COVID-19 Impacts on Urban Travel Demands: A Systematic and Deliberate Approach

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Outline

1. Approach
2. Core-Satellite Structures
3. Cycles of Data Collection
4. Data Fusion by Design
5. Enabling Fusion Embedded Design: common elements
6. 4 Satellites
7. The Core: COVHITS and its Rationale
8. Scheduling and budget
Core-Satellite Approach

- A Core-Filling survey to be conducted in between two core surveys to capture core-type information, but in an extra-ordinary context

- Linked (to the core-filling) Satellites: Probing more into behaviour, asking subjective questions

- 2-cycle small sample survey for each: to capture the dynamics of adaptations in households travel demands towards the (new) normal contexts
A Core-Satellite Structure for COVID-19 Impacts Analysis

- Changes in the use of Shared Travel Modes
- Changes in Transit Choice and Usage Patterns
- Changes in Activity-Travel Scheduling Behaviour
- Changes in Dwelling Type and Home Location Choices

A Core-Filling Household Travel Diary Survey
Fusion by Design:

Common Pandemic Related Questions
- Changes in Activity-Travel Scheduling Behaviour
- Changes in Transit Choice and Usage Patterns
- Changes in the use of Shared Travel Modes
- Changes in Dwelling Type and Home Location Choices

Common Household-Personal Question
- Matching the Core

Fusing Individual Satellite Datasets

A Core-Filling Household Travel Diary Survey
2-Cycle Data Collection

Just after COVID-19 Lockdown

A Core-Filling Household Travel Diary Survey, the COVHITS

Changes in Activity-Travel Scheduling Behaviour

Changes in Transit Choice and Usage Patterns

Changes in Dwelling Type and Home Location Choices

Changes in the use of Shared Travel Modes

1 year after COVID-19 Lockdown

Changes in Transit Choice and Usage Patterns

Changes in Dwelling Type and Home Location Choices

Changes in the use of Shared Travel Modes

A Core-Filling Household Travel Diary Survey
Common Elements in all Satellites: General Pandemic Related Points

- Self-identification as a high-risk person*
- Number of high-risk persons in the household*
- Requirement to be present at one’s workplace during the pandemic
- Attitudes towards social distancing
- Daily routine during the pandemic
- Impact of the pandemic on daily activity frequency
- Belief about when the next pandemic will occur
Common Elements in all Satellites: Linking with the Core

<table>
<thead>
<tr>
<th>Household Attributes</th>
<th>Personal Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential location</td>
<td>Age</td>
</tr>
<tr>
<td>Dwelling type</td>
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<tr>
<td>Housing tenure</td>
<td>Driver’s license ownership</td>
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<tr>
<td>Nature of living arrangements</td>
<td>Transit pass ownership</td>
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<tr>
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<td>Household income</td>
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Changes in Activity-Scheduling Behaviour

General pandemic behaviour
- Identification of severe illness due to COVID-19
- Whether to physically present at workplace
- Familiarisation towards "Social Distancing"
- Frequency of leaving house for specific purpose
- Changes in time budget specification to selected activities
- Extent of cautiousness
- Perceptions regarding recurrence of such pandemic in future

Activities and behaviour

- Before COVID-19 pandemic behaviour
  - Work related
    - Previous experience of teleworking
    - Frequency of teleworking
    - Teleworking category
    - Meeting frequency
    - Average weekly work hours
    - Flexible working time and schedule
  - Shopping related
    - Grocery shopping methods and frequency
    - Grocery shopping travel mode and average TT
    - Non-grocery shopping methods and frequency
    - Eating meals methods and frequency
  - Visiting family/friends methods and frequency

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- After COVID-19 pandemic behaviour
  - Shopping related
    - Grocery shopping methods and frequency
    - Non-grocery shopping methods and frequency
    - Eating meals methods and frequency
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Personal attributes
- Age
- Gender
- * Current marital status
- Driver's license ownership
- Transit pass ownership (monthly or annual)
- Student status
- Employment status
- * Current and prior to COVID-19 closure
- Occupation type
- Level of education

Stated Preference Experiment
- Workplace choice (Alternatives and attributes)
  - Work at home: Working facilities, Working place, Work hour flexibility
  - Work on site: Travel time, Work hour flexibility, Crowding level
- General attributes: Child caring, COVID-19 status

- Grocery shopping alternatives:
  - E-shopping: Delivery time, Delivery fee, Saving basket
  - In-store (small supermarket): Travel time, Crowding level, In-line waiting time
  - In-store (large supermarket): Travel time, Crowding level, In-line waiting time
- General attributes: COVID-19 status

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(Alireza Dianat et al.)
Survey to Measure Changes and Adaptations in daily Activity-travel Scheduling Behaviour During and Post COVID-19 scenarios (Alireza Dianat et al.)

**Activities and behaviour**

[Before COVID-19 pandemic behaviour]

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Activities and behaviour

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- Work related
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[After COVID-19 pandemic behaviour]
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**Stated Preference Experiment**

[Workplace choice, and shopping method choice; six-eight experiment each]

- **Workplace choice (Alternatives and attributes)**
  - Work at home: Working facilities, Working place, Work hour flexibility
  - Work on-site: Travel time, Work hour flexibility, Crowding level
  - General attributes: Child caring, COVID-19 status

- **Grocery shopping alternatives:**
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Typical Transit Trips (prior to COVID-19 Closures)
- Travel Distance
- Total Travel Time
- Access mode to starting stop/station
- Access time to starting stop/station
- Number of Transfers
- Egress mode to destination from the last stop/station
- Egress time to destination from the last stop/station

Information on Commuter’s response to COVID-19 Closures
- Primary mode of transportation for commuting, shopping, and other trips
  - *Current and prior to COVID-19 Closures
  - Level of difficulty due to avoiding Public transit due to COVID-19 pandemic
  - Perceptions regarding the major transportation modes in Toronto considering your safety and comfort during COVID-19 pandemic
  - Willingness to buy monthly pass, after the COVID-19 situation

Attitudinal Questions
[At Pandemic behavior during COVID-19 Closures]
- Identification of severe illness due to COVID-19
- Whether to physically present at workplace
- Familiarization towards “Social Distancing”
- Frequency of leaving house for specific purposes
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Changes in Transit Choice and Usage Patterns

Changes in the use of Shared Travel Modes

Changes in Dwelling Type and Home Location Choices

A Core-Filling Household Travel Diary Survey

Changes in Activity-Travel Scheduling Behaviour

(Sk Mashrur et al.)
Assessment and Measurements of the Factors Influencing the choice of using Transit during the COVID-19 Recovery Period and Post COVID-19 Era  

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**Commuters response to COVID-19 Closures**

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SP Experiments (Work in-progress)

- **Local Transit Context**: Walk, Cycle, Auto Driver, Auto Passenger, Taxi/Ride-hailing, Subway, Bus/Streetcar, Subway & Bus/Streetcar
- **Regional Transit Context**: Auto; Auto passenger; Uber; Go bus; Go Transit; Park & Ride(GO bus); Park & Ride (Go train); Carpool & Ride(GO bus); Carpool & Ride(GO train); Local Transit & Ride(GO bus); Local Transit & Ride(GO train); Cycle & Ride(GO Train); Cycle & Ride(GO Bus).
- **Attributes**:
  - **Mode Specific**: In vehicle travel time, Total walking and waiting time, Travel and parking cost, Purpose of trip (only Mode Choice), Egress mode (only Route Choice)
  - **Transit Policy in response to Pandemic**: Compulsory wearing mask, crowding, boarding & alighting at different door, contactless payment
  - **Pandemic Specific**: Daily new case for 14 days in Ontario, Mortality rate, Vaccine
Changes in the use of Shared Travel Modes (Patrick Loa et al.)

**General Pandemic Behaviour**
- Self-identification as a high-risk person
- Number of high-risk persons in the household
- Requirement to be present at one’s workplace during the pandemic
- Attitudes towards social distancing
- Daily routine during the pandemic
- Impact of the pandemic on daily activity frequency
- Belief about when the next pandemic will occur

**SP Experiments**
(Based on mode choice for a hypothetical commuting and non-commuting trip, during and after the pandemic)
- Alternatives: drive alone, driven by someone you know, public transit, exclusive ride-sourcing, shared ride-sourcing, taxi, bicycle, walk
- Attributes: travel time, travel cost, wait time, walk time, number of other riders, parking cost, level of comfort, whether or not masks are required, whether or not vehicles are disinfected at the end of each day, whether or not there is a physical barrier between the passengers and driver

**Pre-pandemic Behaviour**
- Frequency of using exclusive ride-sourcing services
- Frequency of using shared ride-sourcing services
- Trips for which exclusive ride-sourcing was used
- Trips for which shared ride-sourcing was used
- Frequency of using ride-sourcing services for commuting
- Preference between exclusive and shared ride-sourcing
- Model(s) used for commuting trips
- Model(s) used for non-commuting trips

**Household Attributes**
- Residential location (postal code)
- Dwelling type
- Housing tenure
- Nature of living arrangements
- Number of years at current dwelling
- Number of household members
- Number of household vehicles
- Number of household bicycles
- Number of driver’s license holders
- Number of full-time workers
- Number of part-time workers
- Number of students
- Number of persons under the age of 18
- Number of persons over the age of 60
- Household income

**Personal Attributes**
- Age
- Gender
- Driver’s license ownership
- Transit pass ownership
- Employment status before COVID-19
- Employment status during COVID-19
- Occupation type
- Student status
- Marital status
- Highest completed level of education
- Work location (postal code)

**Behaviour During the Pandemic**
- Frequency of using exclusive ride-sourcing services
- Impact of COVID-19 on the use of ride-sourcing services
- Reasons why ride-sourcing is being used more often
- Reasons why ride-sourcing is being used less often
- Impact of COVID-19 on the use of ride-sourcing for different types of trips
- Impact of potential health and safety measures on the willingness to use ride-sourcing services
- Model(s) that will be used for commuting trips
- Model(s) that will be used for non-commuting trips

**Travel-related Questions**

- Attitudinal Questions (Responses to attitudinal questions will be collected using a five-point Likert scale)
  - Perceptions of risk
  - Willingness to leave the house and travel
  - Changes to out-of-home activity participation

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Study into the use of Shared Travel Modes (SiSTM) during the COVID-19 recovery period and post COVID-19 era (Patrick Loa et al.)

Pre-pandemic Behaviour

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### Behaviour After the Pandemic

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<tbody>
<tr>
<td>• Impact of the development of a vaccine or effective treatment method on the willingness to use ridesourcing</td>
<td>• Perceptions of risk</td>
</tr>
<tr>
<td>• Continued use of ridesourcing after the pandemic</td>
<td>• Willingness to leave the house and travel</td>
</tr>
<tr>
<td>• Impact of COVID-19 on the frequency with which ridesourcing will be used</td>
<td>• Feeling of safety when using ridesourcing services</td>
</tr>
<tr>
<td>• Alternatives to ridesourcing services</td>
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<tr>
<td>• Impact of COVID-19 on the willingness to use ridesourcing</td>
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<tr>
<td>• Likelihood of using ridesourcing for different types of trips</td>
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<tr>
<td>• Earliest point in time that they would be comfortable using ridesourcing</td>
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Assessment of the Impacts on Households’ Preferences of Dwelling type, Home location, and Neighbourhood choices (Saeed Shakib et al.)

General pandemic behavior

<table>
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<th>being at risk of severe illness due COVID-19</th>
</tr>
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<tbody>
<tr>
<td># of HH members at risk</td>
</tr>
<tr>
<td>Physical presence at work</td>
</tr>
<tr>
<td>Acceptance of social distancing</td>
</tr>
<tr>
<td>Following stay at home orders status</td>
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<tr>
<td>COVID-19 daily activity &amp; scheduling</td>
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<tr>
<td>COVID-19 impact on lifestyle</td>
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<td>Concern over future pandemic</td>
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HH current residential location attributes
- Relocation decision before COVID-19
- Neighborhood quality
- Neighborhood’s availability of parking
- Access to public transit
- Access to highway network
- Access to local schools
- Factors considered in choosing current location
- Impact of COVID-19 on those factors
Assessment of the Impacts on Households’ Preferences of Dwelling type, Home location, and Neighbourhood choices (Saeed Shakib et al.)

Choice experiment of HH's residential location

| Region (18 GTA regions) | Tenure (Sale/Rent) | Price ( -30% change to 20% change) | Area ( -20% change to 30% change) | Neighborhood quality (3 levels) | Neighborhood's availability of parking (3 levels) | Access to public transit (3 levels) | Access to highway network (3 levels) | Access to local schools (2 levels) | Having the option of flexible office hour (2 levels) | Having the options of telecommuting (4 levels) |
Survey Sampling, Software & Funding: 4 Satellites

- A random sample of **1000** individuals for **each satellite** for **each cycle**
- Survey programming: Commercial online survey software: SurveyGizmo
- Funding: An NSERC Grant (in collaboration with the City of Toronto)
COVi-19 influenced Households’ Interrupted Travel Schedules (COVHITS) Survey: A 2-Cycle Revealed Preference Study
A Core-Filling survey to be conducted in between two core surveys to capture core-type information, but in an extra-ordinary context.

2-cycle small sample survey: to capture the dynamics of adaptations in households travel demands towards the (new) normal contexts.
Following COVID-19 lockdown, it is expected that the travel may gradually return to normalcy.

→ However, not sure how and in which direction it will take to normalcy!

The disruption in daily life, especially the mass-experience in flexible work schedules, telecommuting, e-shopping, and online social/religious activities, may have lasting impacts on travel patterns.

Without any observational data, we’d not have any reference to the future datasets to assess the return to normalcy as well as to the past datasets to assess the effects of lockdown.
**COVHITS Survey Scope:**

- Replicating the CORE data structure as much as possible.

- Additional attitudinal/behavioural questions on how people see the present compared to the pre-COVID situations.

- Reshaping the CORE questionnaire to make it more activity-oriented: activity purpose classifications to be revised to add some in-home activities (e.g., e-shopping, online meeting, online social/religious gathering)
2-Cycle Revealed Preference approach of COVHITS can identify new travel behaviour patterns early to respond with appropriate policies.

Adjust planning for major projects to reflect the emerging new travel behaviour patterns:

- Adjust parameters (if necessary) in regional travel demand models to give range of possible futures based on COVHITS survey data during the COVID-19 recovery period.

Identify when travel patterns have reached a new normal:

- A similar to the Core TTS data structure in the COVHITS survey will allow examining the stability of underlying travel behaviours in the region.
COVHITS Survey Sampling:

- A random sample of households in the GTHA
- A pure random sample (drawn through postal mail-based and/or random digit dialing options) will not be feasible considering timelines and possible budget: 
  → the use of market research panels will be the best compromise.
  → one or multiple marketing research vendors be recruited to deliver a random sample
- Considering the highest possible variance in population behaviour of concern, a minimum of 1000 household samples per study area is required:
  → for a the maximum level of uncertainty the minimum sample size requirement is around 775 resulting 1000 sample with 1.3 design factor
COVHITS Survey Programming:

Travel and Activity Internet Survey Interface
COVHITS Survey Schedule:

- Survey Software Development and Questionnaire Design: June 15 to Aug 30, 2020
  - Cycle 1 - Fall 2020 COVITH Data Collection: September to November 2020
  - Analysis and Reports on Cycle 1 Data: December 2020
- Questionnaire Revision: January to February 2021
  - Cycle 2 - Spring 2021 COVITH Data Collection: March to May 2021
  - Analysis and Reports on Cycle 2 Data: June 2021
COVHITS Survey Sample Size:

- Sample: at least a 5000 sample households per cycle: A total of 10,000 sample in 2 cycles
- This gives a minimum 1000 sample per regional municipality per cycle.
Funding/Sponsors:

4 Satellites
Survey Experiments are Funded by an NSERC Grant in Collaboration with the City of Toronto

The Core COVHITS is funded jointly by MTO, Metrolinx, City of Toronto, Region of York, Region of Peel, Durham and Halton
Team:

Mashrur
Alireza
Patrick
Saeed
Nora
Habib
Jason
Sanjana
Salehin
Zohreh
Kaili
Thank You.

Questions?