THE IMPACTS OF COVID-19 ON TELE-ACTIVITIES, TRAVEL, AND PURCHASING BEHAVIORS WEBINAR SERIES

WEBINAR #1
Impacts of the COVID-19 Pandemic on Purchasing of Critical Supplies: Roots and Measures to Mitigate "Panic Buying"

July 8, 2020 • 11AM EST

José Holguín-Veras
Trilce Encarnacion
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:
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- Dial 1-415-655-0001, access code 733 020 237
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Impacts of the COVID-19 Pandemic on Purchasing of Critical Supplies: Roots and Measures to Mitigate “Panic Buying”

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Rensselaer Polytechnic Institute
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Transportation Research at Rensselaer
Key Research Areas

- **Freight Transportation Behavior, Modeling, Policy:**
  - To identify the best ways to influence supply chains to adopt socially beneficial behavior changes that increase sustainability, reduce energy consumption, reduce congestion, etc.

- **Disaster Response Logistics:**
  - This area focuses on field work, characterization, and analytical modeling of novel disaster response procedures. The team has studied: Katrina, Port-au-Prince, Hurricane Irene, Japan tsunami, etc.

- **Travel Behavior Modeling:**
  - Explore people's travel behavior in new social and economic contexts, such as enhanced peer influence via online social networking and new forms of interaction enabled by IT, etc.

- **Data analytics for transportation systems:**
  - Develop data acquisition processes and analytical methods to investigate emerging issues in transportation systems, with a focus on impact assessment of new technologies and disruptive events.

- **Transportation network modeling and simulation:**
  - To develop analytical and simulation models tools to facilitate the design of innovative operations to improve system efficiency, robustness, and resilience.
Disaster Response Logistics
Our Goal is To Avert This…

“We need medicines, something to eat…”

“We are asking for food, water, medicine, shelter and clothing. Aren’t we humans?”

(Pictures taken by JHV 10 days after the disaster)
Major Components of Our Work

- Fieldwork: 9/11, Katrina, Indian Ocean, Haiti, Chile, Joplin, Japan, Nepal, Ecuador, etc. etc.

- Diagnosis and characterization:
  - Causes of problems encountered
  - How disaster response logistics take (and should take) place

- Quantification:
  - Aimed at obtaining empirical estimates
  - Provide support to analytical modeling

- Define mechanisms to improve response
  - Policy Suggestions → FEMA, Catastrophic Planning Groups

- Basic research on analytical modeling
  - To develop Decision Support Tools
The Top Ten Lessons Learned from Fieldwork ...

- Disaster Response is a Socio-Technical Process
- Disasters ≠ ≠ ≠ ≠ ≠ ≠ ≠ ≠ ≠ Catastrophes
- Commercial Logistics ≠ ≠ ≠ Post-Disaster Logistics
- Controlling Material Convergence is a MUST
- In Catastrophes: Local Distribution Is the Challenge, Only option: Collaborative Aid Networks
- Effective Private Sector Integration is KEY
- Supply and Demand Are Very Dynamic, Be Ready
- Controlling “Panic Buying” Is Essential
- Preventing Collapse of Private Supply Chains is Key
- Comprehensive Approaches Are Needed
Past Evidence on Disaster Related Buying Behaviors
About “Panic Buying”

- Often referred to as “panic buying,” this is a misnomer.
  - A human reaction to concerns about potential shortages that may occur when disasters are expected, or have occurred.
  - Nevertheless, the practice is problematic.

- Expected to appear in ALL large disasters and catastrophic events.

- There is no formal taxonomy of behaviors, we have identified two main types (there may be others):
  - Precautionary, prompted by concern of self or others...
  - Opportunistic, prompted by the desire of making money, seeking power, political influence, etc.
The Main Issue...

In anticipation of shortages, households and businesses purchase almost **ALL** critical supplies in the market.

Local supplies destroyed, no supplies/services to purchase, no money to pay for them...

The tragedy is that these supplies are the one best positioned to help the survivors...
Examples

- In the case of the Tohoku disasters in Japan, the manager of one of the largest distribution centers in the Tohoku area indicated that the demand “doubled” after the tsunami... he “did not know what to do”...

- Logisticians of a large retailer, after Super Storm Sandy, reported that the closer to the disaster area, the more pronounced the buying is
Overview of Survey
International Data Collection

- Objective: Gain insight into the determinants that explain precautionary and opportunistic buying by individuals during the COVID-19 Pandemic.
Survey Implementation and Cleaning

- Collected using Mechanical Turk and SurveyMonkey
- Two rounds of data collection
  - First round (mid-April): unrestricted
  - Second round (late June): targeted demographics
- USA
  - $605 + 430 = 1035$ observations $\rightarrow$ reduced to $924$ after cleaning
- International
  - $5015$ observations $\rightarrow$ reduced to $4,039$ after cleaning
- Weighting with population distributions
  - Gender, age, income level, education level
Survey Sections

- Purchases of supplies during normal times
  - Frequency and duration of supplies, Store types, Preparation for emergencies, by type of supply
- Purchases of supplies during COVID-19 times
  - In addition to above... reasons, influencer media, key factors, shortages...
- Perceived Trust and Level of Knowledge of relief groups...
- Willingness to change COVID’s purchasing behavior
- Demographics
Basic Supplies

- The survey focused on shopping behaviors related to basic supplies made in each household.

- These supplies include:
  - Food items
  - Personal hygiene items
  - Cleaning supplies
  - Medications
  - Other items required to satisfy basic needs
Pre-COVID-19 Shopping Patterns

These slides summarize research in progress that is subject to change as the analyses are refined and more data are collected.

These results are the tip of the iceberg...
Retail Outlets

Places where regularly shopped before crisis

- Grocery Store: 70%
- Supermarket Chain: 60%
- Big box Store: 37%
- Pharmacy: 31%
- Wholesale Retailer: 19%
- Convenience Store: 13%

Will return to these places when crisis is over?

- Yes: 95%
- No: 5%

31% Online, basic supplies
Inventory of Basic Supplies

Days of Inventory

- 33% had more than 10 days of supplies

Food Items
- Produce: 95%
- Meats: 94%
- Dry Goods: 86%
- Water: 49%

Cleaning & Hygiene
- Toilet Paper: 97%
- Paper Towels: 91%
- Soap: 90%
- Cleaning Wipes: 65%
- Bleach: 39%
- Hand Sanitizer: 32%

Medical
- Gloves: 38%
- Medications: 29%
- N95 Masks: 10%
- Face Masks: 3%
In normal times, do you have basic supplies stored for emergencies in your home?

- Yes: 58%
- No: 42%

How many days do they last?

- 0-5 days: 11%
- 6-10 days: 29%
- 11-15 days: 25%
- 16-20 days: 2%
- 21-30 days: 23%
- 30-59 days: 1%
- 60+ days: 9%
COVID-19 Related Shopping Patterns
Changes in Shopping Habits

- 53% Purchase more quantity
- 30% Switched from buying in stores to buying online
- 20% Purchase more frequently
- 9% Changed retailers

21% No Change
Changes in Shopping Habits

- Grocery Store: 70% Before COVID, 32% After COVID
- Supermarket Chain: 60% Before COVID, 25% After COVID
- Big box Store: 37% Before COVID, 14% After COVID
- Pharmacy: 31% Before COVID, 2% After COVID
- Wholesale Retailer: 19% Before COVID, 7% After COVID
- Convenience Store: 13% Before COVID, 1% After COVID

30% Switched to Online
Changes in Days of Inventory

**BEFORE COVID**

- 60+ days: 1%
- 30-59 days: 12%
- 21-30 days: 17%
- 16-20 days: 17%
- 11-15 days: 18%
- 6-10 days: 49%
- 0-5 days: 18%

**AFTER COVID**

- 60+ days: 5%
- 30-59 days: 20%
- 21-30 days: 32%
- 16-20 days: 26%
- 11-15 days: 13%

**Before COVID**
- 33% had more than 10 days of supplies

**After COVID**
- 62% had more than 10 days of supplies

Mean: 11.53 St.Dev.: 10.07
Mean: 18.59 St.Dev.: 16.86
Changes in Shopping (After minus Before)

Change in Supplies Purchased

- Produce: -31%
- Meats: -30%
- Soap: -26%
- Paper Towels: -19%
- Toilet Paper: -17%
- Dry Goods: -11%
- N95 Masks: -7%
- Cleaning Wipes: -6%
- Gloves: -5%
- Bleach: 0%
- Water: 1%
- Hand Sanitizer: 20%
- Medications: 21%
- Face Masks: 38%
What products could you not buy or could not buy the desired quantity?
Manifestations of Disaster Related Buying Behaviors
<table>
<thead>
<tr>
<th>Reason</th>
<th>Precautionary (71.2%)</th>
<th>&quot;Valid&quot; reasons (28.3%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I was afraid the stores would close</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I may need them in the future</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Someone in my household needs to isolate or…</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I was afraid they would run out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>So that I won't have to go purchase them later</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I was afraid I would not be able to buy them</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I will need them within / to 14 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I need them immediately</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concern for myself and my family</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I will need them this week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insight: Precautionary Buying is driven by a lack of trust on public/private sectors’ ability to deliver the supplies needed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The chart shows the percentage of reasons for purchasing supplies, with Precautionary reasons being the most common (71.2%), followed by "Valid" reasons (28.3%). The least common reason is Opportunistic (0.5%).
Insight #1: Low income individuals were impacted more than high income individuals.

Insight #2: Low income individuals feel much less safer than high income individuals.
Assume that:

- We take for granted that “valid” purchases are OK.
- We focus on hand sanitizer bottles...
- The percent of people with precautionary and opportunistic buying behavior is equal to the breakdown of reasons.

<table>
<thead>
<tr>
<th>Average number of hand sanitizer bottles per person:</th>
<th>Contribution to the overall average of purchases (percent X class average)</th>
<th>Total for US (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precautionary (71.2%)</td>
<td>Opportunistic (0.5%)</td>
<td>Precautionary</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.712</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.712</td>
</tr>
</tbody>
</table>

Key Insight: If the average of opportunistic purchases is larger than about 142 times the average for precautionary purchases, opportunistic purchases will be the majority of all purchases.
Exaggeration?

He Has 17,700 Bottles of Hand Sanitizer Nowhere to Sell Them

Amazon cracked down on coronavirus price gouging. Now, while the rest of the world searches, some sellers are hoarding stockpiles of sanitizer and masks.

The Man With 17,700 Bottles of Hand Sanitizer Just Donated Them

A Tennessee man had planned to sell his stockpile at marked-up prices online. Now he is under investigation for price gouging.

Matt Colvin, a Tennessee man who stockpiled hand sanitizer and wipes, says he has donated what he bought. He faces an investigation on price-gouging charges. Doug Strickland for The New York Times
Opinion of Responding Organizations and Willingness to Change Behavior
Most Trustworthy Organizations

![Bar chart showing trust levels for different organizations]

- Police
- Health Officials
- Local Government
- Local Relief Org
- Local Responders
- Firefighters

Trust (5 is highest)
Most Knowledgeable Organizations

Knowledge of Local Conditions (5 is highest)

- Health Officials
- Local Responders
- State Government
- Police
- Firefighters
- Local Relief Org
- Local Government

Organization
If the group that you trust the most asked that you limit your purchases, how likely are you to reduce your purchases?

- 15% I won't pay attention to them
- 25% I will try to buy less
- 30% I will buy the suggested amount
- 30% I will buy only the strictly necessary
- 1% I will stop purchasing
Key Insights from USA Results
Massive changes in purchasing behavior took place, though some of them may be transient.

American households’ increase of stocks of basic supplies had negative impacts on the supplies available to the response.

Low-income households declared larger numbers of “valid” and “precautionary” reasons:
- They faced larger problems / felt less secure than wealthier households.

Precautionary/Opportunistic buying was a major contributor to the crisis of critical supplies reaching disaster responders:
- Opportunistic buying seem to be a major contributor to the crisis.

Local responders, firefighters, local governments are ideally positioned to convince people to reduce precautionary buying.
International Perspective on Purchasing Behaviors of Critical Supplies during the COVID-19 Pandemic

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Pre-Covid Shopping Habits
Preferred Retailers for Basic Supplies

Percentage of Consumers that shopped online for basic supplies

- **Asia**: 42%
- **North America**: 31%
- **Europe**: 17%
- **South America**: 13%
- **Africa**: 12%

Top retailers before crisis

- **Asia**: Grocery Store 61%
- **North America**: Grocery Store 70%
- **Europe**: Supermarket 75%
- **South America**: Supermarket 89%
- **Africa**: Grocery Store 74%
Stocks of Basic Emergency Supplies

Percentage of population that stores basic supplies for emergencies

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage of Population Storing Supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>68%</td>
</tr>
<tr>
<td>North America</td>
<td>58%</td>
</tr>
<tr>
<td>Europe</td>
<td>52%</td>
</tr>
<tr>
<td>South America</td>
<td>45%</td>
</tr>
<tr>
<td>Africa</td>
<td>40%</td>
</tr>
</tbody>
</table>

Average Days of Inventory of Emergency Supplies

- Asia: 6.5 days
- North America: 20.9 days
- South America: 20.1 days
- Europe: 12.7 days
- Africa: 11.4 days
Changes in Shopping Habits due to COVID-19
Switched to Online

Percentage of population that switched to online for purchase of basic supplies:

<table>
<thead>
<tr>
<th>Region</th>
<th>Switched to Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>South America</td>
<td>31%</td>
</tr>
<tr>
<td>North America</td>
<td>30%</td>
</tr>
<tr>
<td>Europe</td>
<td>18%</td>
</tr>
<tr>
<td>Africa</td>
<td>15%</td>
</tr>
<tr>
<td>Asia</td>
<td>8%</td>
</tr>
</tbody>
</table>

Top Countries:

<table>
<thead>
<tr>
<th>Country</th>
<th>Switched to Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>42%</td>
</tr>
<tr>
<td>Mexico</td>
<td>35%</td>
</tr>
<tr>
<td>Nepal</td>
<td>35%</td>
</tr>
<tr>
<td>Peru</td>
<td>34%</td>
</tr>
<tr>
<td>Brazil</td>
<td>33%</td>
</tr>
<tr>
<td>United States of America</td>
<td>30%</td>
</tr>
<tr>
<td>Italy</td>
<td>29%</td>
</tr>
</tbody>
</table>

Already had 42% buying online.
Days of Inventory of Basic Supplies

Africa

- Before COVID-19: Mean 9.11
- After COVID-19: Mean 14.30

Europe

- Before COVID-19: Mean 6.49
- After COVID-19: Mean 10.73

Asia

- Before COVID-19: Mean 12.55
- After COVID-19: Mean 5.78

South America

- Before COVID-19: Mean 10.91
- After COVID-19: Mean 12.10

North America

- Before COVID-19: Mean 11.53
- After COVID-19: Mean 18.64
Days of Inventory of Basic Supplies

Changes in Inventories

Asia: -33%
South America: 13%
Africa: 67%
North America: 70%
Europe: 72%
What products could you not buy or could not buy the desired quantity?

<table>
<thead>
<tr>
<th>Region</th>
<th>Hand Sanitizer</th>
<th>Face Masks</th>
<th>Toilet Paper</th>
<th>Gloves</th>
<th>Cleaning Wipes</th>
<th>Paper Towels</th>
<th>Meats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>17%</td>
<td>16%</td>
<td>5%</td>
<td>9%</td>
<td>9%</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>Asia</td>
<td>16%</td>
<td>19%</td>
<td>14%</td>
<td>13%</td>
<td>4%</td>
<td>12%</td>
<td>16%</td>
</tr>
<tr>
<td>Europe</td>
<td>17%</td>
<td>20%</td>
<td>12%</td>
<td>15%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>North America</td>
<td>31%</td>
<td>22%</td>
<td>29%</td>
<td>14%</td>
<td>29%</td>
<td>17%</td>
<td>11%</td>
</tr>
<tr>
<td>South America</td>
<td>29%</td>
<td>28%</td>
<td>9%</td>
<td>17%</td>
<td>10%</td>
<td>7%</td>
<td>9%</td>
</tr>
</tbody>
</table>
### Shortages

#### Population that experienced shortages

<table>
<thead>
<tr>
<th>Region</th>
<th>North America</th>
<th>South America</th>
<th>Europe</th>
<th>Africa</th>
<th>Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>47%</td>
<td>41%</td>
<td>30%</td>
<td>24%</td>
<td>14%</td>
</tr>
</tbody>
</table>

#### What products could you not buy or could not buy the desired quantity?

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<td>9%</td>
<td>9%</td>
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<td>5%</td>
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<tr>
<td>Asia</td>
<td>16%</td>
<td>19%</td>
<td>14%</td>
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<td>4%</td>
<td>12%</td>
<td>16%</td>
</tr>
<tr>
<td>Europe</td>
<td>17%</td>
<td>20%</td>
<td>12%</td>
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<td>9%</td>
<td>17%</td>
<td>10%</td>
<td>7%</td>
<td>9%</td>
</tr>
</tbody>
</table>
Valid vs. Precautionary vs. Opportunistic

Europe: 33.0% Valid, 66.2% Precautionary, 0.8% Opportunistic

Asia: 31.4% Valid, 67.9% Precautionary, 0.7% Opportunistic

South America: 29.7% Valid, 69.2% Precautionary, 1.1% Opportunistic

North America: 28.3% Valid, 71.2% Precautionary, 0.5% Opportunistic

Africa: 28.0% Valid, 70.7% Precautionary, 1.2% Opportunistic
### Top Countries by Reason

<table>
<thead>
<tr>
<th>Valid</th>
<th>Precautionary</th>
<th>Opportunistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>38%</td>
<td>Portugal</td>
</tr>
<tr>
<td>Sweden</td>
<td>36%</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Belgium</td>
<td>33%</td>
<td>Canada</td>
</tr>
<tr>
<td>China</td>
<td>32%</td>
<td>UK</td>
</tr>
<tr>
<td>Brazil</td>
<td>32%</td>
<td>Australia</td>
</tr>
<tr>
<td>Singapore</td>
<td>31%</td>
<td>USA</td>
</tr>
<tr>
<td>India</td>
<td>30%</td>
<td>Dominican Rep</td>
</tr>
<tr>
<td>Colombia</td>
<td>30%</td>
<td>Morocco</td>
</tr>
<tr>
<td>Chile</td>
<td>30%</td>
<td>Germany</td>
</tr>
<tr>
<td>Nepal</td>
<td>29%</td>
<td>Italy</td>
</tr>
</tbody>
</table>
Opinion of Organizations

**Level of Trust**
- Africa: Health Officials > Local Responders > National Gov.
- Asia: Firefighters > Health Officials > Local Responders
- Europe: Health Officials > National Gov. > Police
- North America: Local Relief Org > Local Responders > Firefighters
- South America: Local Responders > Firefighters > Health Officials

**Knowledge**
- Local Gov.: Local Responders > Health Officials
- Firefighters: Local Relief Org > Local Gov.
- Police: State Government > Local Responders
Key International Results

- There are great similarities in changes in shopping behaviors worldwide:
  - Purchases of basic supplies online increased significantly in all regions (Asia already had high penetration)
  - Households increased their stocks of basic supplies in most regions, while China decreased their stocks
  - Distribution of Precautionary/Opportunistic motives was consistent thought all regions
  - Local responders, firefighters, local governments are ideally position to convince people to reduce precautionary buying
- Shortages were more pronounced in the Americas
Concluding Remarks
Key Findings

- Disaster Related Buying Behaviors (AKA Panic Buying) creates tremendous challenges to disaster response, supply chains, and freight systems
  - Artificially increases demand, removes critical supplies from the locations that need them the most, etc.
  - It is important to mitigate their effects

- The increases in demand are so high that it become impossible for supply chains to satisfy the demand

- There are multiple motivations behind
  - Valid, in response to a need
  - Precautionary, out of concerns about availability
  - Opportunistic, to benefit from the crisis
Many Similarities in the Results

- **Breakdown of Reasons**
  - Valid → 27% to 38%
  - Precautionary → 62% to 72%
  - Opportunistic → 0.1% to 2.8%

- **Potential Role of Local Actors as Influencers of Behavior Changes**
  - Perceived as trustworthy and knowledgeable
  - They could help mitigate the sharp rise of demand
What Could Be Done?

- It depends on the “reasons”…
  - Precautionary Buying…
    - Appeal to citizens to do what is right…
    - Engage local responders, relief groups… health officials…
  - Opportunistic Buying…
    - Must be prevented…

- Ration critical supplies…

- Establish Public-Private Collaboration Agreements
  - To be activated in case of disasters of a certain size
  - Companies in possession of critical supplies agree to sell them (at a preset price) to the emergency response agencies to support the response and the victims
Our partners

- Brazil: R. da Silva Lima, C. Barbieri, H. Yoshizaki
- China: Y. Wu
- Colombia: V. Cantillo
- Ecuador: C. Pérez
- France: J. González-Feliú, L. van Wassenhove
- India: P. Sahu
- Italy: E. Marcucci, V. Gatta, M. Le Pira
- Nepal: S. Pokharel
- Peru / Chile: W. Yushimito, M. Chong
- South Africa: M. Zuidegeest, J. Joubert
- Spain: L. dell’Ollio
- Sweden: I. Sánchez-Díaz
- Ukraine: A. Rossolov
- Uruguay: M. Tanco
- At RPI: Sofía Pérez, Diana Ramírez
Next Webinars

https://cite.rpi.edu/index.php/training-and-outreach/

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

WEBINAR #3
Impacts of the COVID-19 Pandemic on Person-Trips and Tele-Activities (Part 2)
July 22, 2020 • 11AM EST
José Holguin-Veras Cara Wang
Thanks!