

Scalable Prevention of Chronic Disease

A Program Plan

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Actuate

We aim to turn the tide of chronic disease

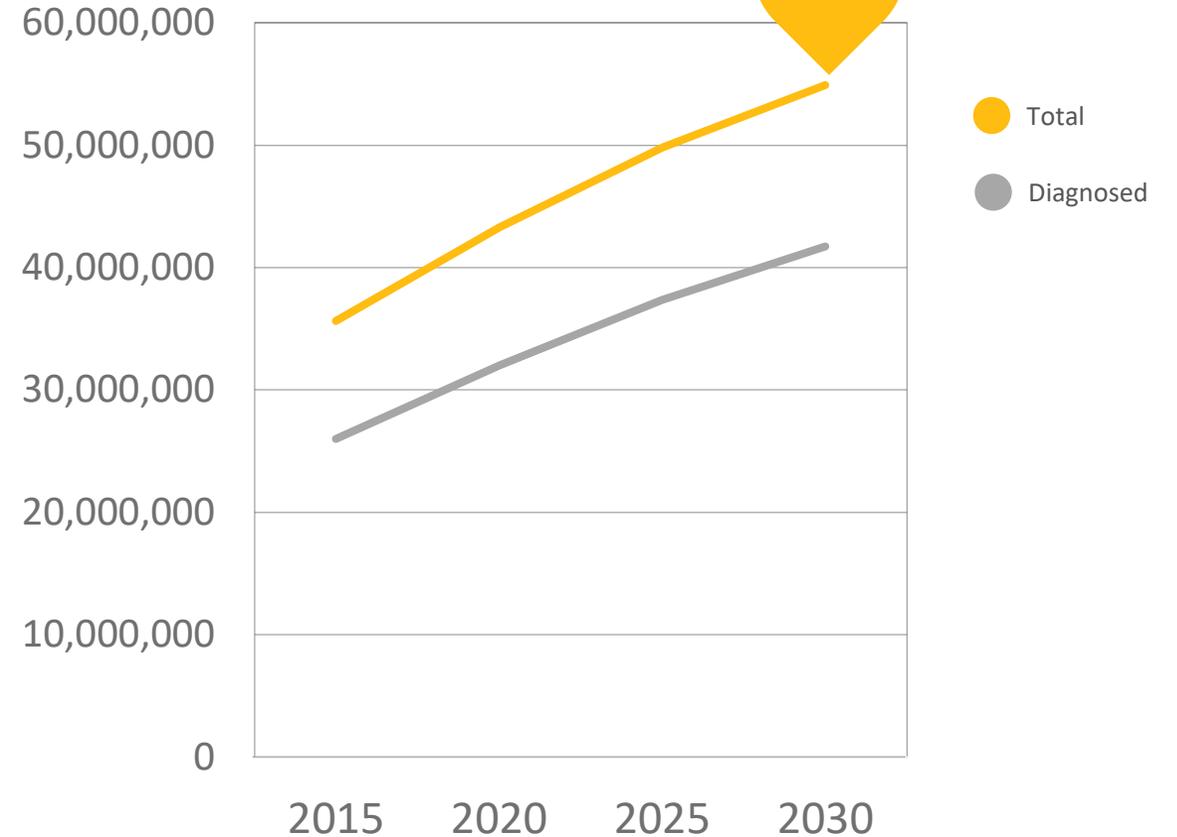
Preventable chronic disease

- Leading cause of healthcare spending in the US (75%)
- Leading cause of US deaths (7 of 10)
- Leading contributor to cost growth
- 1 in 3 people are at risk

Hypertension is the most common chronic disease

Diabetes is the fastest growing chronic disease

Americans with diabetes



+108,000,000 Americans projected to have prediabetes in 2030

Raghupathi W, Raghupathi V. An Empirical Study of Chronic Diseases in the United States: A Visual Analytics Approach. *Int J Environ Res Public Health*. 2018;15(3):431. Published 2018 Mar 1. doi:10.3390/ijerph15030431

Rwolet et al, 2016 Population Health Management. Diabetes 2030: insights from yesterday, today and the future trends. Feb. 1, 2017

Whelton PK, Carey RM, Aronow WS, Casey DE, Collins KJ, Dennison C, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the prevention, detection, evaluation, and management of high blood pressure in adults. *Hypertension*. 2018;71(19):e13–115.



Today's solutions are limited

We know what works



-58%

Almost two decades ago, the Diabetes Prevention Program (DPP) showed that the transition from prediabetes to diabetes was reduced by 58% for those who received lifestyle coaching



Similar healthy habits also underpin prevention for hypertension and other diseases

But many millions who are at risk are not benefiting

24%

Only 24% of those with hypertension have their blood pressure under control

1%

1% of those at risk of diabetes are in an evidence-based prevention program

Why?

Today's solutions have fundamental limits

Diabetes Prevention Program (DPP)

- In-person coaching
- Limiter: labor cost limits adoption

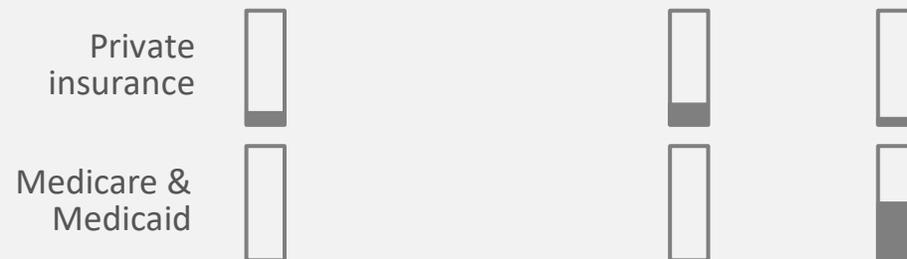
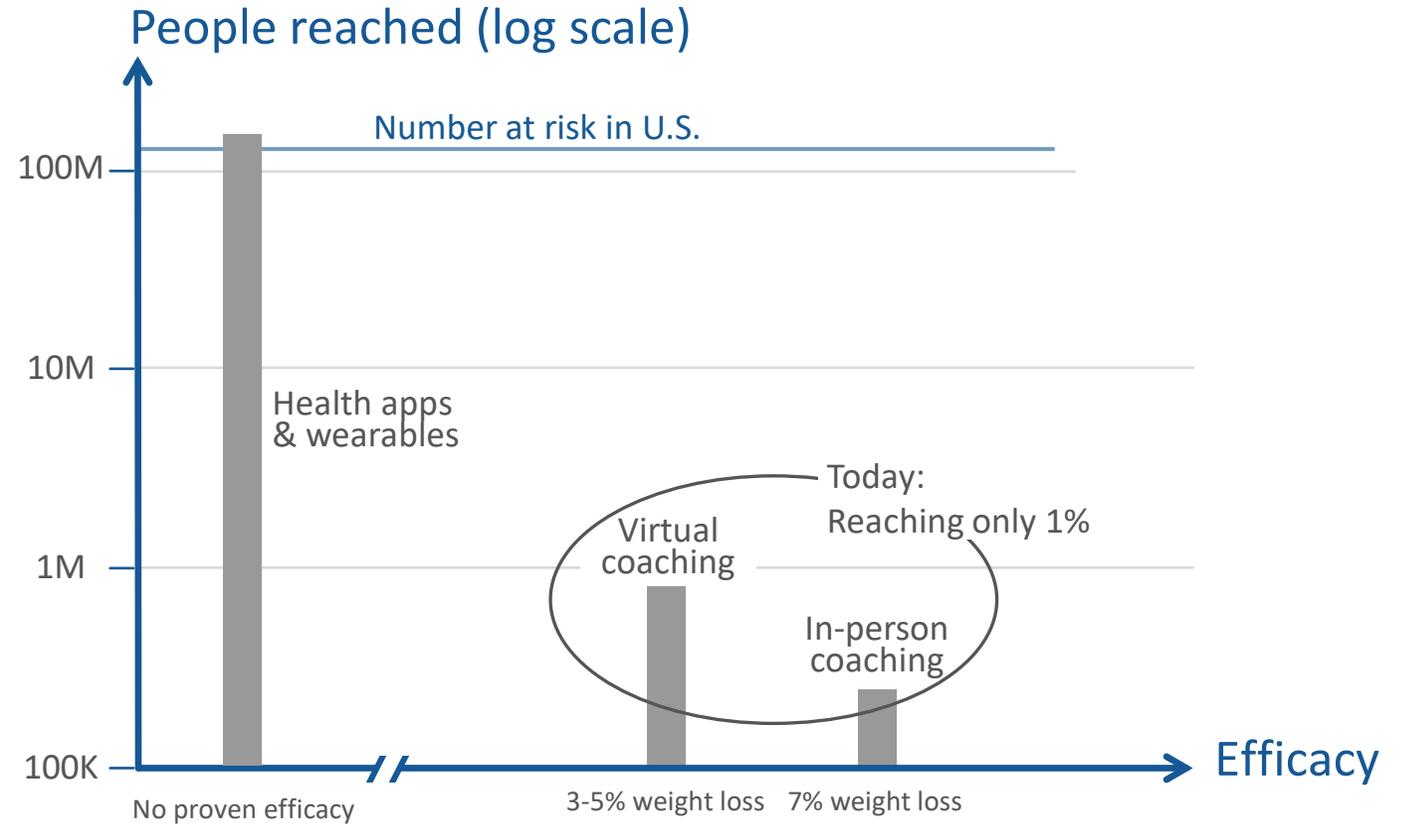
Virtual DPP

- Video coaching, customer support
- Limiter: lower labor cost reduces efficacy

Health apps & wearables

- Sensors, reminders, diaries, networking
- Limiter: inadequate for disease prevention without personal coaching

See appendix for details



Prevention is stuck in a holding pattern

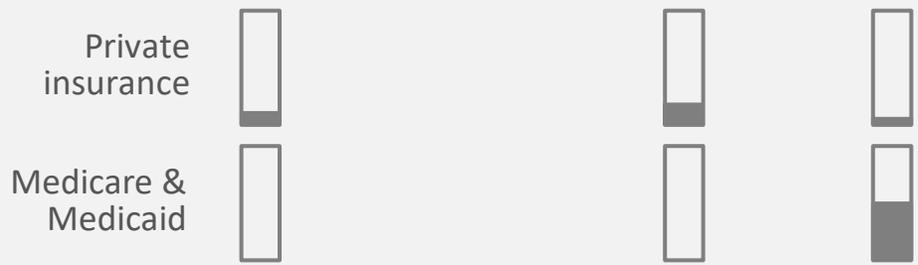
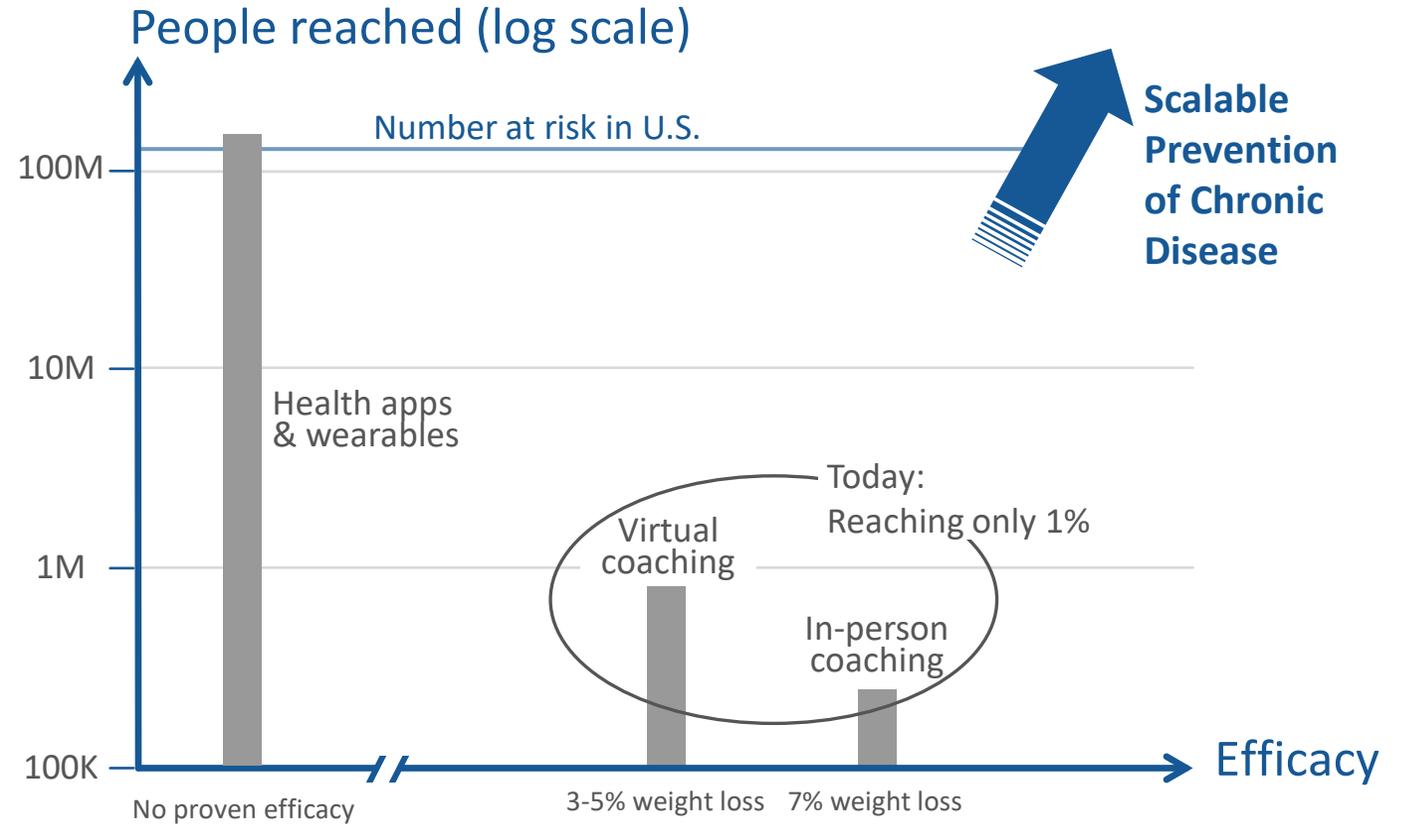


An opportunity to break out

Ultra-low-cost, highly effective behavior change

- Real-time, continuous monitoring with privacy
- Coaching and incentives at the right moment
- Combined: low cost to enable scale and potential for better-than-DPP efficacy

Efficacious, inexpensive prevention could make full insurance coverage viable



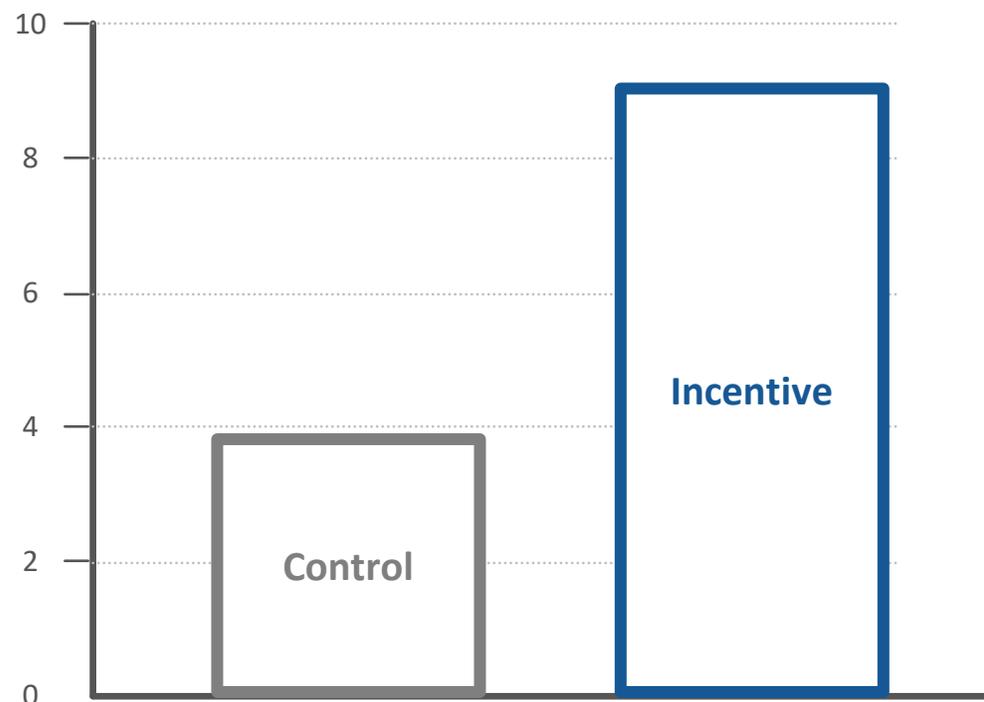
AI-powered research opens the door

Effective incentives

Emerging research

Cash incentives of only 20% of the cost of a pack-a-day habit doubled the number of smokers who quit

% not smoking after 18 months



Furthermore, contingency management studies find that small incentives double the duration of adherence

Implications for prevention

The Diabetes Prevention Program did not incentivize participants' behavior

Adding incentives to DPP-type coaching could significantly boost outcomes

New methods can rapidly develop personalized, optimized incentives with the potential to be even more effective

Research needed to test and build models for:

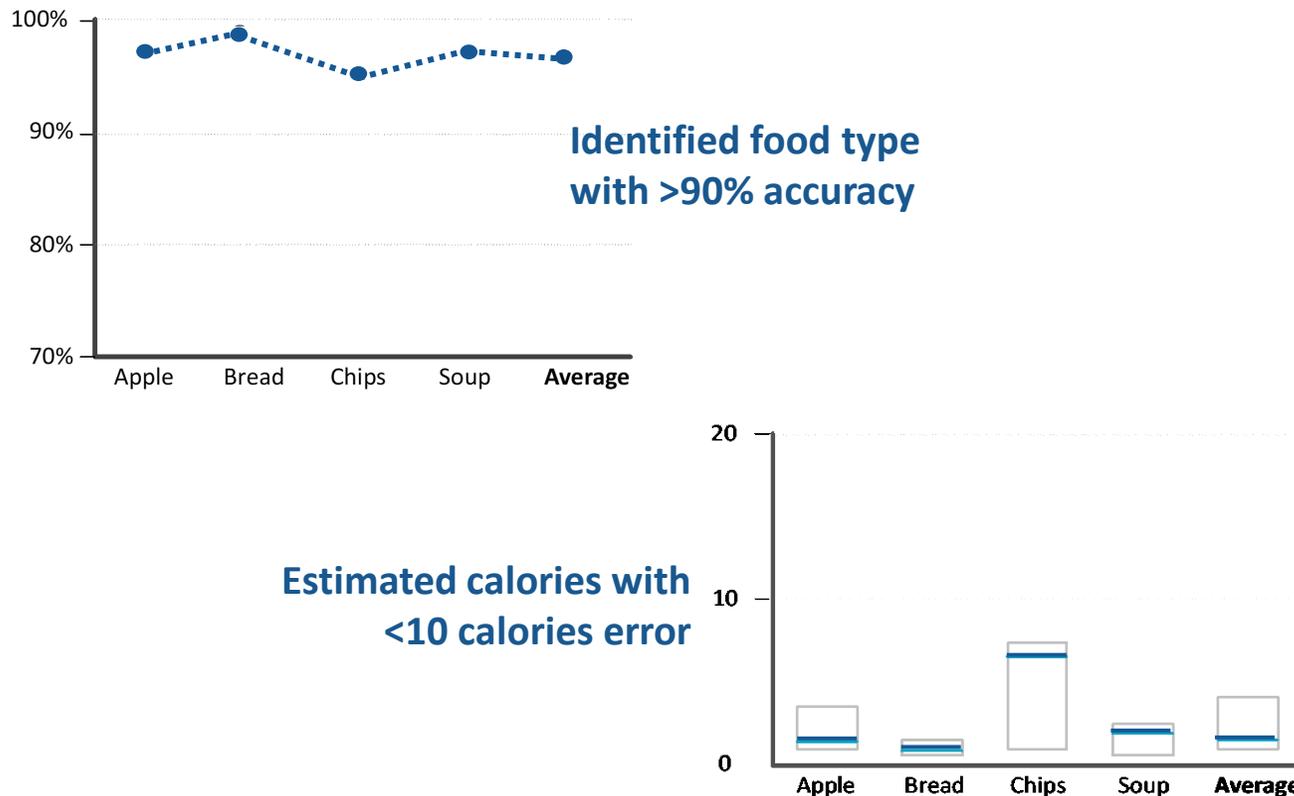
- Financial and non-financial incentives
- Different incentives for different good behaviors
- Optimal times and circumstances to offer incentive for behavior change
- Frequency of incentives
- Continuous refresh to keep high engagement



Sensing behavior

Emerging research

A collection of small commodity sensors identifies which food type is consumed and estimates calories



Implications for prevention

Inspires the possibility of completely passive food intake measurement via smartphone

Research needed to make this approach practical for everyday use:

- Adapt approach to microphones and accelerometers in smartphones and smartwatches
- Train machine learning models to recognize a wide range of foods

Additional research results

Requirement	New research results
<p>Symptom and biomarker sensing</p>	<ul style="list-style-type: none"> • Optical sensors used to measure blood glucose and blood pressure correlates via smartphone and smartwatch
<p>Behaviors</p>	<ul style="list-style-type: none"> • Accelerometer and gyroscope-based activity recognition and intensity measurement via smartphone
<p>Incentivization</p>	<ul style="list-style-type: none"> • Incentives can improve outcomes 2x for behavior adherence for vaccination • Automated and personalized incentives can improve outcomes 6x in advertising • Weekly lottery for prizes ranging in value from \$1-100 (US) increased cocaine abstinence by 4x

Banerjee, A.V., Duflo, E., Glennerster R. & Kothari, D. (2010). Improving immunisation coverage in rural India: Clustered randomised controlled evaluation of immunisation campaigns with and without incentives. British Medical Journal 340. doi:10.1136/bmj.c2220.

Chen, R., Chu, T., Liu, K., Liu, J. and Chen, Y., 2015. Inferring human activity in mobile devices by computing multiple contexts. Sensors, 15(9), pp.21219-21238.

Chunara, R. B. (2013). Assessing the online social environment for surveillance of obesity prevalence. PLoS one 8(4).

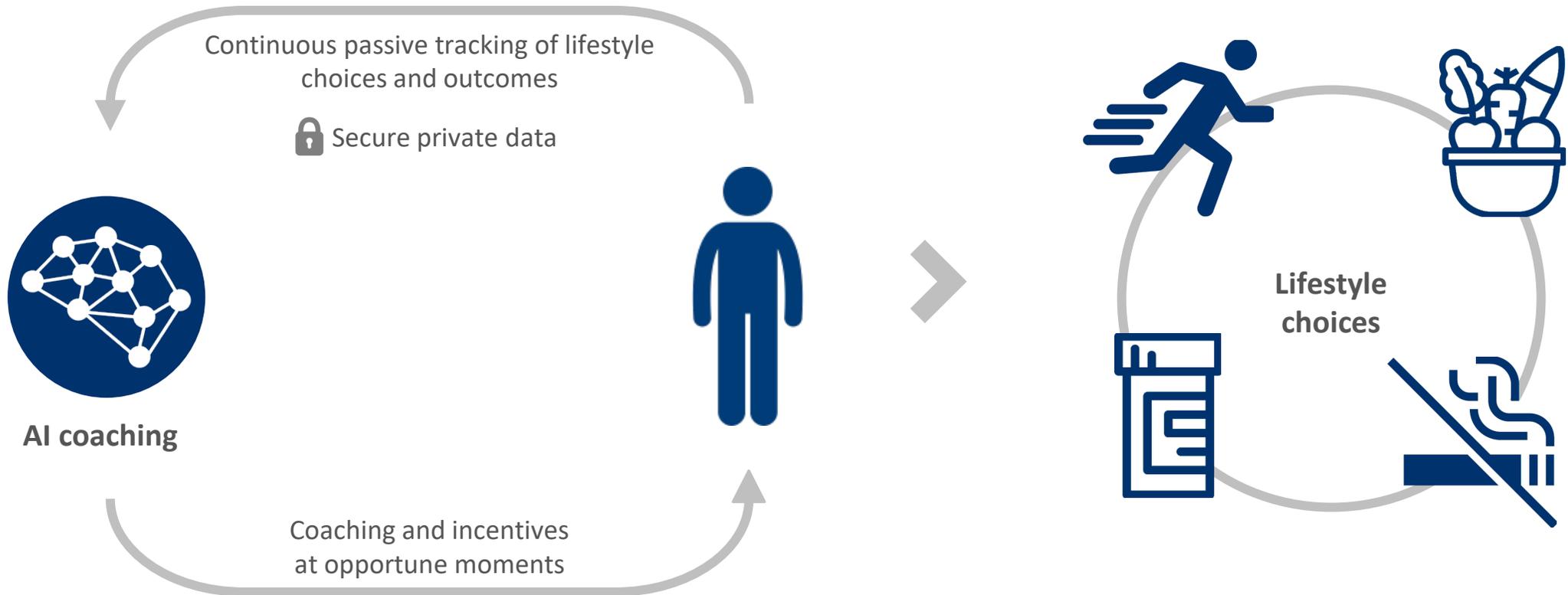
Petry NM. Contingency management: what it is and why psychiatrists should want to use it. Psychiatrist. 2011;35(5):161-163. doi:10.1192/pb.bp.110.031831

Yan, J. L. (2009). How much can behavioral targeting help online advertising? In Proceedings of the 18th international conference on World wide web (pp. pp. 261-270). ACM.



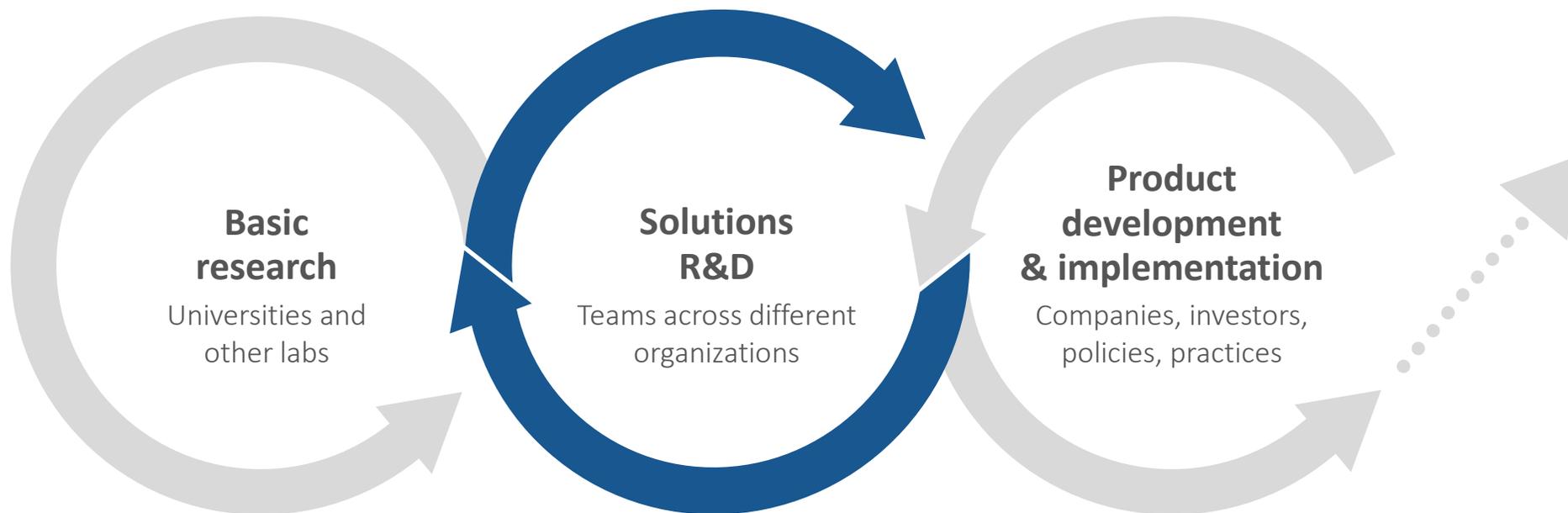
Actuate's Scalable Prevention program

Integrating these disparate research elements can start a new generation of behavioral health



This challenge requires solutions R&D

Existing approaches will not turn the tide of chronic disease



- Essential ingredients but...
- Not applied to behavioral health
- Not integrated into practical solutions
- No clinical proof

- Missing

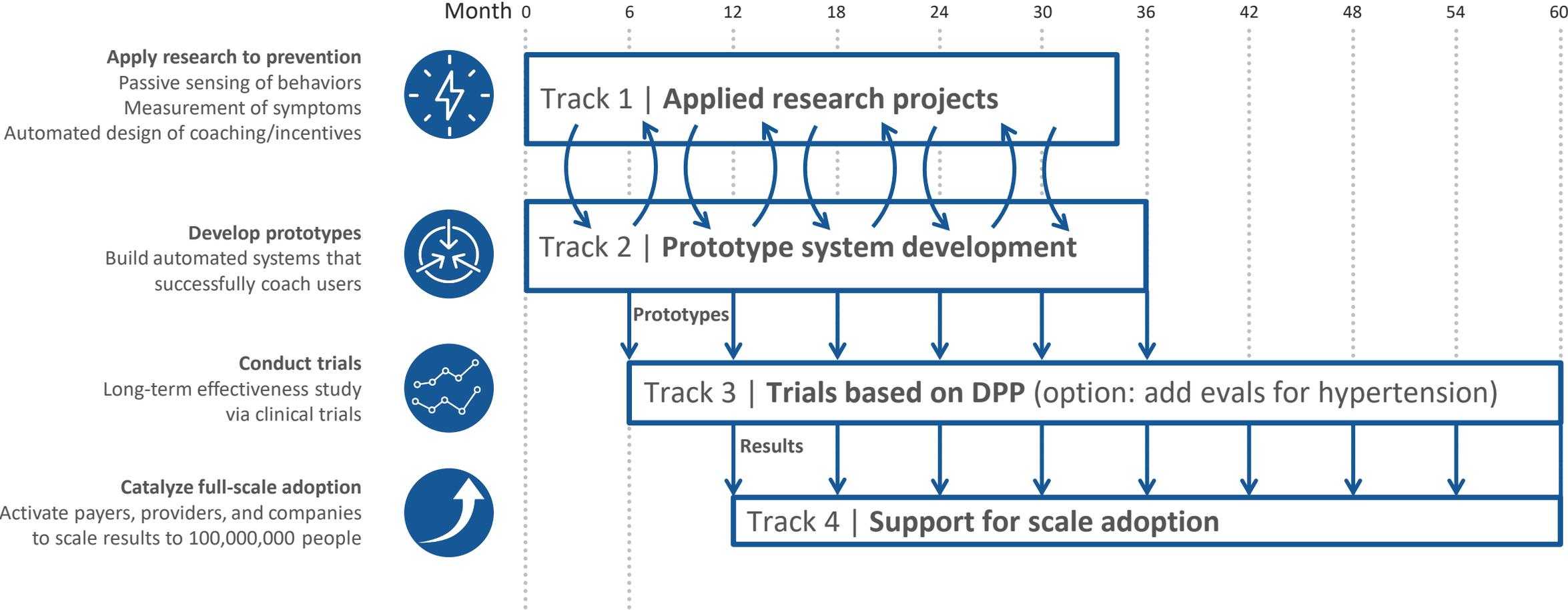
- Companies/investors pursue proven approaches with limited R&D and time horizons
- Business models for tech solutions address profitable niches without solving the societal chronic disease problem — it's bigger than one company

Scalable Prevention of Chronic Disease

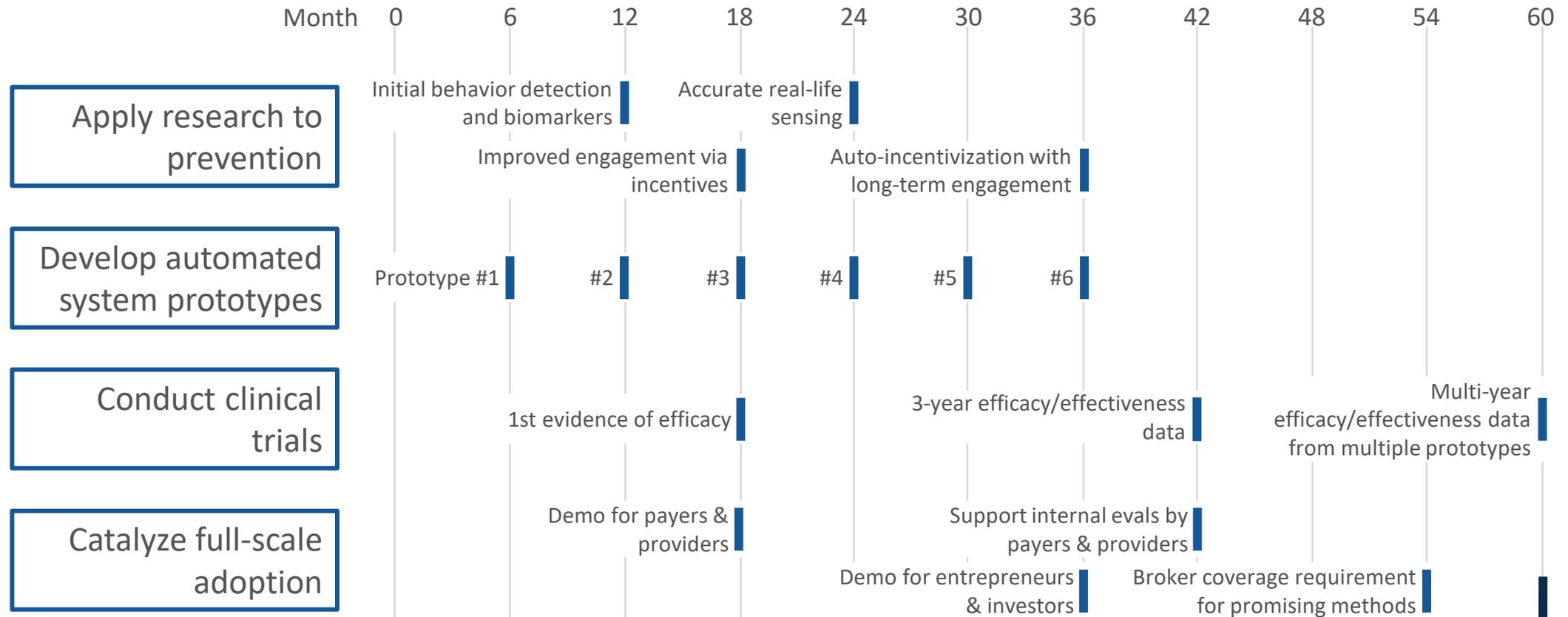
Program objective

Research and demonstrate
unprecedented prevention efficacy
with **ultra-low-cost tools**
that can reach more than 100,000,000 people

Program plan



Scalable Prevention program milestones



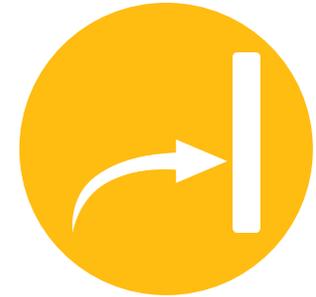
Robust, ultra-low-cost, scalable prevention methods
 Multi-year evidence of a record reduction in the transition to diabetes
 Companies & investors starting to commercialize, payers & providers starting to cover

Scalable Prevention of Chronic Disease



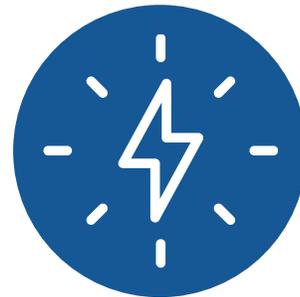
A dangerous problem

Preventable chronic disease is consuming health and healthcare



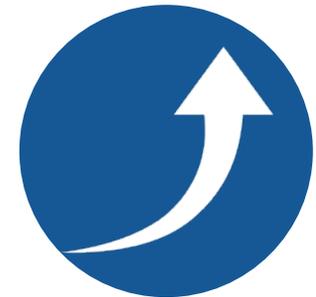
Limited solutions today

We know what works but are reaching only a tiny fraction of those in need



New research

Artificial intelligence + applied behavioral science can unlock extraordinary new possibilities



A program to change what's possible

Research and demonstrate unprecedented efficacy with tools that can reach 100,000,000 people

Appendix

The Diabetes Prevention Program

Diabetes Prevention Program (DPP)
lifestyle coaching

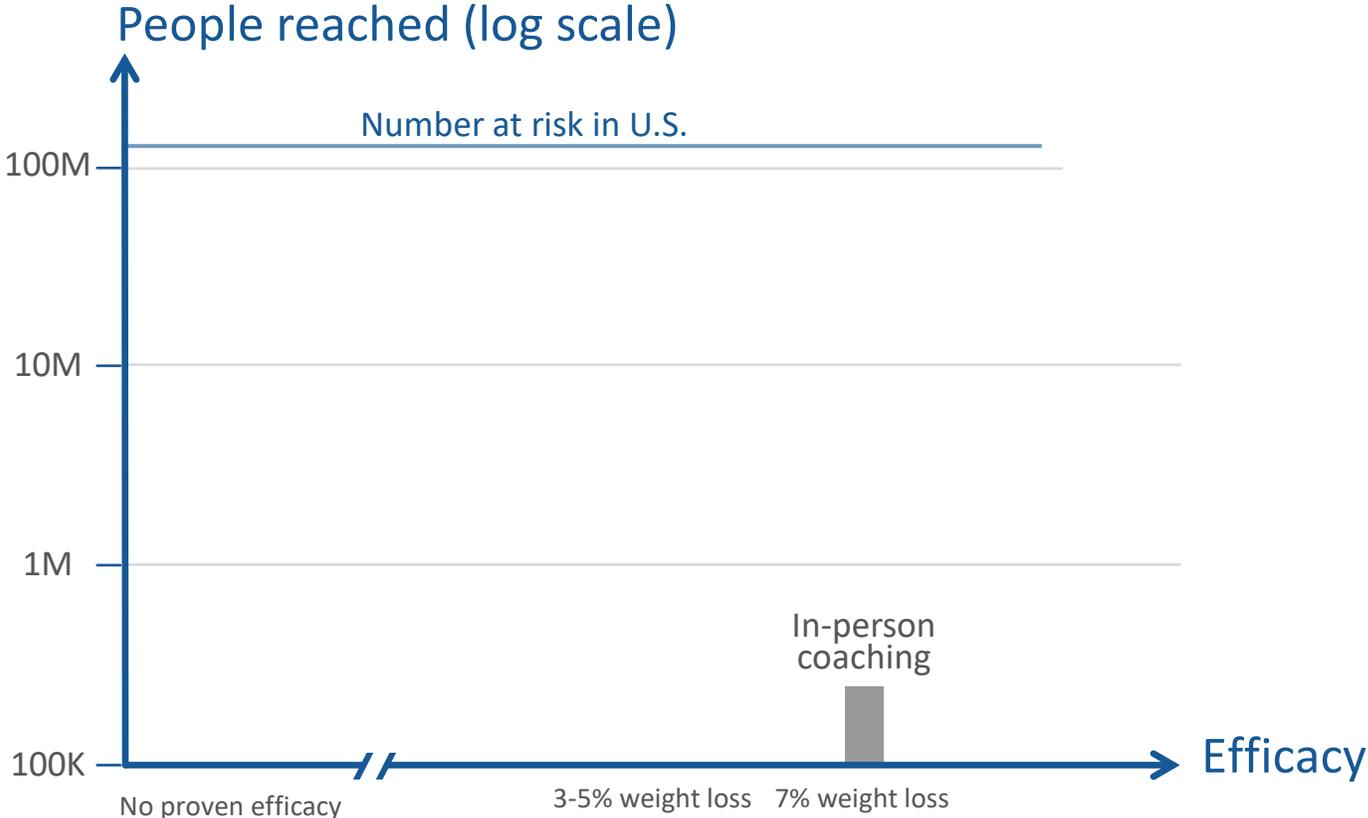
- In-person individual and group coaching at a cost of \$5,500/person over 10 years (2020 dollars)

Lifestyle coaching is the most efficacious prevention to date

- 58% reduction in diabetes risk
- 2x better outcomes vs. metformin

Hard to scale

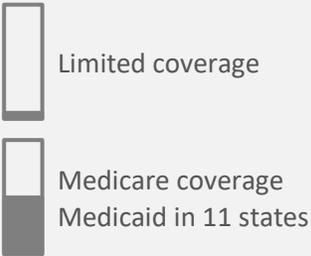
- 2010: CDC introduces national DPP
- 2019: 373,000 out of 100,000,000 enrolled



Fundamental limit:
Labor costs

Private insurance

Medicare & Medicaid



Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002;346(6):393-403. doi:10.1056/NEJMoa012512
 National Diabetes Prevention Program Coverage Toolkit. (29 July 2019). States Where the National DPP is a Medicaid Covered Benefit 2019. Retrieved from: <https://coveragetoolkit.org/medicaid-agencies/medicaid-coverage-2/>
 Shea, Pat. (2019, June 27). "Scaling and Sustaining the National Diabetes Prevention Program" [Webinar]. National Association of Chronic Disease Directors. https://coveragetoolkit.org/wp-content/uploads/2019/07/6.27.19-Case-for-Coverage-webinar-slides_FINAL-v2.pdf
 The 10-Year Cost-Effectiveness of Lifestyle Intervention or Metformin for Diabetes Prevention. The Diabetes Prevention Program Research Group. Diabetes Care Apr 2012, 35 (4) 723-730; DOI: 10.2337/dc11-1468



Virtual DPP (vDPP)

Less coaching, remote labor

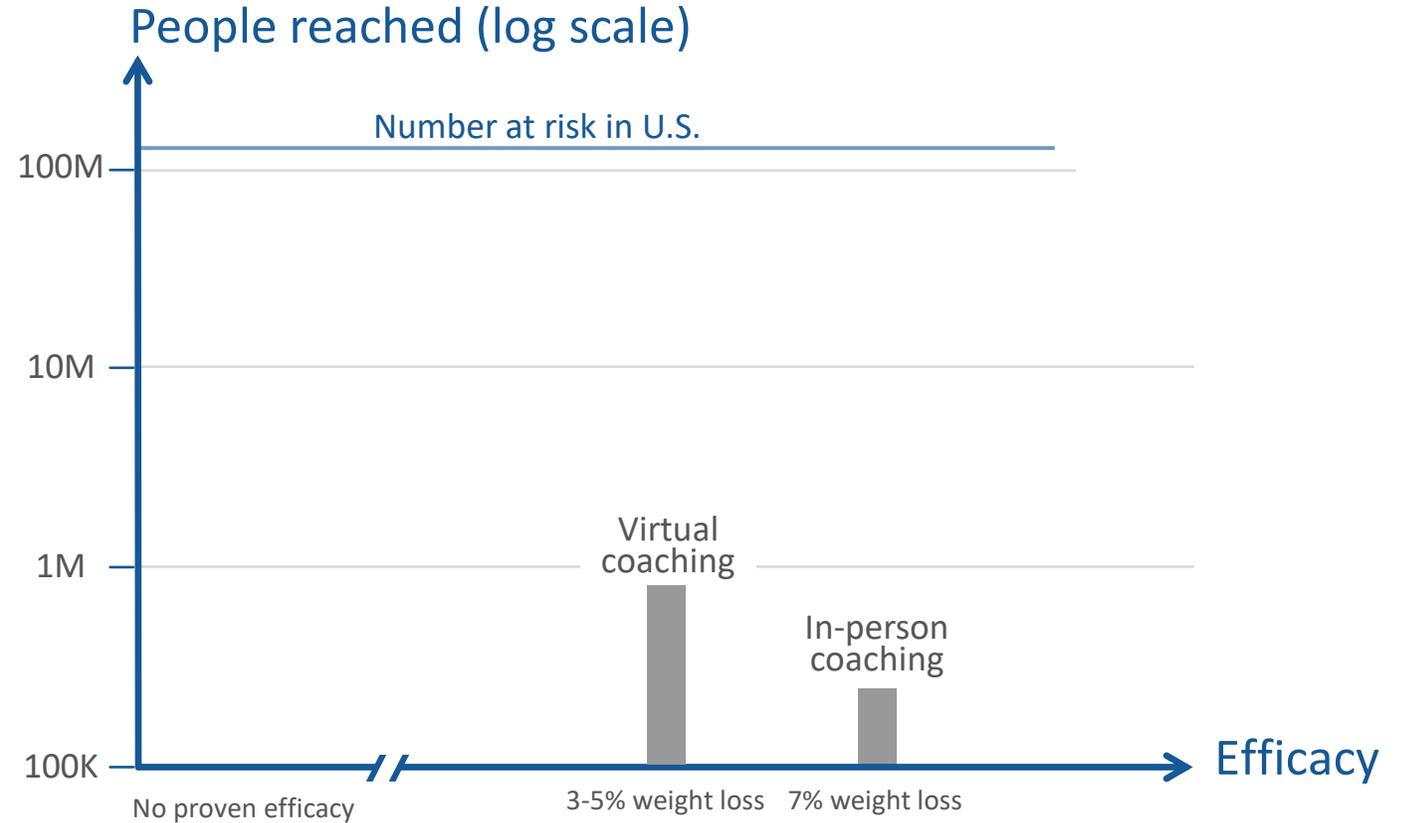
- Individual and group coaching by video, online courses, customer support

Somewhat better reach via lower cost

- Two biggest players report 817,000 users combined

Lower efficacy

- 50% less weight loss after 3 years vs. DPP
- Adherence rates less than 50% of DPP
- Few RCTs; no data on long-term efficacy



Fundamental limit:

Lower labor costs reduce efficacy

Private insurance

Some coverage

Medicare & Medicaid

No coverage



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Health apps and wearables

Apps and wearables

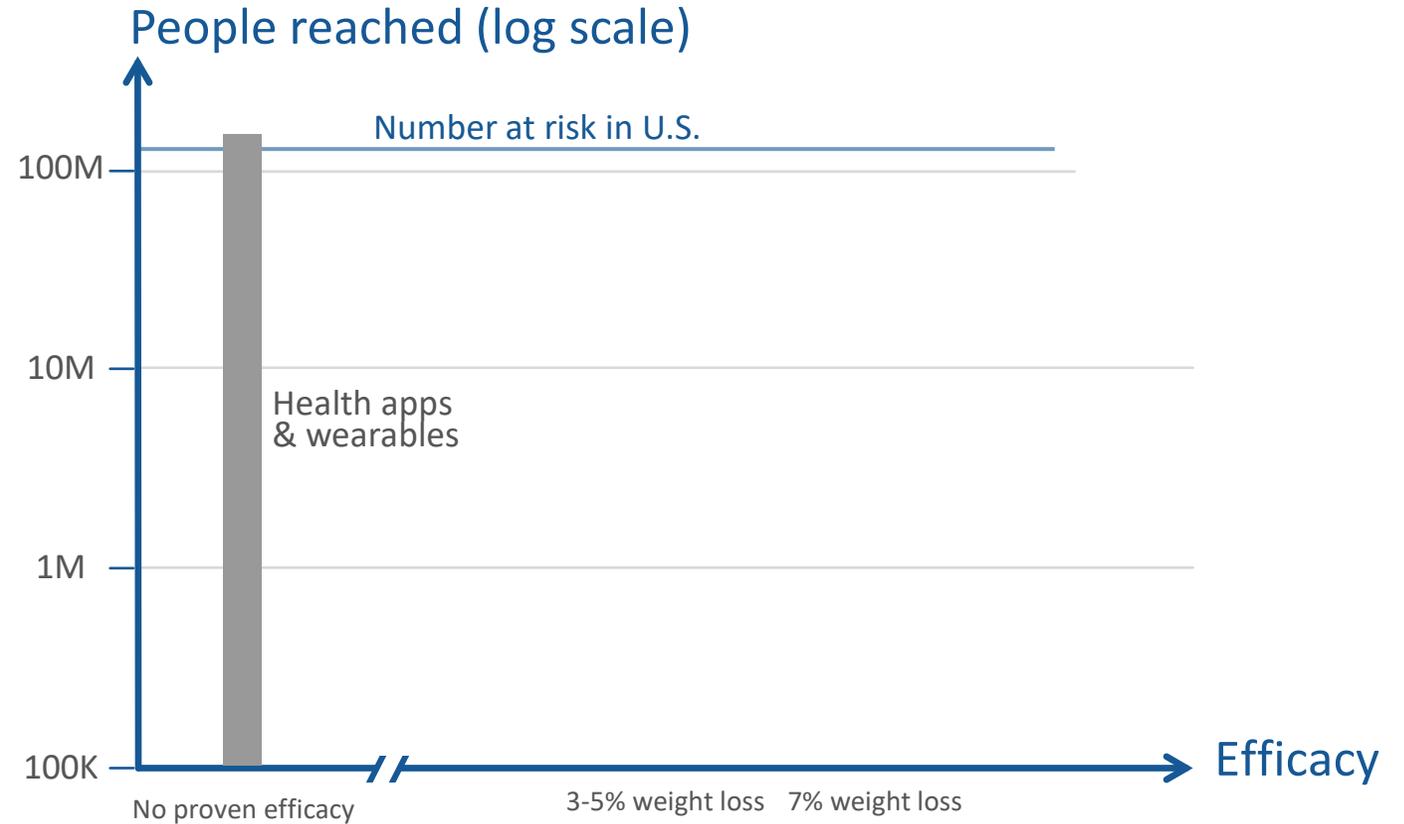
- Sensors for activity tracking
- Reminders, activity & food diaries
- Social networking

Unprecedented reach

- No labor -> inexpensive
- 318,000 apps available
- Up to 150M downloads

No proven efficacy

- Very few RCTs; no long-term studies
- Wearables + DPP-like counseling 40% worse than counseling alone



Fundamental limit:

**Without personalized coaching,
inadequate for disease prevention**

Private insurance

Limited coverage

Medicare & Medicaid

No coverage

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