WEBINAR #3
Impacts of the COVID-19 Pandemic on Person-Trips and Tele-Activities (Part 2)

July 22, 2020 • 11AM EST

José Holguín-Veras
Cara Wang
Mechanics of the Seminar

• The webinar is being recorded, the link to it will be sent out to participants and posted, in a few days at:
  https://cite.rpi.edu/index.php/training-and-outreach/

• Audio options:
  • Use Webex to receive the audio (PRIMARY method)
  • Dial 1-415-655-0001, access code 733 020 237
  • Refer to confirmation email for local number

• Submit questions using the Q&A feature – they will be answered at the end of the webinar
Outline

• Introduction and Preliminary Findings (Cara Wang)
• Discussion of Equity Issues and Concluding Remarks (José Holguín-Veras)
• Questions and Answers
Introduction and Preliminary Findings

Cara Wang
Associate Professor
Civil and Environmental Engineering
Rensselaer Polytechnic Institute
wangx18@rpi.edu
Overview of Webinar Series

- Webinar #1: Impacts of the COVID-19 Pandemic on Purchasing of Critical Supplies, Roots and Measures to Mitigate “Panic Buying”
- Webinar #2: Impacts of the COVID-19 Pandemic on Person-trips and Tele-Activities (Part 1: Mandatory and Discretionary Activities)
- Webinar #3: Impacts of the COVID-19 Pandemic on Person-trips and Tele-Activities (Part 2: Maintenance Activities)

Link to Recordings of Previous Webinars
https://cite.rpi.edu/index.php/training-and-outreach/
Outline

Introduction and Background
- Changes in delivery patterns
- Person-trips and deliveries
- Influence of socioeconomic factors
- Key insights

Preliminary Findings
- Related to person travel patterns
- Related to purchasing patterns: USA and world

Discussion of Equity Issues
- Related to person travel patterns
- Related to purchasing patterns: USA and world

Concluding Remarks
Introduction and Background
Questions to be answered

• How has shopping and service behavior changed?
  • Person trips
  • Deliveries

• What factors influence the behavior change?

• How much of the change will remain?
  • Short term
  • Long term
Preliminary Findings
Survey Process

• Observations collected using Amazon Mechanical Turk

• Two rounds of data collection

• 1163 observations total
  → 938 after cleaning

• Additional waves of data will be collected
## Key Variable Distributions

### Education Level

<table>
<thead>
<tr>
<th>Category</th>
<th>Sample</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than high school</td>
<td>0.5%</td>
<td>12.0%</td>
</tr>
<tr>
<td>High School graduate</td>
<td>34.8%</td>
<td>45.0%</td>
</tr>
<tr>
<td>Associate degree</td>
<td>18.4%</td>
<td>13.0%</td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>34.3%</td>
<td>19.0%</td>
</tr>
<tr>
<td>Master’s or PhD</td>
<td>11.9%</td>
<td>11.0%</td>
</tr>
</tbody>
</table>

### Gender

<table>
<thead>
<tr>
<th>Category</th>
<th>Sample</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>47.2%</td>
<td>50.3%</td>
</tr>
<tr>
<td>Male</td>
<td>52.2%</td>
<td>49.4%</td>
</tr>
</tbody>
</table>

### Income Range

<table>
<thead>
<tr>
<th>Category</th>
<th>Sample</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $14,999</td>
<td>6.1%</td>
<td>10.6%</td>
</tr>
<tr>
<td>$15,000 - $24,999</td>
<td>9.0%</td>
<td>9.0%</td>
</tr>
<tr>
<td>$25,000 - $34,999</td>
<td>12.0%</td>
<td>8.9%</td>
</tr>
<tr>
<td>$35,000 - $49,999</td>
<td>18.7%</td>
<td>12.4%</td>
</tr>
<tr>
<td>$50,000 - $74,999</td>
<td>21.1%</td>
<td>17.4%</td>
</tr>
<tr>
<td>$75,000 - $99,999</td>
<td>13.0%</td>
<td>12.6%</td>
</tr>
<tr>
<td>$100,000 - $149,999</td>
<td>14.1%</td>
<td>15.0%</td>
</tr>
<tr>
<td>$150,000-$199,999</td>
<td>3.5%</td>
<td>6.6%</td>
</tr>
<tr>
<td>$200,000 and above</td>
<td>2.6%</td>
<td>7.6%</td>
</tr>
</tbody>
</table>

### Age Range

<table>
<thead>
<tr>
<th>Category</th>
<th>Sample</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25</td>
<td>6.1%</td>
<td>12.1%</td>
</tr>
<tr>
<td>25~35</td>
<td>28.8%</td>
<td>17.8%</td>
</tr>
<tr>
<td>35~45</td>
<td>25.1%</td>
<td>16.4%</td>
</tr>
<tr>
<td>45~55</td>
<td>14.0%</td>
<td>16.4%</td>
</tr>
<tr>
<td>55~65</td>
<td>16.8%</td>
<td>16.6%</td>
</tr>
<tr>
<td>&gt;=65</td>
<td>9.3%</td>
<td>20.6%</td>
</tr>
</tbody>
</table>

### Weighting-IPF with Population Distributions

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>0.176</td>
</tr>
<tr>
<td>5%</td>
<td>0.213</td>
</tr>
<tr>
<td>10%</td>
<td>0.238</td>
</tr>
<tr>
<td>25%</td>
<td>0.402</td>
</tr>
<tr>
<td>50%</td>
<td>0.557</td>
</tr>
<tr>
<td>75%</td>
<td>1.021</td>
</tr>
<tr>
<td>90%</td>
<td>1.888</td>
</tr>
<tr>
<td>95%</td>
<td>2.796</td>
</tr>
<tr>
<td>99%</td>
<td>5.315</td>
</tr>
</tbody>
</table>
Changes in Delivery Patterns
# Monthly Delivery Frequency by Types of Goods

## Monthly Delivery Frequency

<table>
<thead>
<tr>
<th>Types of Goods</th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groceries (Fresh Direct, Instacart, Blue Apron, etc.)</td>
<td>0.6</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Prepared food</td>
<td>1.9</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Household goods (Paper products, cleaning supplies, etc.)</td>
<td>0.7</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Medical supplies, medications</td>
<td>0.5</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Other packages (clothing, books, electronics, etc.)</td>
<td></td>
<td>3.1</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>3.6</td>
<td>4.1</td>
</tr>
</tbody>
</table>

- **During**: 46.3%
- **After**: 22.0%
Other packages

Changes after pandemic

Changes during pandemic

- Other packages: 15.7%
- Changes during pandemic: 31.1%
Changes after pandemic

Changes during pandemic

Prepared food

Other packages

HH goods
Changes after pandemic

- Large increase during & after
- Low volume
- New behavior for many

Changes during pandemic

- Moderate increase
- Low volume
- New behavior for some

- Small increase
- Large volume
- Impacts of COVID-19 limited
Delivery Service Users

Percentage of Respondents Stating Use of Delivery Service after Pandemic

- Grocery: 29.7%
- Prepared food: 55.1%
- Household goods: 40.9%
- Medical supplies: 31.9%
- Other packages: 83.7%

93% delivery service users in at least one category
Person Trips and Deliveries
Grocery Shopping
Average respondent corresponds to the entire sample, including 29.7% who use grocery delivery service after pandemic, and the rest 70.3% who do not.

- **Monthly Trip Frequency to Grocery Stores and Supermarkets**: During pandemic: significant changes in both grocery shopping trips and grocery deliveries.
  - Before: 6.7
  - During: 3.9
  - After: 6.1
- **Monthly Grocery Delivery Frequency**: After pandemic: grocery shopping trips slightly decrease, grocery deliveries increase.
  - Before: 0.6
  - During: 1.4
  - After: 1.0

  Increase by 0.8

  Increase by 0.4
**Grocery Shopping: Grocery Delivery Service (GDS) Users**

**GDS users:** The average of the 29.7% using grocery delivery service after pandemic

### Monthly Trip Frequency to Grocery Stores and Supermarkets

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>6.4</td>
<td>2.9</td>
<td>5.5</td>
</tr>
<tr>
<td>GDS Users</td>
<td>-3.5</td>
<td>-0.9</td>
<td>+1.5</td>
</tr>
</tbody>
</table>

### Monthly Grocery Delivery Frequency

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>2.0</td>
<td>3.7</td>
<td>3.5</td>
</tr>
<tr>
<td>GDS Users</td>
<td>+1.7</td>
<td>+1.5</td>
<td></td>
</tr>
</tbody>
</table>

- **During pandemic:** significant changes in both grocery shopping trips and grocery deliveries
- **After pandemic:** grocery shopping trips decrease, grocery deliveries increase, slightly lower than during pandemic
Grocery Shopping: Average Respondent vs GDS Users

-0.3

6.7

6.4

-1.0

3.9

2.9

-0.6

6.1

5.5

Grocery Delivery Service (GDS) users

Average respondent: a mixture of 29.7% GDS users and 70.3% non-users

• Compared to average respondent, GDS users’ grocery shopping trip frequency is lower, but overall difference is minimal through all stages of pandemic
Grocery Shopping: Average Respondent vs GDS Users

- Compared to average respondent, GDS users’ grocery shopping trip frequency is lower, but overall difference is minimal through all stages of pandemic.
- GDS users receive significantly more deliveries through all stages of pandemic, especially after pandemic.
Grocery Shopping: Short Term Change vs Long Term Change

- The average respondent represents the current population
  - The stated “after pandemic” behavior compared to their “before pandemic” behavior shows population’s **short-term change** after the pandemic
- GDS users’ behavior provides insights into the future
  - Difference between Average Respondent’ and GDS users’ “after pandemic” behavior suggests the direction of **long-term change**

29.7% will use grocery delivery service after pandemic
Grocery Shopping: Short Term Change vs Long Term Change

- In the short term, grocery shopping trips and grocery deliveries are substitution with -0.6: +0.4
- In the long term, substitution and induction, with -0.6:+2.5
Non-food Retail

Clothing, books, electronics...
Non-Food Retail: Average Respondent

Average respondent corresponds to the entire sample, including 83.7% who use package delivery service (PDS) after pandemic, and the rest 16.3% who do not.

- Retail shopping trips decreased significantly & package deliveries increased during pandemic.
- No change in retail shopping trips, increase in package delivery after pandemic.
Non-Food Retail: Average Respondent vs PDS Users

- Difference between average respondent and PDS users are small
- PDS users make more retail shopping trips and receive more package deliveries
Non-Food Retail: Short Term Change vs Long Term Change

- In the short term, shopping trips to retail stores very stable, small increase package deliveries, with a rate of 0:+0.4
- In the long term, shopping trips to retail stores remain stable, more delivery expected with a rate of +0.2:+0.7
- Complementation & induction, net increase in travel activities in the future
Influence of Socioeconomic Factors: Grocery Shopping as Example
Grocery Shopping: In-store vs Delivery

Individual
- Gender

Household
- Household with vs without children under age 18

Regional
- Density of grocery store and supermarket employment (/sq-mi)
Grocery Shopping by Gender

### Monthly Trip Frequency to Grocery Stores and Supermarkets

- **Male**
  - Before: 6.0
  - During: 7.3
  - After: 6.5

- **Female**
  - Before: 3.8
  - During: 4.0
  - After: 5.8

### Monthly Grocery Delivery Frequency

- **Male**
  - Before: 0.66
  - During: 1.51
  - After: 1.16

- **Female**
  - Before: 0.54
  - During: 1.27
  - After: 0.81

- Female exhibit preference over grocery shopping in physical stores
- Gender difference remains during and after pandemic
Grocery Shopping w. vs w/o Children

- Grocery shopping trip frequency does not differ
- Family with children more likely to use grocery delivery service
Grocery Shopping by Density of Grocery Store and Supermarket Employment

- Grocery shopping trip frequency increases with physical store density
- Grocery delivery used more in locations with medium density of grocery stores
Key Insights
Key Insights

• Behaviors differ by sociodemographic features
• Pandemic has caused short term behavior change
• Part of the change will remain after pandemic and continue to develop in the long term
Key Insights

• Online deliveries unable to replace shopping and service travel activities for most categories:
Key Insights

- Online deliveries unable to replace shopping and service travel activities for most categories:

In the long term, net increase in VMT expected from shopping and service activities
Equity Issues and Concluding Remarks

José Holguín-Veras
William H. Hart Professor
Director of the VREF Center of Excellence for Sustainable Urban Freight Systems
Rensselaer Polytechnic Institute
jhv@rpi.edu
Equity Issues
Related to Personal Travel Patterns
Collected Data about Intensity of ...

- Work/Online working
- Social activities/Online social
- Entertainment activities/Online entertainment
- Shopping Grocery stores/Grocery delivery
- Restaurants/Processed food
- Medical facility/Tele-medicine
- Mall stores/Online shopping

...though for time reasons only income is discussed today
Person-Trips vs. Tele-Activities by Income

- **Work Related**
  - Either stable or slightly decreasing with income

- **Shopping Related**
  - Increasing with income

- **Social Related**
  - Either stable or slightly decreasing with income

Remote working

- Percentage of workers WFH for 1+ day/week
  - Before, During, After
Person-Trips vs. Tele-Activities by Income

Insight: Low-income individuals will have to travel more than their higher-income counterparts, increasing their exposure to transportation externalities and COVID-19...

- Either stable or slightly decreasing with income
- Increasing with income
In reaction to the COVID-19 crisis people...

- Try to get the supplies needed:
  - If not possible
    - Reduce consumption
    - Substitute supplies
  - If possible:
    - Purchase what is needed
    - Purchase more
      - Larger quantities
      - More frequently

- Retail stores
- Ecommerce
- Grocery Delivery Services
- Black markets
- Others
Reasons to Purchase More than Needed

- I need them immediately
- I will need them this week
- Someone in my family needs to isolate or…
- Concern for myself and my family
- I was afraid they would run out
- I was afraid I would not be able to buy them
- So that I won’t have to go to purchase them later
- I will need them within 7 to 14 days
- I may need them in the future
- I was afraid the stores would close
- To Sell

“Valid” reasons (28.3%),
→ there is a need

Precautionary (71.2%)
→ concerns about future...

Opportunistic (0.5%)
→ desire to benefit
Insight: Low income individuals were significantly more impacted than higher income individuals

Insight: Low income individuals feel much less safer than higher income individuals
Insight: In response to higher threats, low income households were less able to stock up than other wealthier households.
Impacts of Opportunistic Purchases

Insight: Opportunistic purchases could remove critical supplies from disadvantaged communities.

- Average number of masks for opportunistic buyers:
  - 237
  - 1,195
  - 2,006
  - 1,344
  - 4,012
  - 11,810

- Average number of masks for precautionary buyers:
  - 0
  - 5
  - 10
  - 15
  - 20
  - 25
  - 30

- Millions of Face Masks

- 38,992
- 21,263
- 11,810
Related to Purchasing Patterns: World
Respondents that Experienced Shortages

Insight: All income levels experienced shortages, though the definitions of “shortages” depend on income.

Based on OECD
Increase in Inventory Days (During vs. Before)

Most likely due to “panic buying” in China

Insight: All income groups increase inventory, with medium and high income levels leading the pack in actual supplies
Concluding Remarks
Impacts of the COVID-19 Pandemic

Market interactions, supply and demand
Economic shutdowns
Health impacts and concerns
Restrictions on transport systems
...Others...

Goal: to shed light into the direction and permanence of the behavior changes enacted by users
Key Findings

• Multifaceted Impacts, Affecting All Aspects of Transportation Behavior
  • Use of traditional transportation modes
  • All trip purposes
  • Purchases and purchase channels
  • …

• Permanence of Effects
  • All signs point at an eventual “new normal”, in between the “before” and the “during” the pandemic
  • Co-evolution of supply and demand is almost certain, suggesting that the “real new normal” will be different than the one captured in these surveys…
Key Findings

• There Are Reasons for Concern and Optimism
  • Numerous beneficial effects have been advanced by the C-19 pandemic → They should be preserved
    • Increases in tele-activities,
  • Numerous detrimental effects have taken place → They should be mitigated/eliminated if possible
    • Tremendous potential for induction
    • Inequitable access to tele-activities

• Proactive Policy Making is Essential to Maximize Net Benefits…
Acknowledgements

Center for Infrastructure, Transportation and Environment

Volvo Research and Education Foundation

VREF Center of Excellence for Sustainable Urban Freight Systems

Joshua Schmid, Trilce Encarnación, Sofía Pérez, Benjamin Caron, Abdelrahman Ismael (RPI)
Thanks!

Questions and Answers