Leveraging Automaticity for Healthy Behavior Change

January 16, 2019 Aurora CO
ACCORDS, Children’s Hospital Colorado

Gretchen Chapman, PhD
Carnegie Mellon University
Can we harness behavioral science to encourage healthy behavior?

get a flu shot
Rational vs. Behavioral Approaches to behavior change

Rational
• Beliefs & information
• Incentives
• Regulation

Behavioral
• Information format
• Social context
• Automation
Increasing Vaccination: Putting Psychological Science Into Action

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Increasing Vaccination: Putting Psychological Science Into Action

- Beliefs & Emotions
- Social Factors
- Intervening directly on behavior

Vaccination

- Weak
- Strong
Intervening on behavior directly

Intention (or Hesitancy) → Vaccination (or Refusal, Delay)

Build on Favorable Intentions
- Keep Vaccination on People’s Minds With Reminders, Prompts, Primes
- Reduce Barriers With Logistics or Behavioral Defaults

Shape Behavior
- Provide Incentives
- Implement Sanctions
- Require Vaccination
Most effective interventions to boost vaccination (Brewer et al., 2017)

- Provider recommendation
- Presumptive recommendation
- On-site vaccinations
- Default vaccination appointments
- Incentives
- Vaccination requirements
Should Governments Invest More in Nudging?

Shlomo Benartzi¹, John Beshears², Katherine L. Milkman³, Cass R. Sunstein⁴, Richard H. Thaler⁵, Maya Shankar⁶, Will Tucker-Ray⁷, William J. Congdon⁷, and Steven Galing⁸

Influenza Vaccinations (Increase in Adults Vaccinated per $100 Spent)

- Planning-Prompt Nudge (Milkman et al., 2011): 12.8
- Default-Appointment Nudge (Chapman et al., 2010): 3.65
- Monetary Incentive (Bronchetti et al., 2015): 1.78
- Educational Campaign (Kimura et al., 2007): 8.85
- Free Work-Site Vaccinations (Kimura et al., 2007): 1.07

Benartzi et al, 2017
Rational vs. Behavioral Approaches to behavior change

**Rational**
- Beliefs & information
- Individual outcomes
- Regulation

**Behavioral**
- Information format
- Social context
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Information Format

- It’s not what you say; it’s how you say it
Prostate Cancer Early Detection

by PSA screening and digital-rectal examination.
Numbers are for men aged 50 years or older, not participating vs. participating in screening for 10 years.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>1,000 men without screening</th>
<th>1,000 men with screening</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many men died from prostate cancer?</td>
<td>8*</td>
<td>8</td>
</tr>
<tr>
<td>How many men died from any cause?</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Harms</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>How many men were diagnosed and treated** for prostate cancer unnecessarily?</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>How many men without cancer got a false alarm and a biopsy?</td>
<td></td>
<td>180</td>
</tr>
</tbody>
</table>

* This means that about 8 out of 1,000 men (50+ years of age) without screening died from prostate cancer within 10 years.
** With prostate removal or radiation therapy, which can lead to incontinence or impotence.
Prostate Cancer Early Detection

by PSA screening and digital-rectal examination.
Numbers are for men aged 50 years or older, not participating vs. participating in screening for 10 years.

1,000 men without screening:

- Men dying from prostate cancer: 8
- Men dying from any cause: 200
- Men that were diagnosed and treated for prostate cancer unnecessarily: –
- Men without cancer that got a false alarm and a biopsy: –
- Men that are unharmed and alive: 800

1,000 men with screening:

- Men dying from prostate cancer: 8
- Men dying from any cause: 200
- Men that were diagnosed and treated for prostate cancer unnecessarily: 20
- Men without cancer that got a false alarm and a biopsy: 180
- Men that are unharmed and alive: 600
Framing Effects & the HPV Vaccine

- Gardasil (c 2006) protects against the two strains of HPV that cause 70% of cervical cancers
Framing Effects & the HPV Vaccine

Condition 1
• Imagine there is a vaccine available; it’s very safe, and 100% effective in preventing virus infections that cause 70% of known cases of a specific type of cancer. In people who aren’t vaccinated, about 4% get this type of cancer. How likely would you be to get vaccinated?

Condition 2
• Imagine there is a vaccine available; it’s very safe, and 70% effective in preventing virus infections that cause all the known cases of a specific type of cancer. In people who aren’t vaccinated, about 4% get this type of cancer. How likely would you get vaccinated?

Li & Chapman (2009, *PBR*)
Dietary Guidelines

**MyPyramid**

Steps to a Healthier You

**MyPyramid.gov**

**GRAINS**
- Make half your grains whole
- Eat at least 3 oz. of whole-grain cereals, breads, crackers, rice, or pasta every day.
- 1 oz. is about 1 slice of bread, about 1 cup of breakfast cereal, or 1/2 cup of cooked rice, cereal, or pasta.

**VEGETABLES**
- Vary your veggies
- Eat more dark-green veggies like broccoli, spinach, and other dark leafy greens.
- Eat more orange vegetables like carrots and sweet potatoes.
- Eat more dry beans and peas like pinto beans, kidney beans, and lentils.

**FRUITS**
- Focus or fruits
- Eat a variety of fruit.
- Choose fresh, frozen, canned, or dried fruit.
- Go easy on fruit juices.

**MILK**
- Get your calcium-rich foods
- Go low-fat or fat-free when you choose milk, yogurt, and other milk products.
- If you don’t or can’t consume milk, choose lactose-free products or other calcium sources such as fortified foods and beverages.

**MEAT & BEANS**
- Go lean with protein
- Choose low-fat or lean meats and poultry.
- Bake it, broil it, or grill it.
- Vary your protein routine - choose more fish, beans, peas, nuts, and seeds.

**Dairy**

**Fruits**

**Grains**

**Vegetables**

**Protein**
Hoagie Night

9,765 hoagie orders over 8 weekly hoagie nights

Policastro, Smith, & Chapman, 2015
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Social Norms

- Help the hotel save energy 16%
- Partner with us to help the environment 31%
- Almost 75% of guests reuse towels 44%
- 75% of the guests who stayed in this room reuse towels 49%

Goldstein, Cialdini, & Griskevicius (2008) *JCR*
Schultz, Wesley, Nolan, Cialdini, Goldstein, & Griskevicius (2007) *Psych Sci*
Social Comparison & Electricity Use

EFFICIENT NEIGHBORS
YOU
ALL NEIGHBORS

HOME ENERGY USE
GREAT 😊😊
GOOD 😊
MORE THAN AVERAGE

OPower
Social Norms

Figure 2: Rate of antibiotic items dispensed per 1000 weighted population for the feedback intervention, September, 2014, to April, 2015. Error bars represent 95% CIs.

Provision of social norm feedback to high prescribers of antibiotics in general practice: a pragmatic national randomised controlled trial

Michael Hallsworth, Tim Chadborn, Anna Sallis, Michael Sanders, Daniel Berry, Felix Greaves, Lara Clements, Sally C Davies

Opioid prescribing decreases after learning of a patient’s fatal overdose

Jason N. Doctor\textsuperscript{1*}, Andy Nguyen\textsuperscript{1}, Roneet Lev\textsuperscript{2}, Jonathan Lucas\textsuperscript{3}, Tara Knight\textsuperscript{1}, Henu Zhao\textsuperscript{1}, Michael Menchine\textsuperscript{4}

Table 3. Adjusted daily average milligram morphine equivalents (MMEs) dispensed per prescriber among persons randomized to the intervention or control groups. Values in parentheses are 95% CIs with 5% trimmed means.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Randomization group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Letter</td>
</tr>
<tr>
<td>Prescribers followed</td>
<td>388</td>
</tr>
<tr>
<td>Preintervention</td>
<td>72.5</td>
</tr>
<tr>
<td></td>
<td>(71.3 to 73.7)</td>
</tr>
<tr>
<td>Postintervention</td>
<td>65.7</td>
</tr>
<tr>
<td></td>
<td>(63.8 to 67.5)</td>
</tr>
<tr>
<td>Increment (pre- to post-)</td>
<td>-6.8</td>
</tr>
<tr>
<td></td>
<td>(-9.9 to -3.8)</td>
</tr>
<tr>
<td>Difference in increment</td>
<td>-6.9</td>
</tr>
<tr>
<td></td>
<td>(-13.1 to -1.0)</td>
</tr>
<tr>
<td>P value</td>
<td></td>
</tr>
</tbody>
</table>
Implied Norms

Reicks et al., 2012; Melnick & Li, 2018
Social Comparisons

Pedometers
• Encourage walking
• Track progress
• Provide feedback

Research Question
• Is feedback more motivating when it is compared to a reference point?

Chapman, Colby, Convery, & Coups (2015)
Funded by the Robert Wood Johnson Foundation
Social Comparison

1 week of baseline with sealed pedometer

Random assignment to condition

Control

Social Comparison

2 weeks of active phase with open pedometer
<table>
<thead>
<tr>
<th></th>
<th>Example</th>
<th>Day One</th>
<th>Day Two</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date:</strong></td>
<td>5/15/13 <em>Wed.</em></td>
<td>Tuesday 6/11/13</td>
<td>Wednesday 6/12/13</td>
</tr>
<tr>
<td>Time On Pedometer</td>
<td>X:XX</td>
<td>7:00 AM (Edit time)</td>
<td>6:15 AM (Edit time)</td>
</tr>
<tr>
<td>Time Off Pedometer</td>
<td>X:XX</td>
<td>10:00 PM (Edit time)</td>
<td>7:30 PM (Edit time)</td>
</tr>
<tr>
<td>Pedometer reading at end of day</td>
<td>X,XXX</td>
<td>8945 (Edit steps)</td>
<td>15872 (Edit steps)</td>
</tr>
<tr>
<td><strong>Rank</strong></td>
<td><em>You did better than 70% of other people.</em></td>
<td><em>You did worse than 79% of other people.</em></td>
<td><em>You did better than 87% of other people.</em></td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td><em>Walked more during break &amp; lunch</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Result of the study:

**Experimental Condition**

- **Control (n=31)**
  - Baseline Period: 6556 steps per day
  - Intervention Period: 7388 steps per day

- **Social Comparison (n=33)**
  - Baseline Period: 7354 steps per day
  - Intervention Period: 8508 steps per day
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Automation

Intervening on behavior directly
## Reminders & Recalls

Automating the action prompt

<table>
<thead>
<tr>
<th>HPV vaccination</th>
<th>Intervention, Enrolled, n = 374, %</th>
<th>Control, n = 555, %</th>
<th>Adjusted Relative Risk (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received dose 2</td>
<td>83</td>
<td>71</td>
<td>1.14 (1.07–1.22)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Received dose 3</td>
<td>63</td>
<td>38</td>
<td>1.59 (1.39–1.83)</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

Effectiveness of Collaborative Centralized (CC) vs Practice-Based (PB) Reminder/Recall Approaches

A, Percentage of children receiving any vaccination (absolute percentage point difference, 5%). B, Percentage of children achieving up-to-date (UTD) status with vaccinations (absolute percentage point difference, 4%). Data are unadjusted.

aP < .001 compared with the CC reminder/recall approach.

bP = .001 compared with the CC reminder/recall approach.
Effective organ donation consent rates, by country. Explicit consent (opt-in, gold) and presumed consent (opt-out, blue). Johnson & Goldstein (2003)
Generic Medication Prescriptions by Default

Patel et al., 2016, JAMA
Opioid Prescriptions by Default

- Before: default number of opioid pills auto-populated in the EMR = 30
  - Median number of pills prescribed: 20
- After: default number of opioid pills auto-populated in the EMR = 12
  - Median number of pills prescribed: 12

Flu Shot Default Appointments

• Opt-in condition
  • Letter stating that flu shots were available
  • Call to make an appointment

• Opt-out condition
  • Letter with pre-scheduled appointment
  • Call to change or cancel appointment

• No letter control
Defaults Affect Vaccination

<table>
<thead>
<tr>
<th>Condition</th>
<th>Opt-out (n=295)</th>
<th>Opt-in (n=296)</th>
<th>No Letter (n=295)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>164 (56%)</td>
<td>15 (5%)</td>
<td>7 (2%)</td>
</tr>
<tr>
<td></td>
<td>47 (16%)</td>
<td>15 (5%)</td>
<td>7 (2%)</td>
</tr>
<tr>
<td></td>
<td>33 (11%)</td>
<td>37 (12%)</td>
<td>44 (15%)</td>
</tr>
<tr>
<td>OR</td>
<td>34.81</td>
<td>1.93</td>
<td>0.79</td>
</tr>
<tr>
<td>95% CI</td>
<td>[20.91, 57.97]</td>
<td>[1.14, 5.47]</td>
<td>[0.52, 1.22]</td>
</tr>
<tr>
<td>p-value</td>
<td>0.0001</td>
<td>0.001</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Chapman, Li, Leventhal, & Leventhal (2016), funded by NIH 1R01AG037943-01

71% no show rate
Vaccination Rate Based on Clinic Record

- Vaccination at Flu Clinic
- Vaccination at Doctor's Office Visit

Opt-out: 25%
Opt-in: 15%
No Letter: 10%
### Implementation Intentions

**Table:**

<table>
<thead>
<tr>
<th>Control Condition</th>
<th>Date Plan Condition</th>
<th>Time Plan Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>[Company Name] IS HOLDING A FREE FLU SHOT CLINIC.</strong></td>
<td><strong>[Company Name] IS HOLDING A FREE FLU SHOT CLINIC.</strong></td>
<td><strong>[Company Name] IS HOLDING A FREE FLU SHOT CLINIC.</strong></td>
</tr>
<tr>
<td>Flu shots will be available on site at the [location of relevant free flu shot clinic] at the following times:</td>
<td>Flu shots will be available on site at the [location of relevant free flu shot clinic] at the following times:</td>
<td>Flu shots will be available on site at the [location of relevant free flu shot clinic] at the following times:</td>
</tr>
<tr>
<td>Monday, October 26th</td>
<td>Monday, October 26th</td>
<td>Monday, October 26th</td>
</tr>
<tr>
<td>Wednesday, October 28th</td>
<td>Wednesday, October 28th</td>
<td>Wednesday, October 28th</td>
</tr>
<tr>
<td>Friday, October 30th</td>
<td>Friday, October 30th</td>
<td>Friday, October 30th</td>
</tr>
<tr>
<td>Tuesday, November 3rd</td>
<td>Tuesday, November 3rd</td>
<td>Tuesday, November 3rd</td>
</tr>
<tr>
<td>Thursday, November 5th</td>
<td>Thursday, November 5th</td>
<td>Thursday, November 5th</td>
</tr>
<tr>
<td>7:00 am – 3:30 pm</td>
<td>7:00 am – 3:30 pm</td>
<td>7:00 am – 3:30 pm</td>
</tr>
</tbody>
</table>

Many people find it helpful to **make a plan** for getting their shot. You can write yours here:

- (day of the week)
- (month)
- (day)
- (time)

Flu shots will be available on site at the [location of relevant free flu shot clinic] at the following times:

| Monday, October 26th | Monday, October 26th | Monday, October 26th |
| Wednesday, October 28th | Wednesday, October 28th | Wednesday, October 28th |
| Friday, October 30th | Friday, October 30th | Friday, October 30th |
| Tuesday, November 3rd | Tuesday, November 3rd | Tuesday, November 3rd |
| Thursday, November 5th | Thursday, November 5th | Thursday, November 5th |
| 7:00 am – 3:30 pm | 7:00 am – 3:30 pm | 7:00 am – 3:30 pm |

Milkman, Beshears, Choi, Laibson, & Madrian, 2011, PNAS
Fig. 2. Vaccination rates by experimental condition and flu shot clinic length.
Presumptive Recommendation

I see you are due for a vaccination. We’ll give that at the end of the visit.

We recommend this vaccination. Would you like to have it?

<table>
<thead>
<tr>
<th></th>
<th>≥1 dose at 3 Mo (%)</th>
<th>Coverage at 3 Mo (%)</th>
<th>Coverage Change Over Previous 3 Mo (%)</th>
<th>Difference From Control (%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>37.3</td>
<td>6.4</td>
<td></td>
<td>Reference</td>
</tr>
<tr>
<td>Announcement</td>
<td>38.0</td>
<td>11.5</td>
<td>5.1 (2.0 to 8.2)</td>
<td></td>
</tr>
<tr>
<td>Conversation</td>
<td>30.3</td>
<td>8.4</td>
<td>2.0 (−0.4 to 4.4)</td>
<td></td>
</tr>
</tbody>
</table>

Announcement and conversation training content.

**Announcement Training**

1. Announce child is due for 3 vaccines
2. If needed
   - Ease main concern about HPV vaccine
3. If needed
   - Recommend HPV vaccine strongly
4. Ask them to return in 2 months
5. Provide HPV vaccine

**Conversation Training**

1. Start the conversation about 3 adolescent vaccines
2. Ease main concern about HPV vaccine
3. Recommend HPV vaccine strongly
4. If needed
   - Ask them to return in 2 months
5. Provide HPV vaccine

Noel T. Brewer et al. Pediatrics 2017;139:e20161764
Conclusions

1. Information format as important as information content
2. Social comparison and social norms affect behavior
3. Automating behavior
   • Reminders & prompts
   • Defaults
   • Implementation Intentions
   • Recommendations
Thank You

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https://www.cmu.edu/dietrich/sds/chapmanlab/