WEBINAR #2
Impacts of the COVID-19 Pandemic on Person-Trips and Tele-Activities (Part 1)
July 15, 2020 • 11AM EST

With a brief introduction from Prof. José Holguín-Veras
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 (José Holguín-Veras)
• Preliminary Findings (Cara Wang)
• Discussion (Michael Maness)
• Questions and Answers
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

Introduction and Research Framework
Background

• The COVID-19 pandemic has had tremendous impacts on the entire world:
  • Large portions of local, regional, and national economies has been shutdown at times;
  • Communities and Individuals have been severely impacted
    • More than 12.8 million individuals caught the disease
    • More than 566 thousand deaths
  • Transportation activity has been curtailed to slow down the spread of the disease
  • Behaviors of transportation users dramatically changed
The COVID-19 Pandemic

The Transportation System

Operations

Demand

Infrastructure

New IT Based Business Models: TNCs, etc.

Ecommerce

Tele-Activities: Tele-work, tele-medicine, tele-education...

New Vehicular Technologies: CAVs, autonomous freight devices

Normal Market Dynamics
Research Goal: To Support Policy

Transportation System Behaviors

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

Policy Goal: To Foster Beneficial Behavior Changes and Deter Detrimental Ones
Implication #1: The Need to Explicitly Consider Disaster Effects

- The study of changes in user behavior must consider the joint effects of:
  - The market dynamics present when the pandemic struck
  - The effects of the pandemic on user behavior

- Major challenges:
  - Lack of understanding of disaster behaviors
  - Large disasters prompt emergent behaviors, many without parallel in normal conditions, which suddenly appear (and vanish after a while):
    - Volunteerism, altruism, etc.
    - Convergence (of people, information, and materiel) to the disaster
    - Disaster Related Buying Behaviors AKA “Panic Buying”
  - COVID-19 may be different, because of its duration
    - Some behaviors may persist over time
Implication #2: The Need to Consider Behavior Complexity

- Co-Evolution of Supply and Demand
- Demand:
  - Substitution
  - Induction
  - Complementation

Taxonomy of Impacts

- Substitution of transportation for tele-activities is beneficial.
- Induction of transportation activity is not good and should be mitigated.
- Complementation’s net effects could go both ways.

Diagram:
- Substitution (S)
- Induction & Induction, Substitution & Induction, Substitution & Complementation (SI)
- Induction & Induction, & Complementation (SIC)
- Induction & Complementation (SC)
- Complementation (C)

Ecommerce
Tele-commuting
Tele-medicine
Survey Design

• Travel Activity
  • Changes in travel patterns due to the pandemic and how people expect to travel after restrictions are fully lifted

• Shopping Activity
  • How people shop in stores and online and the effects of the pandemic

• Telecommuting and Online Activities
  • How working from home and online activities were affected by the pandemic

• Socio-demographic Information
  • Individual information
  • Household information
  • Zip code – to be linked to regional information
Survey Process

• Observations collected using Amazon Mechanical Turk and SurveyMonkey
• Two rounds of data collection
• 1163 observations total → 938 after cleaning
• Additional waves of data will be collected
### Key Variable Distributions

<table>
<thead>
<tr>
<th>Category</th>
<th>Sample</th>
<th>Population</th>
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</thead>
<tbody>
<tr>
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<td>0.5%</td>
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<tr>
<td>High School graduate</td>
<td>34.8%</td>
<td>45.0%</td>
</tr>
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<td>Associate degree</td>
<td>18.4%</td>
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</tr>
<tr>
<td>Bachelor’s degree</td>
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<td>19.0%</td>
</tr>
<tr>
<td>Master’s or PhD</td>
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<td>11.0%</td>
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<thead>
<tr>
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<td>47.2%</td>
<td>50.3%</td>
</tr>
<tr>
<td>Male</td>
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<td>49.4%</td>
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<thead>
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<th>Category</th>
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<tbody>
<tr>
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<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>
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<td>45~55</td>
<td>14.0%</td>
<td>16.4%</td>
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<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>
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<th>Population</th>
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<tr>
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<td>6.1%</td>
<td>10.6%</td>
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<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>
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<tr>
<td>$35,000 - $49,999</td>
<td>18.7%</td>
<td>12.4%</td>
</tr>
<tr>
<td>$50,000 - $74,999</td>
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<td>13.0%</td>
<td>12.6%</td>
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<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>
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#### Weighting-IPF with Population Distributions

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Value</th>
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<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>
Preliminary Findings

Cara Wang
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Civil and Environmental Engineering
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wangx18@rpi.edu
Outline

• Overview
  • Travel patterns
  • Tele-activities

• Relationship between travel and tele-activities
  • Working
  • Social activities
  • Entertainment
Overview of Travel Patterns
Trip frequency per month

<table>
<thead>
<tr>
<th>Tour Destination</th>
<th>% Change from Before</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>During</td>
</tr>
<tr>
<td>Work</td>
<td>-60.0%</td>
</tr>
<tr>
<td>School</td>
<td>-96.1%</td>
</tr>
<tr>
<td>Recreation</td>
<td>-75.1%</td>
</tr>
<tr>
<td>Grocery store</td>
<td>-41.6%</td>
</tr>
<tr>
<td>Convenience store</td>
<td>-53.2%</td>
</tr>
<tr>
<td>Retail store</td>
<td>-73.0%</td>
</tr>
<tr>
<td>Daycare</td>
<td>-93.8%</td>
</tr>
<tr>
<td>Friends</td>
<td>-74.3%</td>
</tr>
<tr>
<td>Restaurants</td>
<td>-84.2%</td>
</tr>
<tr>
<td>Medical facilities</td>
<td>-46.5%</td>
</tr>
<tr>
<td>Entertainment</td>
<td>-96.8%</td>
</tr>
<tr>
<td>Airports</td>
<td>-91.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>-66.8%</strong></td>
</tr>
</tbody>
</table>
• Overall travel frequency reduced by 66.8% during pandemic
• Expected to reduce by 5.5% after pandemic
Working trip reduced by 60.0% during pandemic compared to before.

Working trip will still be reduced by 8.2% after pandemic compared to before.

Average working trip frequency is 13.4 before pandemic.
- Moderate reduction during pandemic
- Continued reduction after pandemic
- Flexible needs for physical travel
- Significant reduction during pandemic
- Continued reduction after pandemic
- Flexible needs for physical travel
-30.0%  -20.0%  -10.0%  0.0%  10.0%  20.0%  30.0%

Changes during pandemic

Changes after pandemic

-100.0%  -90.0%  -80.0%  -70.0%  -60.0%  -50.0%  -40.0%  -30.0%

-30.0%  -20.0%  -10.0%  0.0%  10.0%  20.0%  30.0%

Significant reduction during pandemic
Rebound expected after pandemic
Strong needs for physical activities

-30.0%  -20.0%  -10.0%  0.0%  10.0%  20.0%  30.0%  40.0%  50.0%  60.0%  70.0%  80.0%  90.0%  100.0%

Changes during pandemic

Changes after pandemic

-30.0%  -20.0%  -10.0%  0.0%  10.0%  20.0%  30.0%

-100.0%  -90.0%  -80.0%  -70.0%  -60.0%  -50.0%  -40.0%  -30.0%

Significant reduction during pandemic
Rebound expected after pandemic
Strong needs for physical activities

-30.0%  -20.0%  -10.0%  0.0%  10.0%  20.0%  30.0%  40.0%  50.0%  60.0%  70.0%  80.0%  90.0%  100.0%

Changes during pandemic

Changes after pandemic
- Moderate reduction during pandemic
- Strong rebounce expected after pandemic
- Very strong needs for physical activities
Overview of Tele-Activities
Remote working

Distribution of WFH frequency for employed in different stages

- **Before**
  - Never: 32.9%
  - <1/month: 8.6%
  - 1/month, but <1/wk: 15.4%
  - 1-2/wk: 8.9%
  - 3+/wk: 32.9%
  - Always: 43.5%

- **During**
  - Never: 60.3%
  - <1/month: 9.7%
  - 1/month, but <1/wk: 11.2%
  - 1-2/wk: 14.2%
  - 3+/wk: 47.5%

- **After**
  - Never: 47.5%
  - <1/month: 7.0%
  - 1/month, but <1/wk: 14.2%
  - 1-2/wk: 11.2%
  - 3+/wk: 22.1%

All respondents

Employed

Will WFH to some extent (53%)
Weekly hours spent on tele-activities

<table>
<thead>
<tr>
<th>Type of activities</th>
<th>% Change from Before</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>During</td>
</tr>
<tr>
<td>Online Entertainment</td>
<td>+39.6%</td>
</tr>
<tr>
<td>Online Social</td>
<td>+60.6%</td>
</tr>
<tr>
<td>Tele-education</td>
<td>+151.2%</td>
</tr>
<tr>
<td>Tele-medicine</td>
<td>+115.9%</td>
</tr>
<tr>
<td>Online Service</td>
<td>+19.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>+51.6%</td>
</tr>
</tbody>
</table>
Online Entertainment

Tele-education

Online Social

Tele-medicine

Changes after pandemic

Changes during pandemic

11.5% Online Service

51.6%
• New behavior largely adopted during pandemic
• Effects will continue but diminish after pandemic
- **Online Entertainment**
  - Changes after pandemic: -20.0%
  - Changes during pandemic: -10.0%
  - Effects continue but diminish after pandemic

- **Online Social**
  - Changes after pandemic: 0.0%
  - Changes during pandemic: 10.0%

- **Tele-education**
  - Changes after pandemic: 20.0%
  - Changes during pandemic: 30.0%

- **Tele-medicine**
  - Changes after pandemic: 40.0%
  - Changes during pandemic: 50.0%

- **Strong demand**
- **New behaviors by some people during pandemic**
Online Entertainment

Online Social

Tele-education

Tele-medicine

Changes after pandemic

Changes during pandemic

- High demand
- Tele-activities widely adopted before pandemic
- Impacts of pandemic limited
Any activities that you would like to do remotely that you cannot currently do?
Relationship between Travel and Tele-Activities
Working trips vs Remote working

- Working trip and remote working may substitute each other
- Working trips will be less frequent after pandemic
- WFH part of the time after pandemic
Working by Gender

Working trips

Monthly working trip frequency

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>18.7</td>
<td>16.4</td>
<td>7.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16.4</td>
</tr>
<tr>
<td>Female</td>
<td>17.4</td>
<td>17.4</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16.2</td>
</tr>
</tbody>
</table>

Remote working

Percentage of Workers WFH for 1+Day/Week

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>35.9%</td>
<td>65.3%</td>
<td>55.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>30.1%</td>
<td>51.1%</td>
<td>44.0%</td>
</tr>
</tbody>
</table>

- Working trip frequencies show no significant difference
- Rate of WFH is lower for female
- Similar changing trends during and after pandemic
Working by Income Level

- Working trip frequency and rate of WFH did not differ much before
- Working trip frequency decreases, and rate of WFH increases with income during pandemic
- “After” is in between “before” and “during”
Working by Education Level

- Before pandemic, both working trip frequency and rate of WFH increases slightly with education level.
- Working trip frequency decreases and rate of WFH increases significantly with education level during pandemic.
- The “after” WFH rate is in the middle of “before” and “during.”
• “Essential” workers generally make more working trips than “non-essential,” and have less flexibility to WFH.

• During pandemic, “essential” workers cannot reduce working trip as much as “non-essential” workers.
## Working by Employment Type

### Working trips

<table>
<thead>
<tr>
<th>Monthly Trip Frequency</th>
<th>Employment Type</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Financial services</td>
<td>-87.7%</td>
<td>-10.0%</td>
</tr>
<tr>
<td>18.9</td>
<td>Health Care/Social Assistance</td>
<td>-34.1%</td>
<td>-5.8%</td>
</tr>
<tr>
<td>19.6</td>
<td>Professional &amp; Business Services</td>
<td>-81.4%</td>
<td>-13.9%</td>
</tr>
<tr>
<td>16.5</td>
<td>Retail</td>
<td>-35.1%</td>
<td>-1.5%</td>
</tr>
<tr>
<td>17.5</td>
<td>Technology &amp; Telecommunications</td>
<td>-79.2%</td>
<td>-21.5%</td>
</tr>
<tr>
<td>17.0</td>
<td>Financial services</td>
<td>91.0%</td>
<td>58.2%</td>
</tr>
<tr>
<td>17.3</td>
<td>Health Care/Social Assistance</td>
<td>41.7%</td>
<td>23.3%</td>
</tr>
<tr>
<td>18.5</td>
<td>Professional &amp; Business Services</td>
<td>69.6%</td>
<td>51.8%</td>
</tr>
<tr>
<td>14.2</td>
<td>Retail</td>
<td>69.6%</td>
<td>51.8%</td>
</tr>
<tr>
<td>13.5</td>
<td>Technology &amp; Telecommunications</td>
<td>70.9%</td>
<td>50.9%</td>
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</tbody>
</table>

### Remote working

<table>
<thead>
<tr>
<th>Percentage of Workers WFH for 1+Day/Week</th>
<th>Employment Type</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial services</td>
<td>55.2%</td>
<td>22.4%</td>
<td></td>
</tr>
<tr>
<td>Health Care/Social Assistance</td>
<td>28.3%</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>Professional &amp; Business Services</td>
<td>33.9%</td>
<td>17.9%</td>
<td></td>
</tr>
<tr>
<td>Retail</td>
<td>15.2%</td>
<td>14.1%</td>
<td></td>
</tr>
<tr>
<td>Technology &amp; Telecommunications</td>
<td>40.9%</td>
<td>20.0%</td>
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</tr>
</tbody>
</table>

Flexible, remote working highly possible in long term
## Working by Employment Type

### Working trips

<table>
<thead>
<tr>
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### Remote working

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</tr>
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<tr>
<td>Health Care/Social Assistance</td>
<td>41.7%</td>
<td>13.3%</td>
<td>23.3%</td>
</tr>
<tr>
<td>Professional &amp; Business Services</td>
<td>85.7%</td>
<td>51.8%</td>
<td>69.6%</td>
</tr>
<tr>
<td>Retail</td>
<td>81.0%</td>
<td>21.7%</td>
<td>37.0%</td>
</tr>
<tr>
<td>Technology &amp; Telecommunications</td>
<td>91.8%</td>
<td>50.9%</td>
<td>70.9%</td>
</tr>
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</table>

### Percentage of Workers WFH for 1+Day/Week

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</tr>
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<td>Technology &amp; Telecommunications</td>
<td>40.9%</td>
<td>20.0%</td>
<td></td>
</tr>
</tbody>
</table>

Mixture, on-site working largely needed
- Before pandemic, working trip frequency almost the same.
- Transit users significantly reduced working trips during pandemic.
- The difference continues to exist after pandemic.
• Before pandemic, working trip frequency almost the same.
• During pandemic, people travel longer reduced more trips and are more likely to WFH.
• The “after” condition is similar to the “before” condition with universal reduction in travel and increase in WFH.
How efficiently are you working from home compared to working at your normal work location?

- Retail: 97.4
- Professional & Business Services (consulting, legal, marketing): 94.5
- Technology & Telecommunications: 92.9
- Financial services: 88.7
- Health Care/Social Assistance: 79.4
Social Activities
Social Activities

Person trips

Social trip frequency per month

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>3.7</td>
<td>1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Change</td>
<td>-74.3%</td>
<td></td>
<td>+7.4%</td>
</tr>
</tbody>
</table>

Tele-activities

Online social hours per week

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1.2</td>
<td>3.1</td>
<td>1.8</td>
</tr>
<tr>
<td>Change</td>
<td></td>
<td>+160.6%</td>
<td>+49.2%</td>
</tr>
</tbody>
</table>

- Reduction in social trips somewhat compensated by online social activities
- People’s social needs may be increased: after pandemic, people will increase **both** physical and online social activities
Entertainment
Entertainment activities

Person trips

Entertainment and recreational trip frequency per month

<table>
<thead>
<tr>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5</td>
<td>7.6</td>
<td>+0.5%</td>
</tr>
</tbody>
</table>

-78.9%

Tele-activities

Online entertainment hours per week

<table>
<thead>
<tr>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.3</td>
<td>17.1</td>
<td>+39.6%</td>
</tr>
<tr>
<td></td>
<td>12.8</td>
<td>+4.8%</td>
</tr>
</tbody>
</table>

• Increase of online entertainment hours less than the decrease of entertainment trips
• People’s entertainment needs are stable
Discussion

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Gender Differences in Activity Participation (Pre-COVID)

Top 10 activities chosen by more women (Percent difference versus men)
- Baking/cooking: 28%
- Garden: house plants: 15%
- Dancing: 12%
- Reading fiction: 11%
- Visit Others: 10%
- Working puzzles: 8%
- Board gaming: 8%
- Painting: 7%
- Cards: 7%
- Collecting books: 6%

Top 10 activities chosen by more men (Percent difference versus women)
- Watch movies: 23%
- Watch football: 19%
- Weight lifting: 15%
- Chess: 12%
- Golf: 11%
- Bicycling: 11%
- Poker: 10%
- Video games: 10%
- Gambling: 10%
- Shooting pool: 9%

Survey Source: Social Capital and Leisure Activity Survey
Social Activities by Gender

- Female exhibit preference of physical social activities over online social activities
- Changing trends are similar for both genders during and after pandemic
Social Support During the Pandemic

Available Social Support: COVID-19 and the Future Survey

- Help You Around House When Sick
- Watch You If Seriously Ill
- Pick Up from Evening Social Event
- Talk About Your Day
- Household / Garden Help
- Offer Appreciation for Who You Are
- Feeling Down & Want Talk
- Health Issues Info
- Computer Assistance
- Finding New Residence
- Family Problems Advice
- Borrow large sum of money
- Legal Advice
- Help finding a job

Survey Source: https://covidfuture.org/
A Tale of Two Activities

- Work and Discretionary Activities exhibit quite different properties
  
  - Work Activities
    - Working from home is doable, adjusted our home to enable it
    - Employers now have experience with it
    - Teleworking likely will increase
  
  - Social and Discretionary Activities
    - Not easily substituted
    - Not figured out how to modify our homes and communications to deal with lessening physical sociality
    - But this still goes back to even the telephone, it never made us see each other less
Feedback Effect from Telework?

- Will this transformation in telework lead to more experiences?

- Moktharian et al. (2006) mentions this as ICT-enabled reallocation.

- Fancourt et al. (2020) found depression & anxiety lessening but still persisting after some easing of restrictions.

Sources: [https://doi.org/10.1007/s11116-005-2305-6](https://doi.org/10.1007/s11116-005-2305-6)
[https://doi.org/10.1101/2020.06.03.20120923](https://doi.org/10.1101/2020.06.03.20120923)
Experience Economy

• Transitioning to businesses emphasizing the customer experience
  • Malls become not just shopping destinations but entertainment hubs
  • Choosing tourism over obtaining larger homes

• There is some evidence here to suggest that
  • ICT-enabled substitution is not occurring for leisure
  • Some induction (creating new trips) of leisure travel shown in this study but needs to be monitored
    • Social trip rebound + increase, entertainment trip rebound
    • Lack of chance to increase socialization during current crisis
Some Policy Implications

• Less centralized trip patterns and widening evening peak
  • Move towards flexible schedule, flexible route transit systems

• Activity Planning
  • Leisure activity spreading
  • Incentivization of activity times and locations, equity concerns
  • Encourage employers to provide flexible telework schedules (e.g. Noon-8pm, long midday breaks)
Conclusions
Conclusions

• Changes in physical and tele-activities depend on many sociodemographic features, policy measures need to consider these.

• Needs for physical vs tele-activities differ by nature of activities:
  • Travel needs for discretionary activities are stable even with wider adoption of tele-activities.
  • Opportunity to foster staggered working days with increasing WFH rate.
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Registration Link
https://cite.rpi.edu/index.php/training-and-outreach/