medicine | Original Investigation

Effect of Electronic Reminders, Financial Incentives, and Social Support on Outcomes After Myocardial Infarction
The HeartStrong Randomized Clinical Trial

Kevin G. Volpp, MD, PhD; Andrea B. Troxel, ScD; Shivan J. Mehta, MD, MBA, MSHP; Laurie Norton, MA; Jingyan Zhu, MS, MBA; Raymond Lim, MA; Wendi Wang, MS; Noora Marcus, MA; Christian Terwiesch, PhD; Kristen Cassarella, MHA; Tova Levin, MBA; Mike Relich, MA; Nathan Negin, MD; Aaron Smith-McLallen, PhD; Richard Snyder, MD; Claire M. Spettell, PhD; Brian Drachman, MD; Daniel Kolansky, MD; David A. Asch, MD, MBA

IMPORTANCE Adherence to medications prescribed after acute myocardial infarction (AMI) is low. Wireless technology and behavioral economic approaches have shown promise in improving health behaviors.

OBJECTIVE To determine whether a system of medication reminders using financial incentives and social support delays subsequent vascular events in patients following AMI compared with usual care.

DESIGN, SETTING, AND PARTICIPANTS Two-arm, randomized clinical trial with a 12 month intervention conducted from 2013 through 2016. Investigators were blinded to study group, but participants were not. Design was a health plan–intermediated intervention for members of several health plans. We recruited 1509 participants from 7179 contacted AMI survivors (insured with 5 large US insurers nationally or with Medicare fee-for-service at the University of Pennsylvania Health System). Patients aged 18 to 80 years were eligible if currently prescribed at least 2 of 4 study medications (statin, aspirin, β blocker, antiplatelet agent), and were hospital inpatients for 1 to 180 days and discharged home with a principal diagnosis of AMI.

INTERVENTIONS Patients were randomized 2:1 to an intervention using electronic pill bottles combined with lottery incentives and social support for medication adherence (1003 patients), or to usual care (506 patients).

MAIN OUTCOMES AND MEASURES Primary outcome was time to first vascular rehospitalization or death. Secondary outcomes were time to first all-cause rehospitalization, total number of repeated hospitalizations, medication adherence, and total medical costs.

RESULTS A total of 35.5% of participants were female (n = 536), mean (SD) age was 61.0 (10.3) years. There were no statistically significant differences between study arms in time to first rehospitalization for a vascular event or death (hazard ratio, 1.04; 95% CI, 0.71 to 1.52; P = .84), time to first all-cause rehospitalization (hazard ratio, 0.88; 95% CI, 0.73 to 1.06; P = .27), or total number of repeated hospitalizations (hazard ratio, 0.94; 95% CI, 0.60 to 1.48; P = .79). Mean (SD) medication adherence did not differ between control (0.42 [0.39]) and intervention (0.46 [0.39]) (difference, 0.04; 95% CI, −0.01 to 0.09; P = .10). Mean (SD) medical costs in 12 months following enrollment did not differ between control ($29 811 [$74 850]) and intervention ($24 038 [$66 915]) (difference, −$5773; 95% CI, −$13 682 to $2137; P = .15).

CONCLUSIONS AND RELEVANCE A compound intervention integrating wireless pill bottles, lottery-based incentives, and social support did not significantly improve medication adherence or vascular readmission outcomes for AMI survivors.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT01800201

JAMA Intern Med. 2017;177(8):1093-1101. doi:10.1001/jamainternmed.2017.2449
Published online June 26, 2017.

Author Audio Interview
Supplemental content

Author Affiliations. Author affiliations are listed at the end of this article.

Corresponding Author. Kevin G. Volpp, MD, PhD, Perelman School of Medicine, University of Pennsylvania, 1101 Blockley Hall, 423 Guardian Dr, Philadelphia, PA 19104 (volpp1@wharton.upenn.edu).

© 2017 American Medical Association. All rights reserved.

A compound intervention integrating wireless pill bottles, lottery-based incentives, and social support **did not significantly improve medication adherence or vascular readmission outcomes** for AMI survivors

n = 1509
12 month intervention

4

Source: Mahler SA, Riley RF, Hiestand BC, et al. The HEART Pathway Randomized Trial: Identifying Emergency Department Patients With Acute Chest Pain for Early Discharge. Circulation Cardiovascular quality and outcomes. 2015;8(2):195-203. doi:10.1161/CIRCOUTCOMES.114.001384.

The REMIND clinical trial showed no improvement in medication adherence using multiple digital solutions

"devices **did not measurably improve medication adherence**.

Future research should focus on effective **strategies to ensure uptake and sustained use** of these interventions"

n = 53480
12 month intervention

JAMA Internal Medicine | Original Investigation

Effect of Reminder Devices on Medication Adherence
The REMIND Randomized Clinical Trial

Author Affiliations: Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts (Choudhry, Krumme, Tong, Khan, Franklin); Center for Healthcare Delivery Science, Department of Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts (Choudhry, Krumme); CVS Health, Woonsocket, Rhode Island (Ercole, Girdish, Brennan, Matlin, Shrank).

Corresponding Author: Nilesh K. Choudhry, MD, PhD, Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital, 1620 Tremont St, 3rd (630), Boston, MA 02120 (nkchoudhry@bwh.harvard.edu).

Copyright 2017 American Medical Association. All rights reserved.

Source: Choudhry NK, Krumme AA, Ercole PM, Girdish C, Tong AY, Khan NF, Brennan TA, Matlin OS, Shrank WH, Franklin JM. Effect of Reminder Devices on Medication Adherence The REMIND Randomized Clinical Trial. JAMA Intern Med. 2017;177(5):624–631. doi:10.1001/jamainternmed.2016.9627.

5

2018 PDA Universe of Pre-Filled Syringes and Injection Devices | October 8-9, 2018 | Orlando, FL | #PDAPFS | @PDAOnline

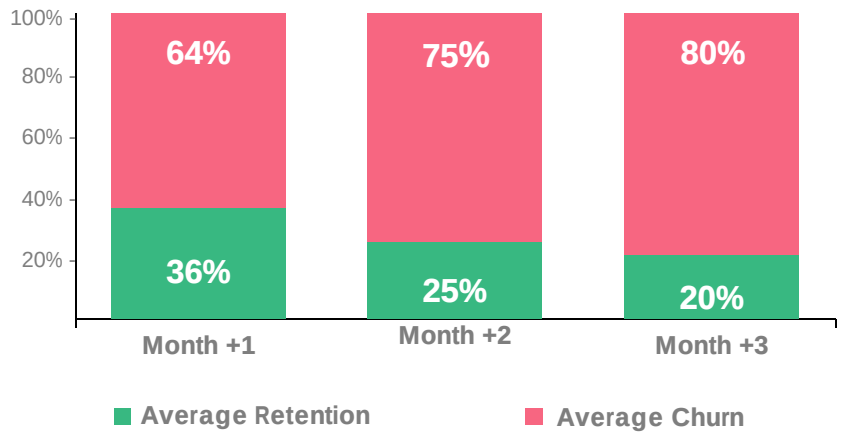
The promise of digital health solutions has not yet been fulfilled

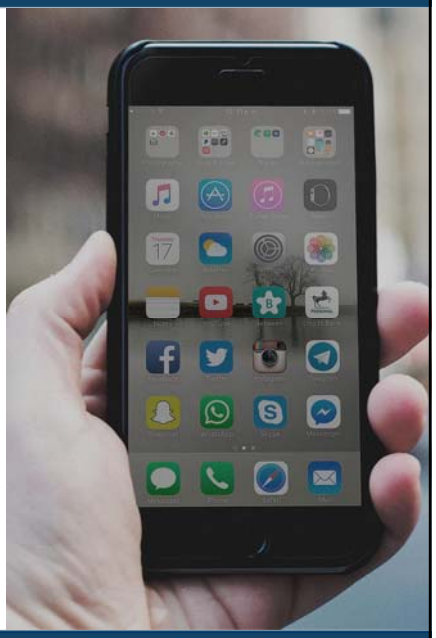
So far, health apps and tech have struggled to achieve meaningful medication adherence improvements in the long term

6

2018 PDA Universe of Pre-Filled Syringes and Injection Devices | October 8-9, 2018 | Orlando, FL | #PDAPFS | @PDAOnline

Average mobile app retention is only 20% after 3 months





Retention defined as - Returning to the app at least 1x within 30 days

Source: March 21, 2017, Mobile Apps: What's A Good Retention Rate? - Localytics 2016

Behavior design is being employed across a broad range of industries to change behavior and increase engagement

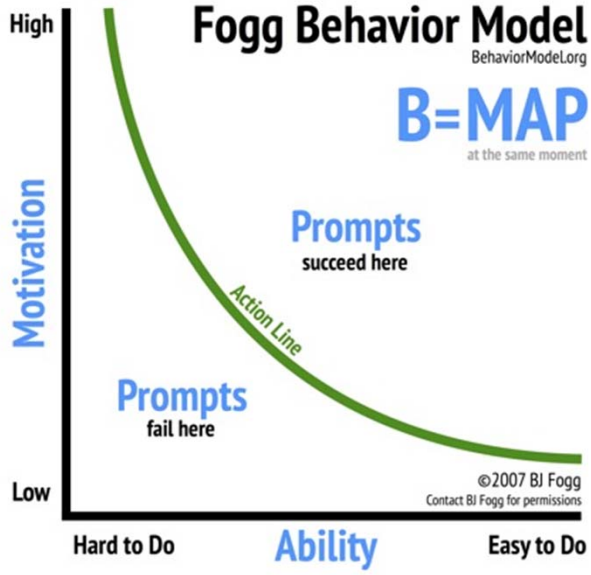
Google aetna Walmart NIKE WebMD Walgreens Virgin HEALTHMILES Instagram WeightWatchers Medtronic

8

Behavior Design is the **application** of behavioral sciences to **change human behavior**.

(A joining of cognitive neuroscience, behavioral economics, proven experiments, etc. with design thinking)

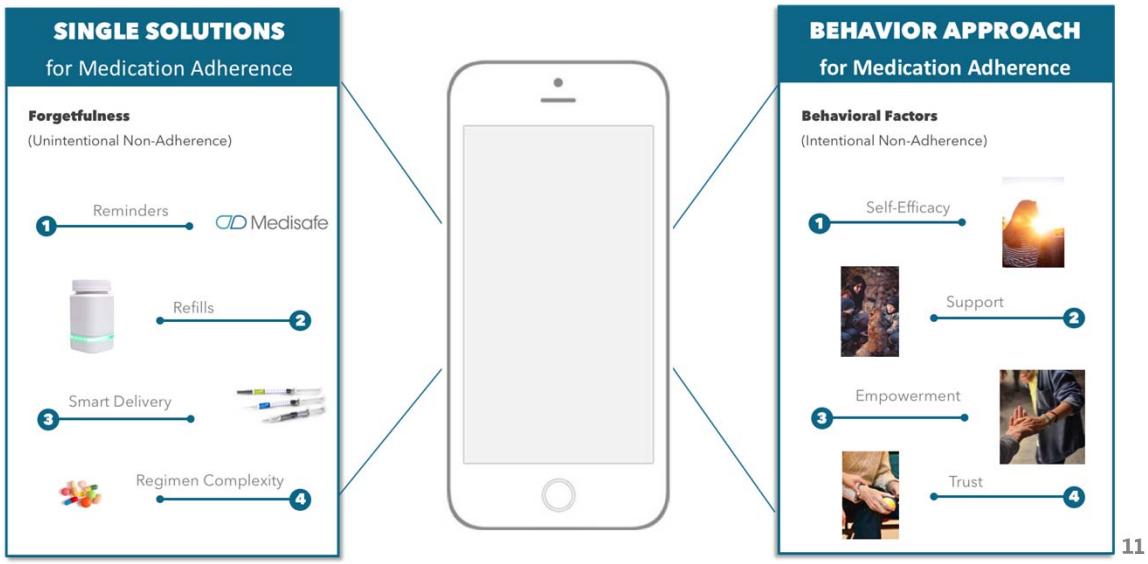
B.J. Fogg of Stanford University's Persuasive Technology Laboratory is *ground zero* for behavior design



- Maxim #1: **Help people do what they already want to do**.
- Maxim #2: **Help people feel successful**.
- **Models** and **methods** to create solutions for changing human behavior. Focused on:
  - **Selecting** a target behavior or sequence
  - **Solving** for the target behavior
  - **Testing** and **iterating** solutions
- Also useful for "debugging"

10

There are key principles to a behavior design approach that can integrate with solutions

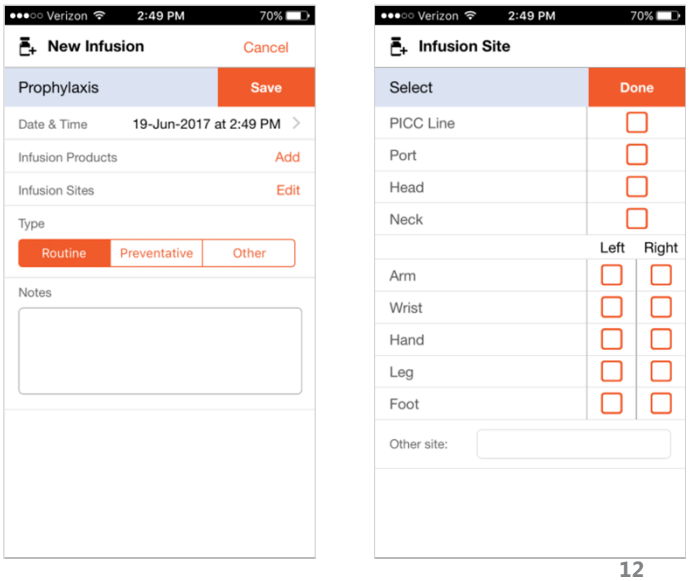


11

2018 PDA Universe of Pre-Filled Syringes and Injection Devices | October 8-9, 2018 | Orlando, FL | #PDAPFS | @PDAOnline

Whether for remote monitoring purposes or for improving medication adherence, *logging* is commonly employed

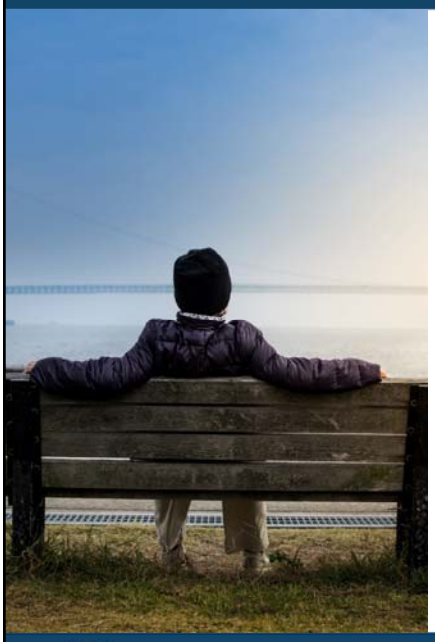
Accurate logging of medication adherence is ideal for clinicians and risk holders. Yet, it has **burdened and disengaged** chronic disease patients who often need a minimal logging system.



12

2018 PDA Universe of Pre-Filled Syringes and Injection Devices | October 8-9, 2018 | Orlando, FL | #PDAPFS | @PDAOnline

Instead of logging, offer a positive focus on process (and perceived control) – correlated with improved self care



- Give credit for patient efforts without heavy logging (ideally transparent)
- Reward "good" choices/actions thereby shifting focus from negative symptoms/feelings to the positive things a patient has done for their care
- Use rewards systems like streaks which leverage loss aversion to increase long-term engagement

13

A common feature that is often employed are alerts or reminders

"Unintentional non-adherence" is a term in the literature and is primarily defined by *forgetfulness*.
Reminders are a necessary (*but not sufficient*) component to any intervention.
Any reminder system should be **time-bound** and therefore more **achievable** and **empowering**.

Don't do this:

Simple alerts and reminders

In the brain, logging and alerts are not sustainable over a long period of time due to alert fatigue and desensitization

Do this:

- Variable, emotionally intelligent reminders
- Short "sprints" to jumpstart habit formation while avoiding desensitization

14

Success stories work to increase self-efficacy, which is a major component of unintentional non-adherence

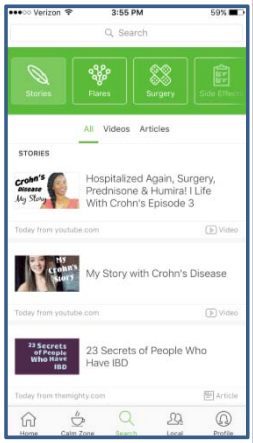
Don't do this:

High production value "stories"

- Most videos, especially in the pharma space, are **over-produced** and place the patient in an **artificial** setting.
- This creates **disengagement** because a patient can no longer see themselves in the story ("this is forced", "this is paid for", "the person isn't telling the truth")

Do this:

- Success stories reassure a patient that they can get better by showing how people like them improved.
- Have content that is scientifically vetted
- Use patient-generated video content that is **real**, **patient-centric**, and **brief**



15

Conclusion

- There are many reasons why we should apply behavior design to our digital health solutions.
- Let's **stop** creating solutions that don't work.
- Let's **start** applying behavior design and generating the evidence of what works.

16

Check out these resources to learn more about behavior design

Resources

- http://behaviormodel.org/
- https://www.bjfogg.com/

- Anglada-Martinez, H., Riu-Viladoms, G., Martin-Conde, M., Rovira-Illamola, M., Sotoca-Momblona, & J. M. Codina-Jane, C. (2015). Does mHealth increase adherence to medication? Results of a systematic review. International Journal of Clinical Practice, 69(1), 1742-1241.
- Fogg, B. 2009. A behavior model for persuasive design. In Proceeding of the 4th International Conference on Persuasive Technology, 26-29.
- NCPA. "Medication Adherence in America: A National Report Card." (2013). Langer Research Associates. Retrieved from http://www.ncpanet.org/innovation-center/adherence-simplify-my-meds/simplify-my-meds/preview-of-simplify-my-meds-/medication-adherence-in-america-a-national-report-card
- American Psychological Association "10 Ways to Build Resilience." Web. 22 June 2017. http://www.apa.org/helpcenter/road-resilience.aspx

17

Thank you!

Paul Upham
upham.paul@gene.com
@paularthurupham

18