Leveraging loss aversion and present bias to improve incentives for smoking cessation

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• I also receive research support from the Greenwall and Donaghue Foundations, and Haas Family Charitable Trust

• I have never received any support from any industry of any kind, including the tobacco industry
878 General Electric employees, assigned to usual care (access to cessation counseling) or usual care + incentives worth $750

Randomized Trial of Four Financial-Incentive Programs for Smoking Cessation

Scott D. Halpern, M.D., Ph.D., Benjamin French, Ph.D., Dylan S. Small, Ph.D., Kathryn Saulsgiver, Ph.D., Michael O. Harhay, M.P.H., Janet Audrain-McGovern, Ph.D., George Loewenstein, Ph.D., Troyen A. Brennan, M.D., J.D., David A. Asch, M.D., M.B.A., and Kevin G. Volpp, M.D., Ph.D.

- **Sample:** 2,538 CVS Health employees or friends or family
- **Usual care:** access to information about benefits of cessation & to nicotine replacement therapy (NRT) & behavioral counseling

All programs had expected values of $800

No differences across arms in actual payments

Table S1: Observed incentive payouts to participants in the four incentive arms

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Interquartile Range</th>
<th>Full Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>All participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>achieving abstinence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for 6 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual Reward</td>
<td>76</td>
<td>$800</td>
<td>$800</td>
<td>$800-800</td>
<td>$0-800</td>
</tr>
<tr>
<td>Collaborative Reward</td>
<td>83</td>
<td>$890.36</td>
<td>$800</td>
<td>$700-1100</td>
<td>$0-1,700</td>
</tr>
<tr>
<td>Individual Deposit</td>
<td>56</td>
<td>$557.14</td>
<td>$800</td>
<td>$0-800</td>
<td>$0-800</td>
</tr>
<tr>
<td>Competitive Deposit</td>
<td>52</td>
<td>$839.62</td>
<td>$900</td>
<td>$630-1100</td>
<td>$0-1,940</td>
</tr>
</tbody>
</table>

Sustained abstinence rates (ITT)

Rewards (15.7%) vs. Deposits (10.2%)
\[ p < 0.001 \]

Group (13.7%) vs. Individual (12.1%)
\[ p = 0.29 \]

Complier average treatment effect analysis shows that among people who would have accepted deposits, deposits were more efficacious than rewards (29% vs. 16%)

A Pragmatic Trial of E-Cigarettes, Incentives, and Drugs for Smoking Cessation

Scott D. Halpern, M.D., Ph.D., Michael O. Harhay, Ph.D., Kathryn Saulsgiver, Ph.D., Christine Brophy, Andrea B. Troxel, Sc.D., and Kevin G. Volpp, M.D., Ph.D.
Incentives programs each worth $600

All smokers at 54 U.S. companies who identified as smokers on health-risk assessment in prior year

Halpern SD, et al. NEJM 2018
6,131 Vitality members across 54 companies with opt-out enrollment

1. Basic Vitality program
Employee benefits plus tailored email messaging

2. E-cigarette Arm
Basic Vitality program AND free e-cigarettes

3. Choice Cessation Aids Arm
Basic Vitality program AND choice of free NRT, varenicline, bupropion; e-cig option if fail

4. Reward Incentive Arm
Basic Vitality program, choice of any free aid, AND $600 incentives for confirmed tobacco cessation

5. Virtual Deposit Arm
Basic Vitality program, choice of any free aid, AND pre-funded deposit contract of $600 (loss framing of same incentive)

Opted out = 125
Never engaged = 4,815
Engaged = 1,191
8 contrasts specified *a priori*, with significance thresholds adjusted using Holm method

Statistically significant

Not statistically significant

Figure 2. Sustained Smoking Abstinence at 6 Months after the Target Quit Date.

Halpern SD, et al. NEJM 2018
Answers to our questions

1. How successful are workplace smoking-cessation programs among all people to whom they are offered?  
   Not very, but cost-effective

2. How effective are incentives when added to free nicotine-replacement therapy and pharmacotherapy (bupropion or varenicline)?  
   Still triple quit rates

3. How effective are free e-cigarettes or free cessation aids when added to smoking cessation information without assistance on how to use?  
   Not effective

4. Do deposit contracts that are funded in advance without participant contributions, but from which money is removed if abstinence milestones are not met, achieve higher quit rates than reward incentives?  
   No

Halpern SD, et al. NEJM 2018
Discussion
Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening

The National Lung Screening Trial Research Team®
Smoking cessation & lung cancer screening

1. USPSTF defines high risk as: 55-80 years old; 30+ pack-year history; active smoker or quit within past 15 years (2020 changes: 50-80 years, and 20+ pack-years)

2. Several studies estimate that 50% of patients meeting these criteria are actively smoking, and that there are ~ 5 million eligible active smokers in U.S.*

3. CMS began reimbursement for LDCT February 5, 2015

4. Requirements: (a) shared decision-making visit; (b) smoking cessation counseling

5. Lung cancer screening sites report: lack of patient interest; lack of staff training or time; complexities of reimbursement for smoking cessation services; lack of knowledge of what works best, let alone what is most cost-effective in this setting
Smoking cessation and SCALE collaboration

1. Patients who quit during LCS estimated to derive a 4-year increase in life expectancy

2. SCALE: NCI and VA fund 8 RCTs of smoking cessation interventions within LCS

3. Characteristics of 8 trials:
   a. Six have 7 sites or fewer (max 26)
   b. Sample sizes range from 500-1,650
   c. All use traditional informed consent
   d. Anticipated enrollment of 19% or fewer Black patients in 7 trials (37% in 1)
   e. All test ask-advise-refer, behavioral counseling, and/or pharmacologic interventions

4. In light of evidence for above interventions, diverse stakeholder panel recommends testing “mobile health applications” and “financial incentives”
Eligible Population

Current smokers
- Current smokers

Order for LDCT scan
- Ages ≥ 18 years

Underserved
- Black, or
- Hispanic, or
- Rural residence, or
- Low SES (no greater than HS education or 2x fed poverty)

In 4 Health Systems
- Penn Medicine
- Kaiser Permanente
- Henry Ford Health System
- Geisinger
4-arm Pragmatic Trial

1. Ask-advise-refer

2. and free medications

3. and money to quit

4. and episodic future thinking (EFT) tool
Discussion
The "comparison between two treatments" is a problem which is inadequately specified even in its over-all characteristics. It may imply one of at least two types of problem which are basically different.

The first type corresponds to an explanatory approach, aimed at understanding. It seeks to discover whether a difference exists between two treatments which are specified by strict and usually simple definitions. Their effects are assessed by bio-

The second type corresponds to a pragmatic approach, aimed at decision. It seeks to answer the question—which of the two treatments should we prefer? The definition of the treatments is flexible and usually complex; it takes account of auxiliary
Combining the ‘forward thinking’ of lung cancer screening programs and episodic future thinking to supercharge incentives in underserved populations

Figure 1: Conceptual model of barriers to smoking cessation that will be addressed by interventions in this RCT
<table>
<thead>
<tr>
<th>Domain</th>
<th>Relevant trial features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligibility</td>
<td>All underserved smokers getting lung-cancer screening</td>
</tr>
<tr>
<td>Recruitment</td>
<td>Built into routine workflow; use of opt-out consent</td>
</tr>
<tr>
<td>Setting</td>
<td>More than 30 screening centers within 4 large health systems</td>
</tr>
<tr>
<td>Organization</td>
<td>No clinician training required, minimal onsite research staff</td>
</tr>
<tr>
<td>Flexibility of delivery</td>
<td>Interventions delivered in ways compatible with usual care</td>
</tr>
<tr>
<td>Flexibility of adherence</td>
<td>Automated prompting of clinical staff to distribute iPads to promote enrollment and access to interventions</td>
</tr>
<tr>
<td>Follow-up</td>
<td>Outcomes data collected through automated, web-based research portal, including uploading of laboratory test results</td>
</tr>
<tr>
<td>Primary outcome</td>
<td>Most widely used outcome, of importance to all stakeholders</td>
</tr>
<tr>
<td>Primary analysis</td>
<td>Data available for all participants, intention-to-treat analyses</td>
</tr>
</tbody>
</table>

*Criteria from Loudon et al. The PRECIS-2 tool: designing trials that are fit for purpose. BMJ 2015*
Target sample size: 3,200 underserved smokers undergoing lung cancer screening
Patient Enrollment via iPad

Congratulations!

We are excited to connect you with the **Healthy Lungs Program**.

This program is being offered by The University of Pennsylvania to help people quit smoking if they choose.

You will be paid for participating in activities that you choose to complete, such as surveys. Before getting started, you’ll review information about the Healthy Lungs Program.

**Next, you will be asked to:**
Steep temporal discounting reduces incentive effectiveness
Delay discounting partially mediates relation between EFT and smoking

Without mediator

With mediator

* indicates statistical significance.
### Proposed precision variables and effect modifiers

#### Precision variables

- **Age**
- **Education**
- **Gender**
- **Race**
- **Ethnicity**
- **Income** (as a % of poverty line)
- **Rurality**

#### Test for effect modification

- **Temporal discounting score**
- **Nicotine dependence score**
- **Number of prior lung cancer screenings**
- **Results of lung cancer screening**
- **Use of smartphone with mobile data cancer screening**
- **Financial well-being score**
- **Insurance type**
- **Presence of chronic smoking-related illness**
- **Presence of mental health diagnosis**
- **Lung cancer risk (Tammemagi score)**