A RANDOMIZED CONTROLLED TRIAL TO MOTIVATE AND SUSTAIN PHYSICAL ACTIVITY AMONG TAXI DRIVERS USING FINANCIAL INCENTIVES – TAKSI STUDY

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Outline

- Background
- Study design
- Testable hypotheses
- Preliminary Results
- Discussion
There are above 28,000 registered taxis in Singapore.

Taxi drivers are an especially sedentary group due to their long shifts and working conditions.

Taxi drivers are also unlikely to engage in structured physical activity programs due to their unusual shifts.

Lack of physical activity puts taxi drivers at risk to a wide range of Non-Communicable Diseases (e.g. Pate et al., 1995)
Financial incentives to promote physical activity

- Neo-classical economics predicts that financial incentives can motivate drivers to increase their physical activity.
  - Cash incentives would work best as cash is assumed to be fully fungible.

- Research in behavioral economics showed that individuals partition their budget according to expense types, which is a form of mental accounting (Thaler, 1980).
  - Individuals prefer avoiding losses to acquiring gains (Kahneman and Tversky, 1984).

Our approach is to incentivize drivers with taxi rental credits to capitalize on both mental accounting and loss aversion.
Study design

- The TAKSI study measures the effect of Cash and Taxi Rental incentives on physical activity and health among taxi drivers aged 50 to 75.
- 316 eligible taxi drivers were randomized into one of two equisized parallel study arms:
  - **Arm 1**: Drivers receive *Cash incentives* if they achieve activity goals.
  - **Arm 2**: Drivers receive *Taxi Rental credits* if they achieve activity goals.
- The only difference between the two arms is how the reward is *framed*.
  - *the incentive amounts are the same in both groups.*
- In both arms, the incentive is reinforced by means of study messaging and monthly reports on physical activity and target attainment.
Study design, goals and timeline

<table>
<thead>
<tr>
<th></th>
<th>Baseline (Month 0)</th>
<th>Intervention period (Months 1 to 4)</th>
<th>Post-intervention period (Months 5 to 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timeline</strong></td>
<td>21 days</td>
<td>28 days (per month)</td>
<td>28 days (per month)</td>
</tr>
<tr>
<td><strong>Step target</strong></td>
<td>None</td>
<td>At least 7,000 steps in 20 or more days (per month)</td>
<td>None</td>
</tr>
<tr>
<td><strong>Financial Incentive</strong></td>
<td>None</td>
<td>One day Taxi rental credit (per month)</td>
<td>None</td>
</tr>
</tbody>
</table>

- The program takes 8 months to complete, including baseline, intervention and post-intervention period
- In the intervention period, drivers can earn incentives by meeting specified step targets – 7,000 or more steps daily in at least 20 out of 28 days in a month
  - Incentives are removed after Month 4
- All participants receive a Fitbit Zip™ wireless pedometer to monitor daily step activity
- Assessments are done at Months 0, 4 and 7 to collect info on biometrics and self-reported health status

- Daily steps activity
- Daily driving data – mileage, earnings and log-on hours
- Biometrics – height, weight, resting heart rate and blood pressure (at Months 0, 4 and 7)
- Self-reported health and work productivity (at Months 0, 4 and 7)
Testable Hypotheses

- Financial incentives increase physical activity and improve health outcomes
  
  H1: Drivers in both arms will have a higher number of steps at Month 4 compared to baseline

- Rental Credit incentives are more effective than cash incentives
  
  H2: Month 4 Improvements will be greater in the Taxi Rental arm compared to the Cash arm

  Financial incentives will lead to habit formation even when they are withdrawn and this effect will be larger in the Taxi Rental arm

  Same comparisons as above between Month 7 and baseline, that is 3 months after financial incentives have been discontinued
Study participants (baseline)

<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>All (N=316)</th>
<th>Rental arm (N=157)</th>
<th>Cash arm (N=159)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age</td>
<td>58.6 (sd=4.8)</td>
<td>58.2 (sd=4.6)</td>
<td>58.9 (sd=4.9)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.91%</td>
<td>1.92%</td>
<td>1.90%</td>
</tr>
<tr>
<td>Male</td>
<td>98.09%</td>
<td>98.08%</td>
<td>98.10%</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td>88.5%</td>
<td>87.8%</td>
<td>89.2%</td>
</tr>
<tr>
<td>Malay</td>
<td>4.5%</td>
<td>5.8%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Indian</td>
<td>6.4%</td>
<td>5.8%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Others</td>
<td>0.6%</td>
<td>0.6%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>93.6%</td>
<td>95.5%</td>
<td>91.8%</td>
</tr>
<tr>
<td>Widowed</td>
<td>0.6%</td>
<td>0.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Divorced</td>
<td>3.5%</td>
<td>2.6%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Never married</td>
<td>2.2%</td>
<td>1.9%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Highest educational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>attainment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary or lower</td>
<td>13.4%</td>
<td>14.1%</td>
<td>12.7%</td>
</tr>
<tr>
<td>Secondary</td>
<td>76.8%</td>
<td>75.6%</td>
<td>77.9%</td>
</tr>
<tr>
<td>Diploma or University</td>
<td>9.9%</td>
<td>10.3%</td>
<td>9.5%</td>
</tr>
</tbody>
</table>

- 157 drivers are assigned to Rental arm while 159 drivers are in the Cash arm
- The drivers are 59 years old on average
- Most of the drivers are Chinese (89%), married (94%), males (98%) with at least secondary education (87%)
Study participants (baseline)

Almost half of the drivers have monthly household income below $2,000.

Majority of the drivers (40%) are inactive or do little activity than usual daily activities.

A large proportion of drivers are overweight (44%) and obese (33%).

28% of the drivers are hypertensive.
Effects on daily step activity – Intervention period at Month 4

- Drivers in both arms increased their daily step activity
  - Rental arm walks more than baseline by 2,283 steps
  - Cash arm walks more than baseline by 1,535 steps

- The increase in daily steps is larger in Rental arm
  - Incremental difference: 2,283 (Rental) – 1,535 (Cash) = 748 steps

Framing of the incentives as rental credit is more effective than cash

**Graph**

- **Bar Chart**
  - Rental arm: Average steps baseline: 6281.74, Average increment: 2283.39
  - Cash arm: Average steps baseline: 6907.69, Average increment: 1535.39

**Table**

<table>
<thead>
<tr>
<th>Average steps (per day)</th>
<th>Baseline (N=316)</th>
<th>Intervention Period (N=316)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental arm</td>
<td>6281.7 (185.7)</td>
<td>8565.1 (180.5)</td>
</tr>
<tr>
<td>Cash arm</td>
<td>6907.7 (238.4)</td>
<td>8443.1 (170.5)</td>
</tr>
<tr>
<td>First diff - Rental arm</td>
<td>2283.4*** (164.3)</td>
<td></td>
</tr>
<tr>
<td>First diff - Cash arm</td>
<td>1535.4*** (152.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Diff-in-diff</strong></td>
<td>748.0*** (223.78)</td>
<td></td>
</tr>
</tbody>
</table>

* p<0.10, ** p<0.05, *** p<0.01

Standard errors in parentheses
Drivers in both arms are walking less without the incentive but are still more active than baseline – *habit formation*
- Rental arm walks more than baseline by 1,994 steps
- Cash arm walks more than baseline by 1,169 steps

The increment is bigger in Rental arm
- Incremental difference:
  1,994 (Rental) –1,169 (Cash) = 825 steps

Financial incentives create habit formation and the effect is stronger by framing it as rental credit

<table>
<thead>
<tr>
<th>Average steps (per day)</th>
<th>Baseline (N=316)</th>
<th>Post-intervention Period (N=297)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental arm</td>
<td>6281.74 (185.71)</td>
<td>8276.23 (236.35)</td>
</tr>
<tr>
<td>Cash arm</td>
<td>6907.69 (238.37)</td>
<td>8077.48 (173.30)</td>
</tr>
<tr>
<td>First diff – Rental arm</td>
<td></td>
<td>1994.49*** (223.77)</td>
</tr>
<tr>
<td>First diff – Cash arm</td>
<td></td>
<td>1169.78*** (181.99)</td>
</tr>
<tr>
<td><strong>Diff-in-diff</strong></td>
<td></td>
<td>824.71*** (288.43)</td>
</tr>
</tbody>
</table>

\* p<0.10, \** p<0.05, \*** p<0.01
Standard errors in parentheses

Note: Estimates are still preliminary as data collection is still going. Final data collection is in July.
Rental arm drivers achieve their monthly step target 84% of the time (vs 81% in the cash arm)
At month 4, all drivers report being more active than at baseline:
- Rental arm’s sedentary time is lower than baseline by 2 hours
- Cash arm’s sedentary time is higher than baseline by 0.28 hours

The incremental difference is bigger for the Rental arm drivers by 2.19 hours.
Health effects during the intervention period at Month 4 compared to baseline

At month 4, improvements in health measures (EQ5D, EQ-VAS, weight and blood pressure) are observed in both arms

- Rental arm drivers have higher EQ5D and EQ-VAS index than baseline by 0.03*** and 3.9***
- Cash arm drivers increased EQ5D and EQ-VAS index by 0.014 and 2.5**
- Rental arm drivers also have lower systolic blood pressure than baseline
- Rental and cash arms have reduced weight by 0.86 and 0.34*** kilograms, respectively

*p<0.10, **p<0.05, ***p<0.01
Summary and policy implications

- Financial incentives are found to increase step-based physical activity among older taxi drivers.
- Health improvements in terms of improved systolic blood pressure and quality of life have also been found.
- Framing the incentive as a taxi rental credit provides an additional benefit for free.
- Behavioral economics can improve the cost-effectiveness of public health interventions.
Acknowledgment

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