

Behavioral Economic Approaches to Increase Physical Activity

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The 5000 hours problem

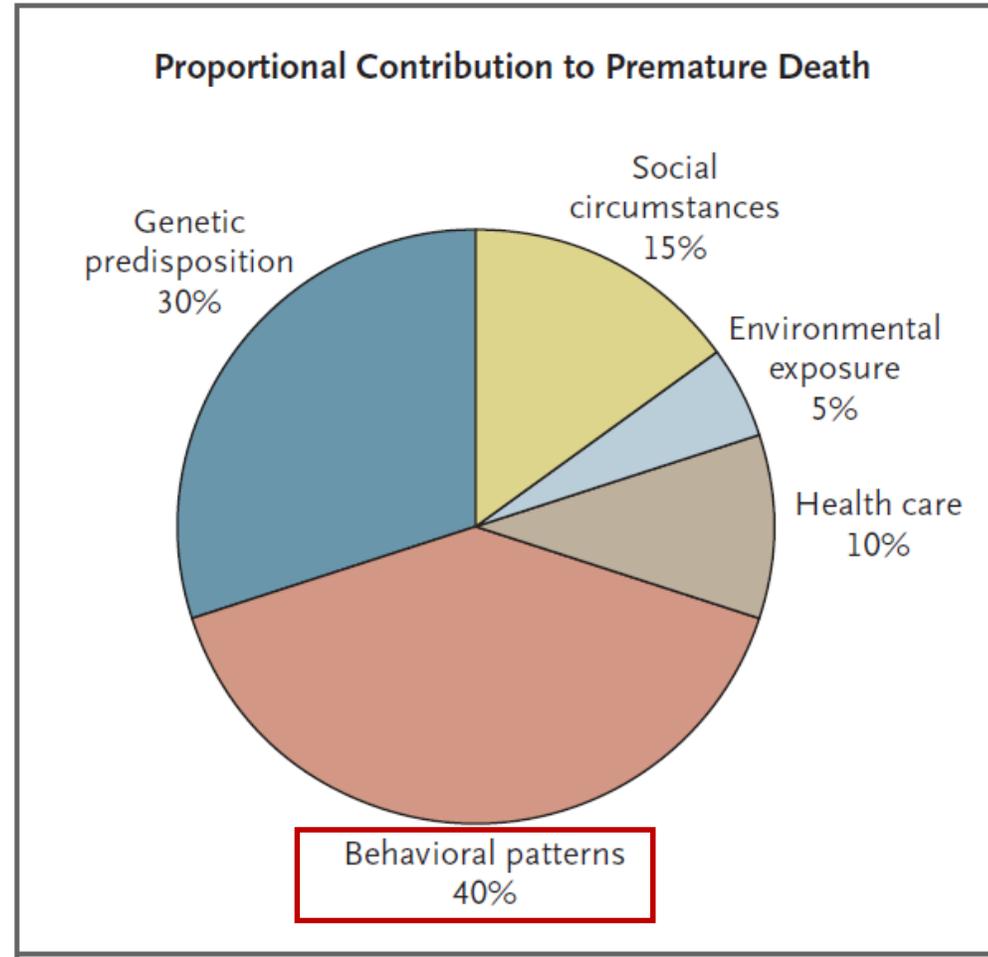
- The average patient with a chronic condition spends no more than a few hours a year with a clinician
- In contrast, more than 5000 waking hours is spent doing everything else within their everyday lives



Our daily behaviors influence our health



The NEW ENGLAND
JOURNAL of MEDICINE



New models of care are needed

Reactive, visit-based model
is not sufficient

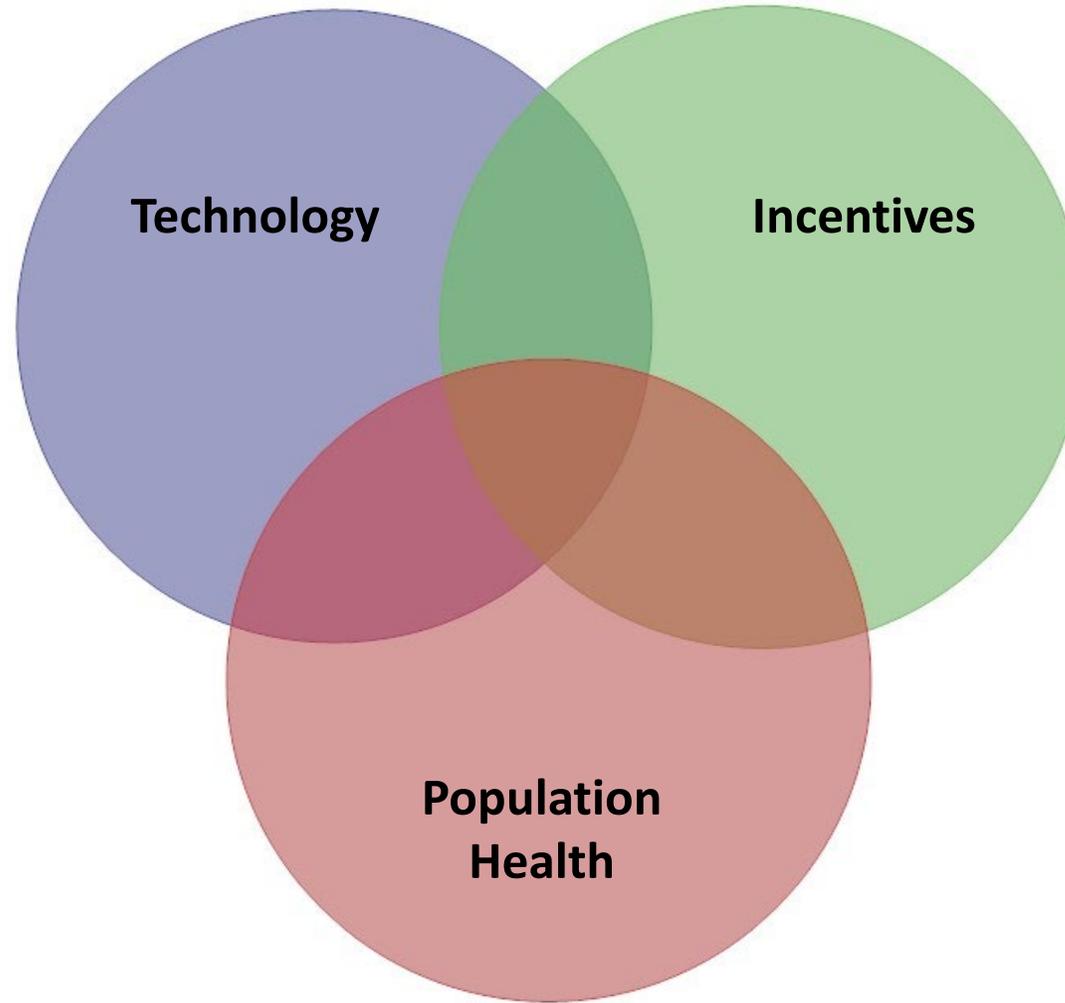


Shifting to a more
proactive model



Three evolving market trends

Innovations in mobile technology allow us to better monitor health behaviors



Our understanding of the science of motivation has evolved

Health care financing is shifting focus

Poll Question #1

- Have you used a wearable device?
 - Yes, I'm wearing it now
 - Yes, but I stopped wearing it
 - No, I have not

Increasing interest in using wearable devices for population health

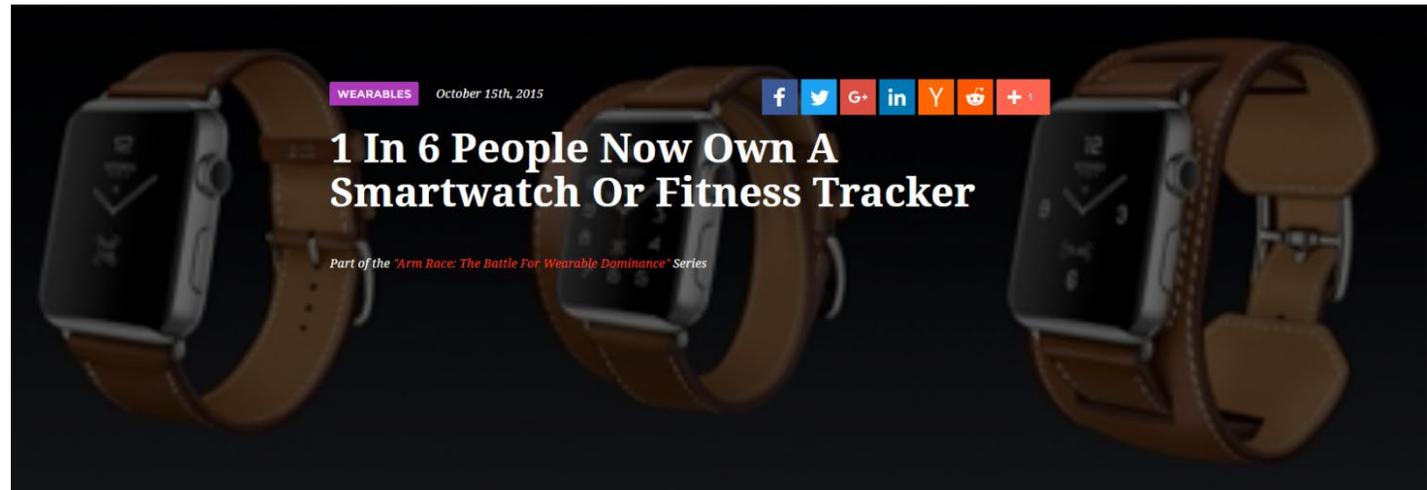
- Major technology companies entering the space
 - Apple, Google, Samsung, Microsoft, and others
- Adoption of wearable devices is low but growing
 - Less than 5% of US population
 - Annual sales are expected to surpass \$50 billion
- Changing health behaviors
 - Hope: educate and motivate individuals towards better habits and improved health
 - Concern: most evidence suggests that these devices alone are unlikely to change behavior



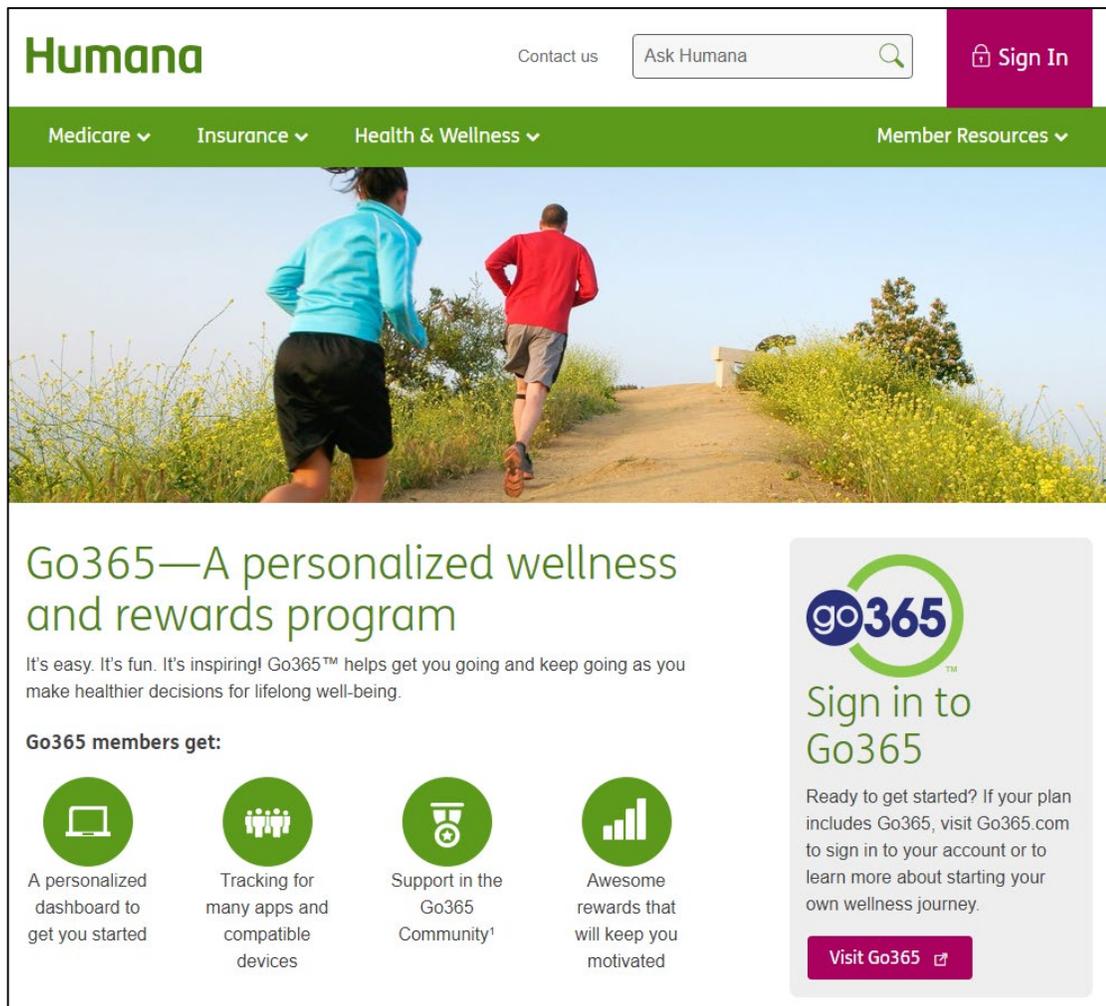
Four key challenges for wearable devices

Surveys on wearable device use

20 PERCENT OF AMERICANS SAY THEY USE WEARABLE TECH



Evidence from a national sample



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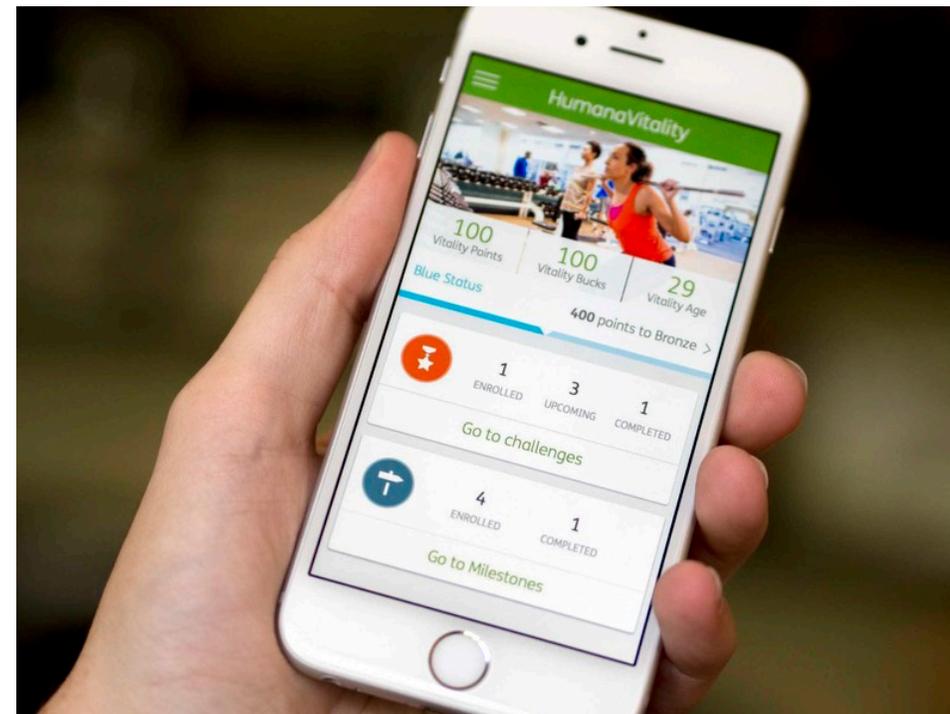
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Evidence from a national sample

- Activation rates were low
 - 1.2% of 4.48 million members
- Varied by age
 - Younger adults were 30 times more likely to engage than 65+ years (2.8-3.1% vs. 0.1%)
- Varied by income
 - Higher income individuals more likely to engage

Table 1. Initial Activation of Activity Trackers

Characteristic	Sample, n (%) (n = 4 483 853 [100.0%])	Activated an Activity Tracker Device, n (% within group) (n = 53 245 [1.2%])
Age		
≤22 y	635 524 (14.2)	1150 (0.2)
23-34 y	549 173 (12.3)	17 117 (3.1)
35-49 y	740 366 (16.5)	20 337 (2.8)
50-64 y	882 178 (19.7)	12 679 (1.4)
≥65 y	1 675 250 (37.4)	1 962 (0.1)
Missing	1362 (0)	0 (0)
Sex		
Male	2 108 421 (47.0)	19 447 (0.9)
Female	2 375 432 (53.0)	33 798 (1.4)
Insurance type		
Commercial	2 675 401 (59.7)	51 644 (1.9)
Medicare	1 807 911 (40.3)	1 545 (0.1)
Other/unknown	541 (0)	56 (10.4)
Relationship to insurance plan holder		
Self	3 426 437 (76.4)	45 527 (1.3)
Spouse	375 764 (8.4)	6 279 (1.7)
Child	675 483 (15.1)	1 409 (0.2)
Missing	6169 (0.1)	30 (0.5)
Median household income, \$‡		
≤20 000	16 731 (0.4)	145 (0.9)
20 001-34 999	490 775 (11.0)	3 206 (0.7)
35 000-49 999	1 519 731 (33.9)	14 446 (1.0)
50 000-74 999	1 687 735 (37.6)	24 329 (1.4)
75 000-99 999	548 546 (12.2)	8 730 (1.6)
≥100 000	168 495 (3.8)	2 074 (1.2)
Missing	51 840 (1.2)	315 (0.6)

Improving access to wearables

Target to Offer Fitbits to 335,000 Employees



Bloomberg Technology Markets Tech Pursuits Politics Opinion Businessweek

Aetna Will Subsidize Apple Watch in First U.S. Insurer Deal

Four key challenges for wearable devices



Access

Individuals with the most to gain are less likely to use them

Challenges to sustaining use

- Individuals who already self-identified to have challenges changing behavior are asked to change additional behaviors
 - Put it on and wear it everyday
 - Regularly charge the device
 - Sync data with another device
- Extra steps create high hurdles for sustaining use



Evolution of activity trackers

Four key challenges for wearable devices



Access

Individuals with the most to gain are less likely to use them



Sustainability

Half of people that purchase devices stop using them within a few months

A wide range of behaviors targeted by wearable device companies



Poll Question #2

- Which devices were most accurate?
 - Wearable devices
 - Smartphones
 - Both wearable devices and smartphones
 - Neither wearable devices or smartphones

Accuracy of devices for tracking physical activity

Figure 1. Device Outcomes for the 500 Step Trials

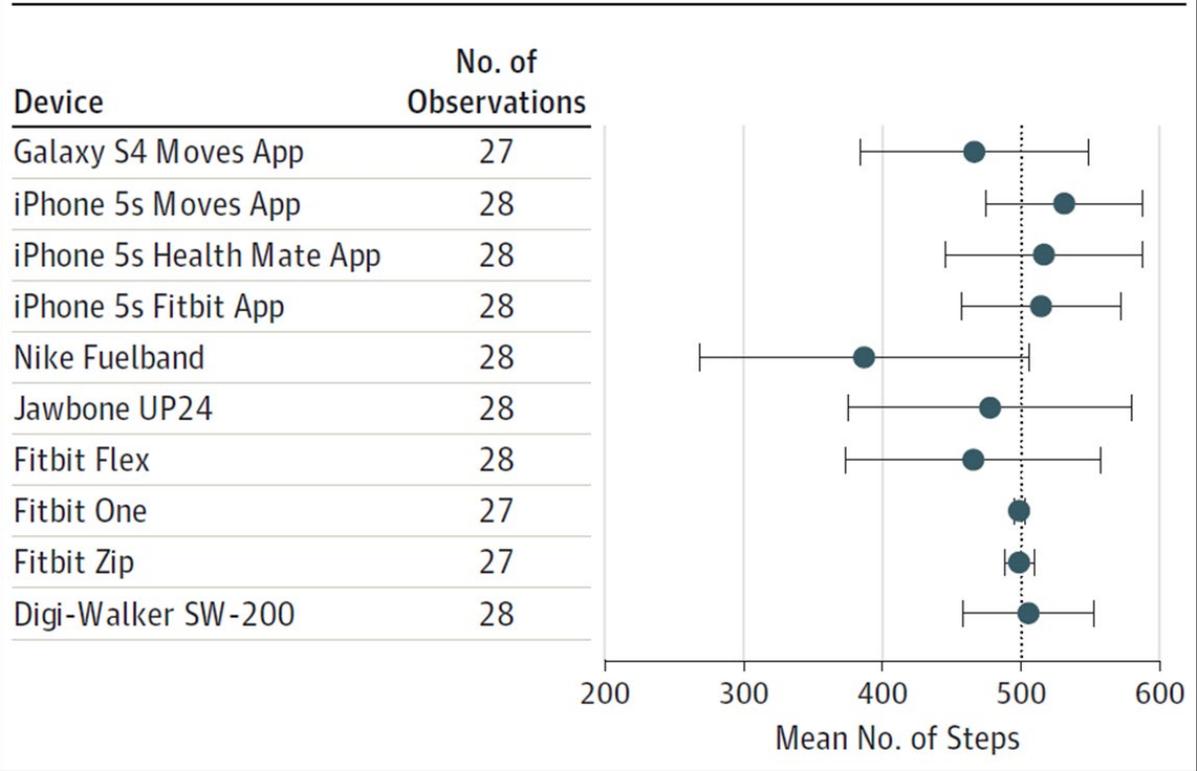
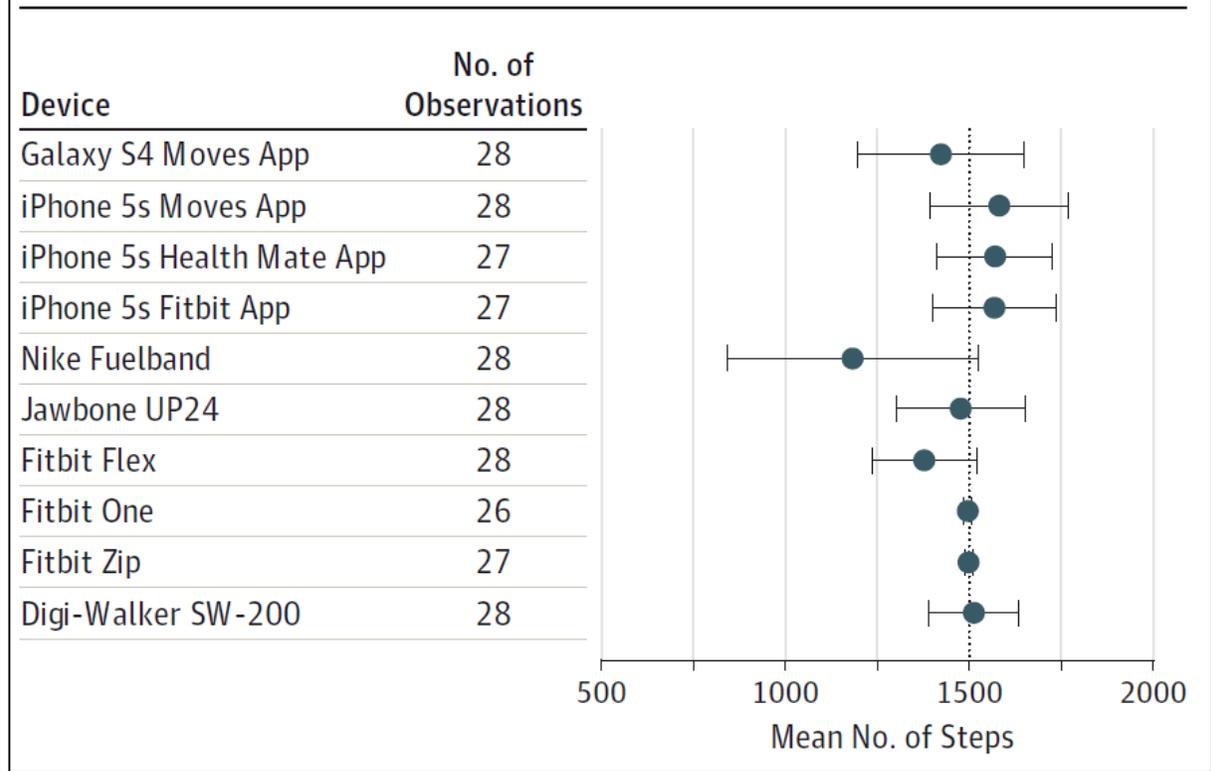


Figure 2. Device Outcomes for the 1500 Step Trials



Shortly after the study was published...

Nike fires majority of FuelBand team, will stop making wearable hardware

The sportswear company has decided that only software has a future in Nike's technology vision. That means cutting the FuelBand, including a slimmer version planned for the fall.

Nike, Apple Settle Fuelband Dispute With \$25 'Gift'

Nike agreed to pay Fuelband owners \$15 or \$25 gift check as part of the move to settle the class action suit lodged against the company and Apple.



Fitness devices usually rely on sensors and an algorithm, which experts say are not enough to accurately produce biometric data.

Accuracy of devices for heart rate monitoring



Table. Concordance Correlation Coefficients for Each Heart Rate Monitor

Device	Agreement With Electrocardiogram
	Concordance Correlation Coefficients (95% CI)
Polar H7	.99 (.987-.991)
Apple Watch	.91 (.884-.929)
Mio Fuse	.91 (.882-.929)
Fitbit Charge HR	.84 (.791-.872)
Basis Peak	.83 (.779-.865)

Accuracy worsened with higher levels of exercise

Four key challenges for wearable devices



Access

Individuals with the most to gain are less likely to use them



Sustainability

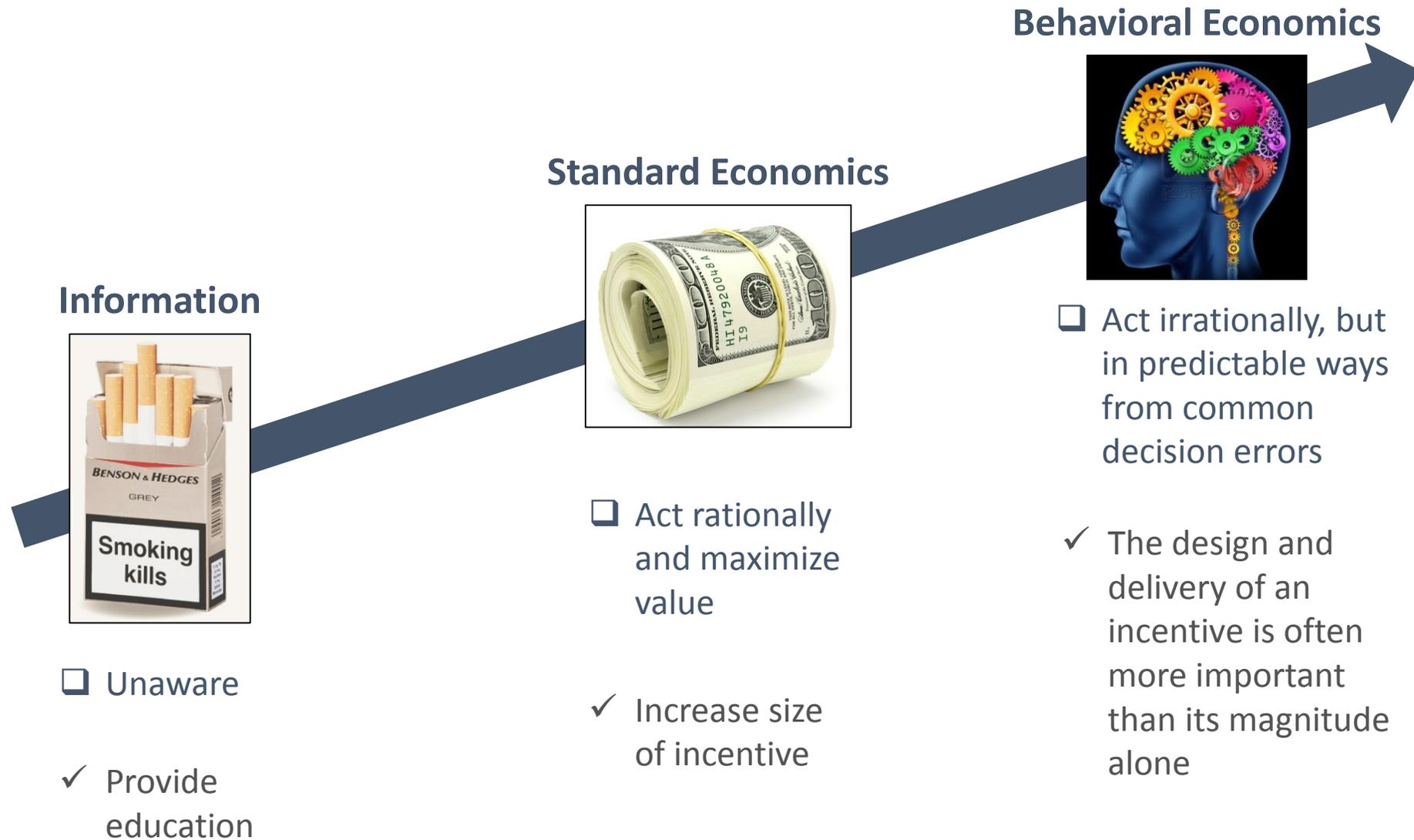
Half of people that purchase devices stop using them within a few months



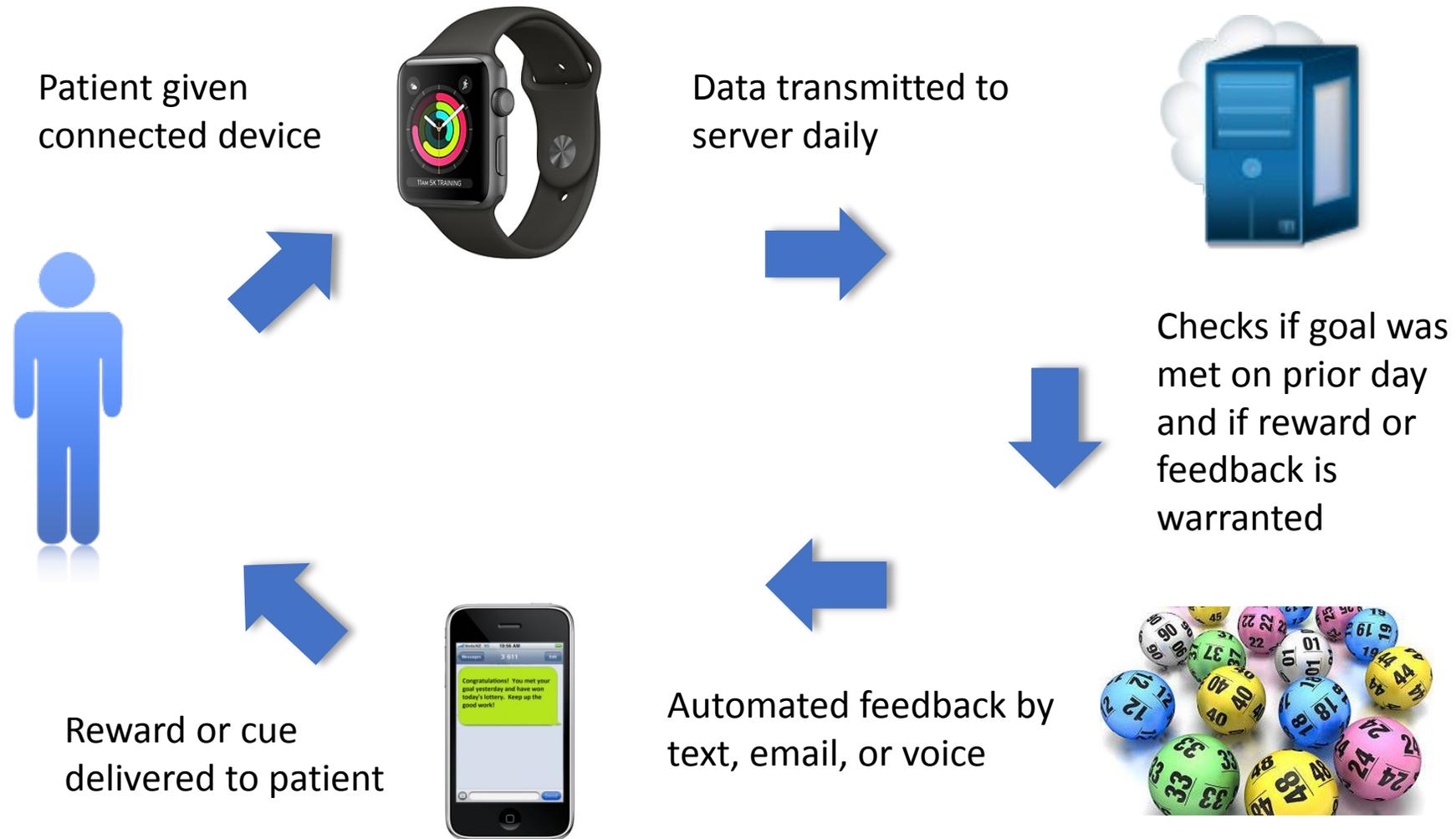
Accuracy

Many devices for different behaviors with little evaluation

Science of motivation has evolved



Automated Hovering



Incentives for Physical Activity

Framing Financial Incentives

- Design
 - Adults BMI ≥ 27 using smartphones
 - 7000 step goal for 6 month trial
- Arms
 - Control
 - Standard gain framing incentive
 - \$1.40 earned each day goal is achieved
 - Daily lottery incentive
 - 1 in 5 chance of \$5 and 1 in 100 chance of \$50
 - Expected value \sim \$1.40 per day
 - Loss framing incentive
 - Each month, \$42 in virtual account, \$1.40 taken away each day goal is not achieved

Using loss framing within wellness programs

THE WALL STREET JOURNAL.

BUSINESS | MANAGEMENT

Employees Get Apple Watch for \$25 (But There's a Catch)

Since passage of the Affordable Care Act, employers have dangled ever-larger incentives to motivate workers to stay healthy



- But there's a catch
 - They must meet monthly fitness goals over 2 years or risk paying back the full price of the Apple Watch

ACTIVE REWARD Trial

- Sample
 - Adults with ischemic heart disease from 4 hospitals Ineligibility criteria
 - Already enrolled in a formal cardiac rehab
 - Unable to use a smartphone or tablet compatible with wearable
- 2-arm randomized trial over 24 weeks
 - Enrolled from home
 - Provided informed consent online
 - Selected study communications via text message or e-mail
 - Mailed a wearable device
 - Estimated a baseline step count using a 2-week run-in period
 - Randomized using block sizes of 2, stratifying on age (< 65 ; ≥ 65)



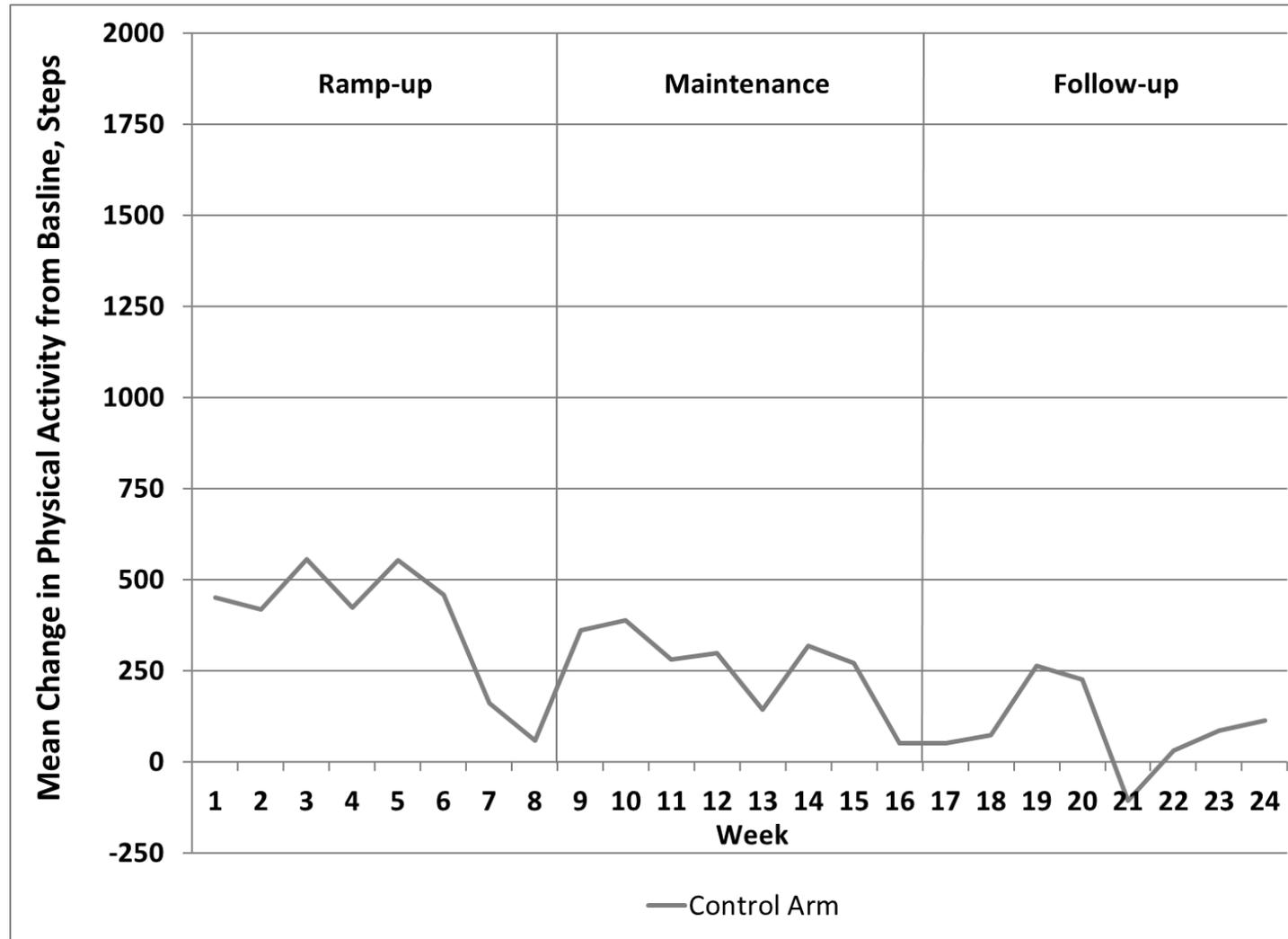
Misfit Shine Features

- **Display progress to goal**
- **Battery lasts 6+ months**
- **Waterproof**
- **Tracks sleep patterns**

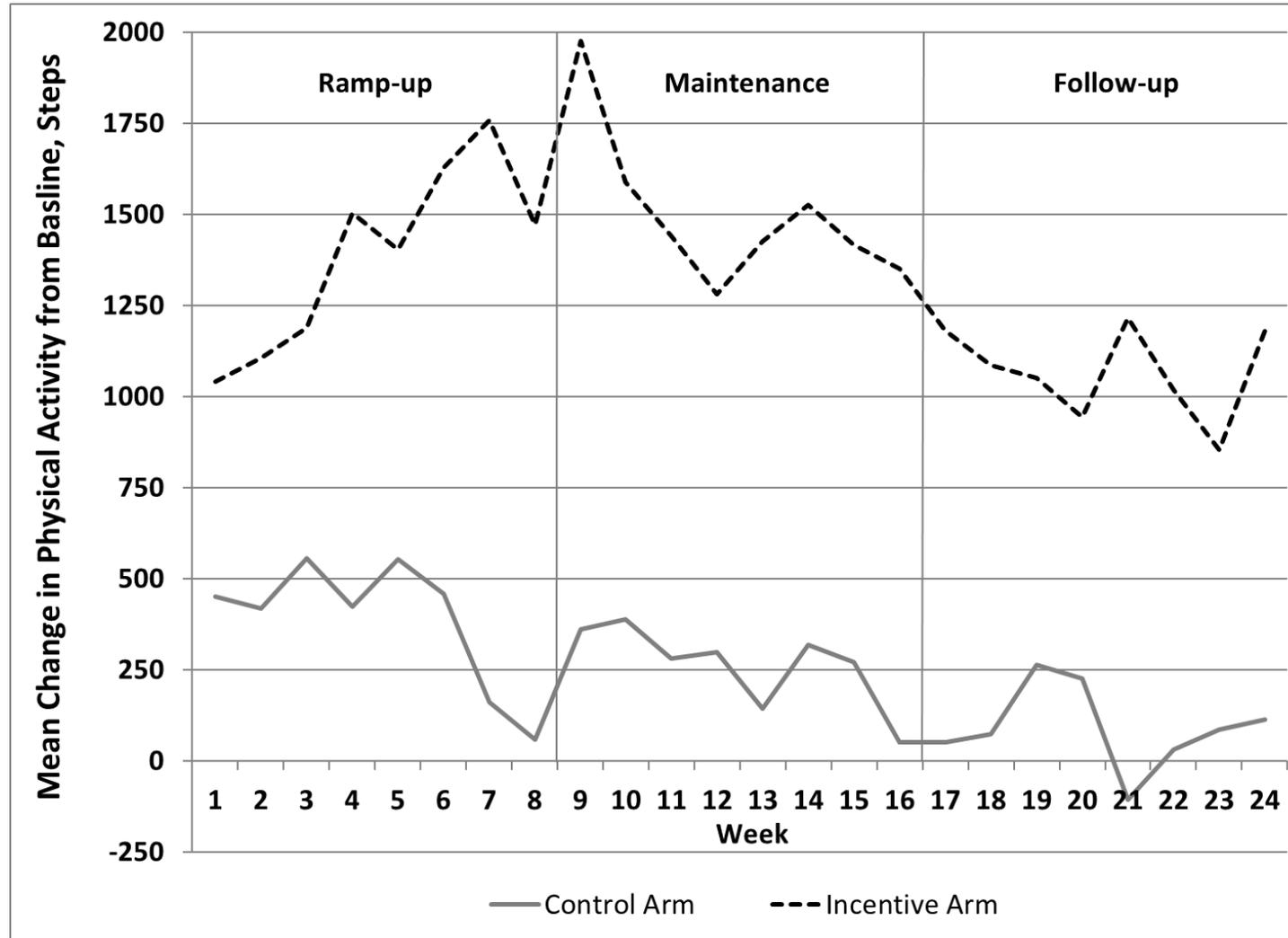
ACTIVE REWARD Trial

- Control
 - Provision of a wearable device
- Intervention
 - Personalized goal-setting with daily feedback for 24 weeks
 - Ramp-up (weeks 1-8): Goals increased from baseline by 15% with a maximum of 10,000 steps
 - Maintenance (weeks 9-16) Remained fixed
 - Follow-up (weeks 17-24): Remained fixed
 - Loss-framed financial incentives for first 16 weeks
 - \$14 place in a virtual account at beginning of each week
 - \$2 lost each day the step goal was not met (loss aversion)
 - Account replenished each week (fresh start effect)

ACTIVE REWARD Trial



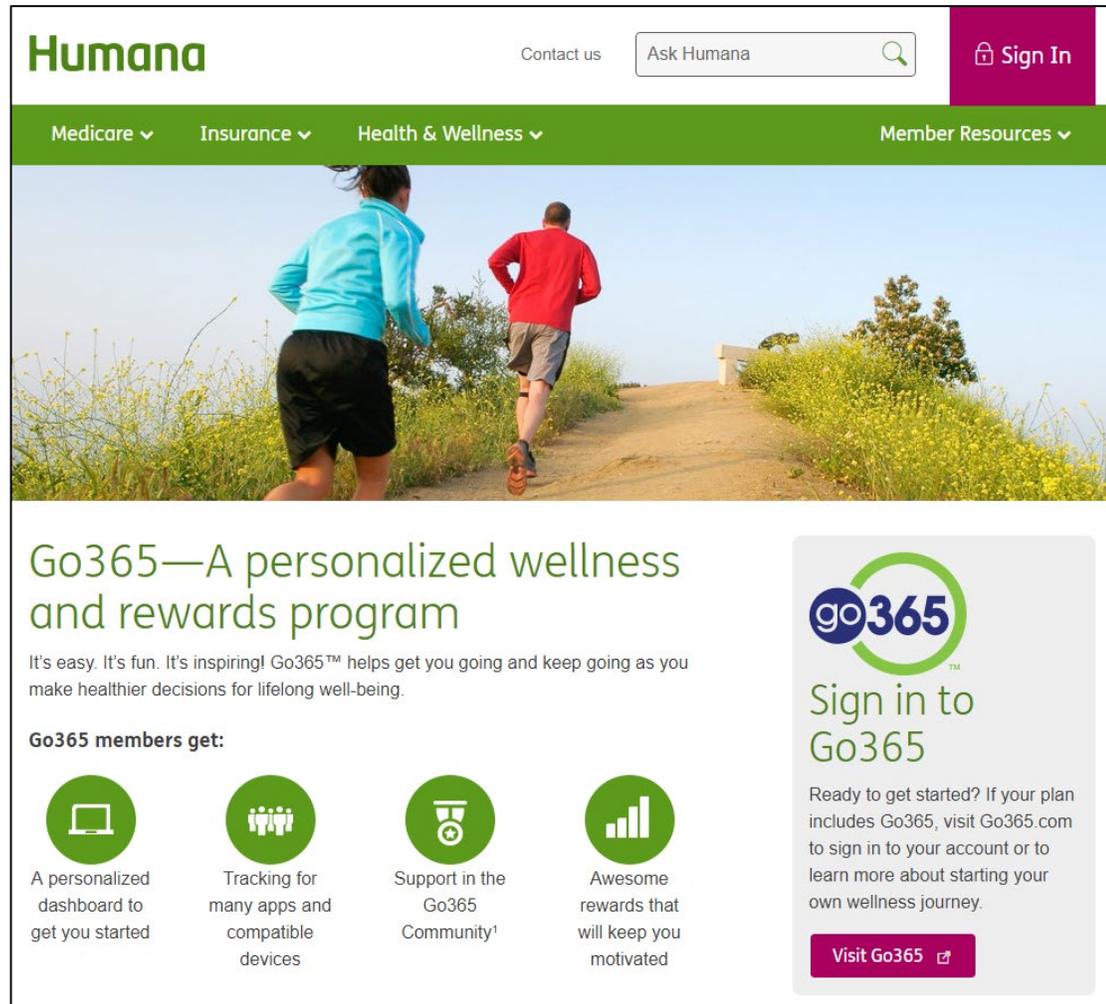
ACTIVE REWARD Trial



Gamification



Evidence from a national insurer using gamification



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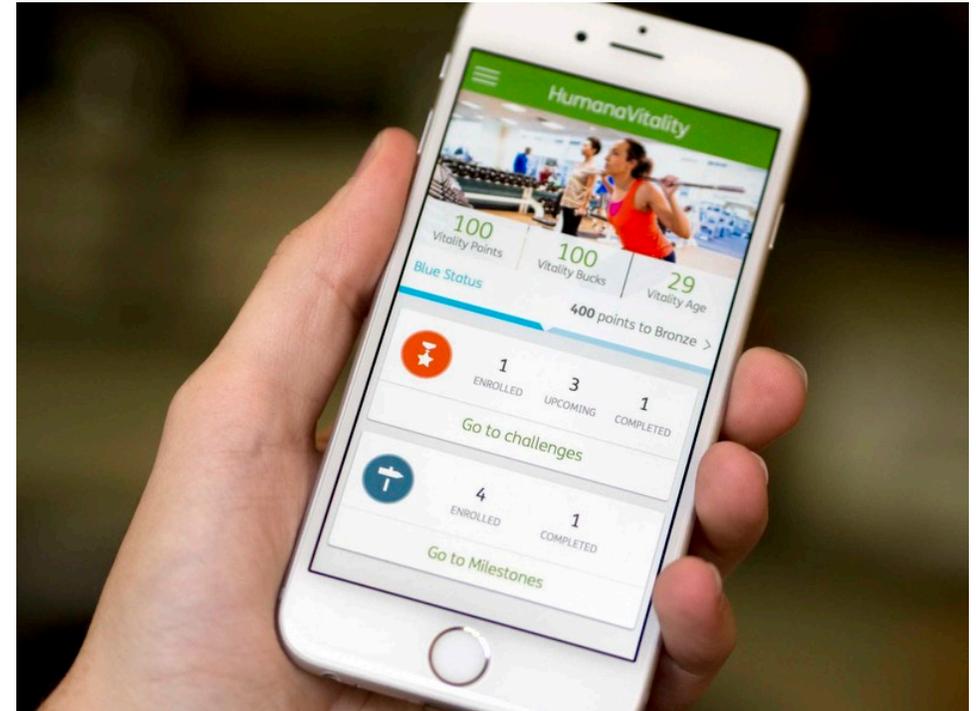
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Gamification is commonly used in digital health applications

Applied Research Brief

Gamification Use and Design in Popular Health and Fitness Mobile Applications

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American Journal of Health Promotion
1-4

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Abstract

Purpose: To evaluate the presence of gamification in popular mobile applications and whether principles from behavioral economics were incorporated in the design.

Design: The top 50 ranked free health and fitness applications were downloaded. Gamification elements were predetermined through literature review, and applications were evaluated for their presence.

Setting: App Store by Apple Inc.

Measures: Presence of gamification, type of game element, and use of behavioral economic principles.

64% of popular apps used elements of gamification

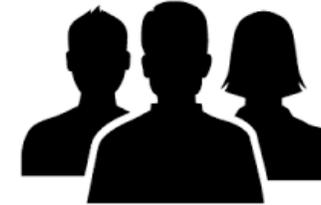
None used key behavioral economic principles

Table 2. Gamification Design Elements and their Frequency of Use.

Gamification Feature	Description	Frequency of Use, N (%)
Goals	Performance-based measures and targets	25/32 (78.1)
Social influences	Performance is publicly displayed or ability to communicate directly with another member	25/32 (78.1)
Challenges	Time-limited goals or competitions	20/32 (62.5)
Collaboration	Work together with other members to achieve a goal	15/32 (46.9)
Competition	Compete with other members either head-to-head or through leaderboards	13/32 (40.6)
High scores	Tracking of best attempts at goals or challenges	7/32 (21.9)
Badges	Recognition earned for completing specific milestones	6/32 (18.8)
Narrative	A story is used to provide context for targeting a goal	4/32 (12.53)
Streaks	Recognition for consecutive goal achievement	3/32 (9.4)
Points	Accumulate points that help progress through game and/or can be redeemed for rewards	2/32 (6.3)
Levels	Progress through parts of the game (eg, level 1 to level 2) or gradients of status (eg, bronze level to silver level)	1/32 (3.1)
Unlockable content	Access to enhanced functionality or content for accumulating experience or achieving a specific goal	1/32 (3.1)
Lifelines	Ability to obtain help or gain a second chance at completing a goal	0/32 (0)

BE FIT - Randomized Clinical Trial to Increase Physical Activity

- Enroll with your family



- Select a personalized goal



- Sign a pre-commitment pledge



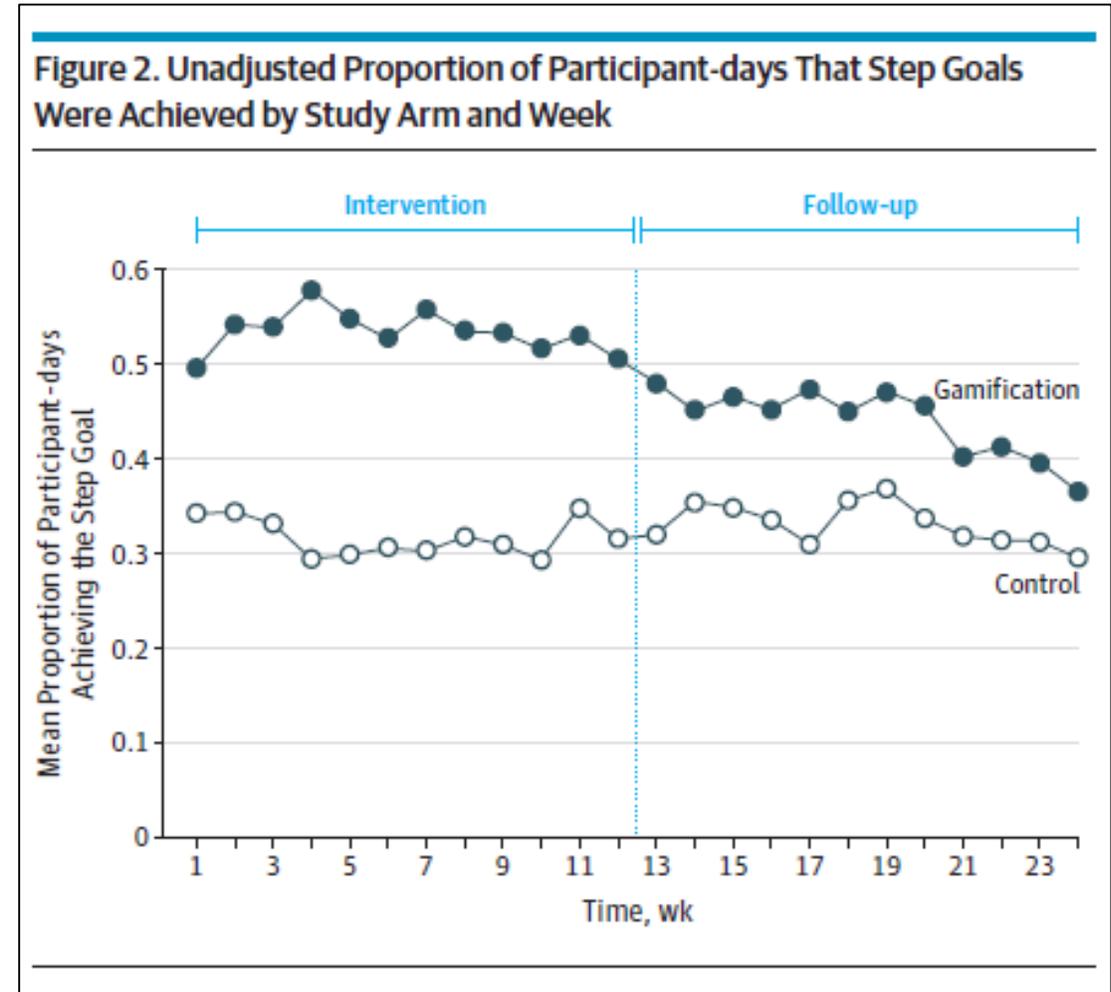
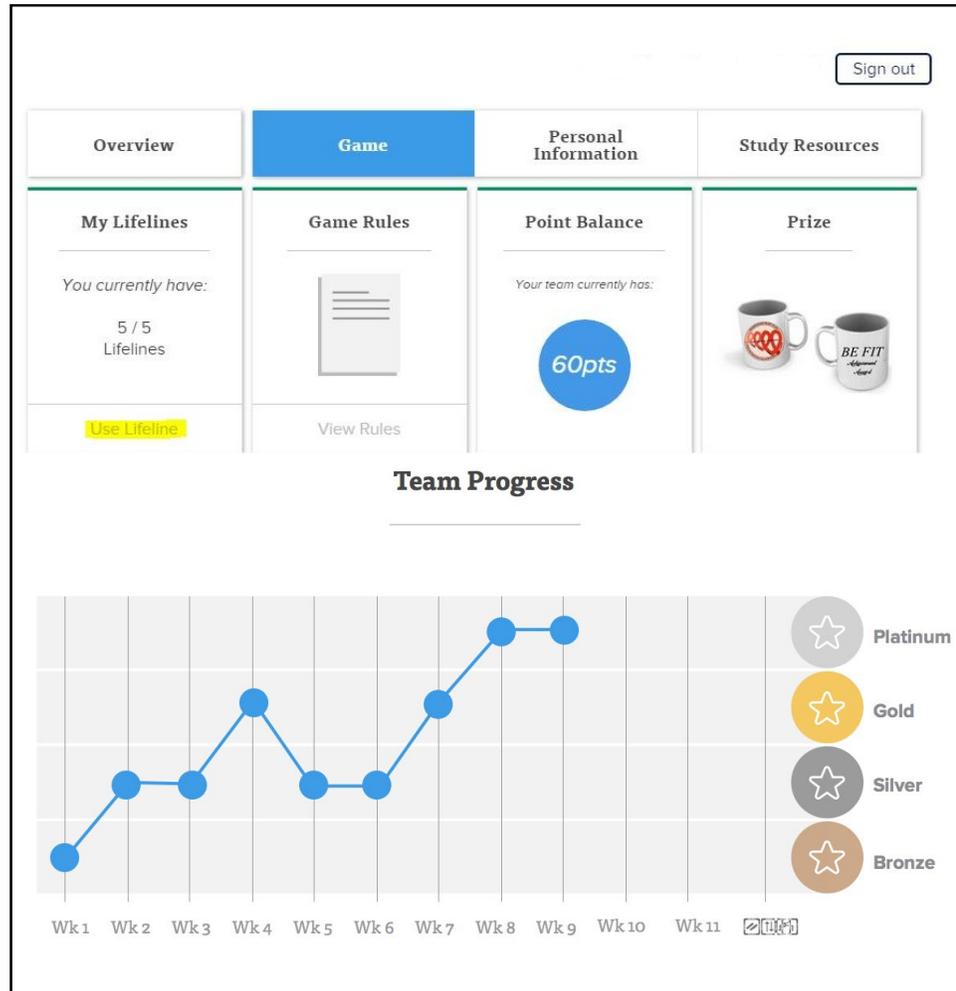
BE FIT - Randomized Clinical Trial to Increase Physical Activity

- Endowed with 70 points each week
- One family member selected each day
- Progress through levels

fresh
START



BE FIT - Randomized Clinical Trial to Increase Physical Activity



Increasing Physical Activity among Veterans

Veterans' perspectives on using wearable devices

- Convenience sample of 16 veterans
 - Completed a survey on mobile technology use and physical activity levels
- Offered a free wearable device to use for 2 months
 - All but one were still using the device on follow-up phone calls
- Veterans identified both opportunities and barriers for incorporating wearables into physical activity interventions

Veterans' perspectives on using wearable devices

Table 2. Veteran perspectives on opportunities and barriers to using wearable activity monitors to increase physical activity.

Perspective	Opportunity	Barrier
Providing wearable activity monitors to veterans	<ul style="list-style-type: none"> • “Veterans would like it because devices like that are very expensive.” 	<ul style="list-style-type: none"> • “People might not be comfortable with the idea of someone else tracking their behavior.”
Efficacy of wearable activity monitors in creating a behavioral change	<ul style="list-style-type: none"> • “This increased my activity 100%. I lost 9 lbs. I went from taking three meds [for diabetes] to one, and I didn't have to go on insulin.” • “When I'm out I might take some more steps if I don't hit the star” • “I can check when walking, sleeping. It allowed me to adjust my behavior. It made me set my alarm so I don't sleep too long. I was sleeping too long.” 	<ul style="list-style-type: none"> • “When I'm out and about, I set the goals differently. Sometimes I set goals, sometimes I just go with it.”
Potential interventions combining the device with a social incentive	<ul style="list-style-type: none"> • “Sometimes you need another person.” • “I think [it would help]. I didn't think I'd get into the watch, but I did, so yes.” • “[Being paired with another person] would be motivating and could build on the MOVE! program [which is a national weight management program designed by the Veterans Affairs National Center].” 	<ul style="list-style-type: none"> • “Hypothetically I would [be willing to be paired with a partner], but my disability prevents me from doing certain things, so it would be challenging.” • “I do better alone.”

RCT among overweight and obese Veterans

- Study design
 - 180 Veterans from CMCVAMC with body mass index ≥ 25
 - Provide Fitbit to track daily step counts
 - 12-week intervention and then 8-week follow-up
- Study arms
 - Control
 - Gamification with a support partner
 - Gamification with a support partner + loss-framed financial incentive of \$2/day

Summary

- Our daily health behaviors contribute significantly to our health
- Key is to combine these technologies with effective approaches to increase and sustain engagement
- Insights from behavioral economics can be used to design interventions that address predictable barriers to behavior change

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