COVID-19 Data Analysis: Tools for Managing Uncertainty

Presented by: Michael Porter, Rob Millar, Pete Quinn, Ken Lord, Sheldon North, and Jarod Broadwater
Date: April 22, 2020
Data and modelling updates and insights…
Updated projections of acute phase timing and duration…
The role of testing as we reduce social distancing
Impacts to BGC and industries we work in…
Staff questions…
Pete Quinn, Ph.D., ing., P.Eng.
Principal Geotechnical Engineer
 stil NOT an epidemiologist)

Data in the following few slides come from https://coronavirus.jhu.edu/map.html unless otherwise cited
Passing the peak – select countries

Daily fatalities per million

Days since fatalities reached 0.01 per million population

Fatalities per million (daily change)

- Belgium
- Chile
- Germany
- Italy
- DR
- Spain
- Sweden
- UK
- USA
- Canada
What affects ultimate societal impact?

Confirmed Cases - scaled to population - Eastern NATO countries

Confirmed Cases - scaled to population - Western NATO countries

Average trend of eastern NATO nations

Average trend of western NATO nations
What affects ultimate societal impact?

Cell phone mobility data from: https://www.apple.com/covid19/mobility

Daily fatalities per million - to 15 April 2020

Fatalities day of restrictions versus 25 days later

$y = 56.641n(x) + 116.84$

$R^2 = 0.6468$
Projections - US

Graphic from Institute for Health and Metric Evaluation (funded by the Bill & Melinda Gates Foundation):
www.covid19.healthdata.org

150,000

PQ forecast for mid to end-May

100,000

80,000

65,976 COVID-19 deaths projected by August 4, 2020
Future outcomes depend on human behavior, which is unpredictable.

The next couple of weeks are “locked in” from past behavior, but outcomes beyond ~ 2 weeks depend on behavior starting today.

The US in particular may see a resurgence in fatalities with beaches opening in Florida, Georgia relaxing all restrictions and other states following suit.
Rob Millar: Moving towards a “New Normal”
Hammer and the Dance

March 19 2020

British Columbia

BC’s daily new cases, new ICU admissions & deaths

Data from March 1, 2020 – April 14, 2020. Cases (diagnosed through testing) initially rose and have plateaued, as have ICU admissions. Deaths appear to follow no trend in relation to cases or ICU admissions.

# Oxford Stringency Index

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>School Closing</td>
<td>0- No Measures</td>
</tr>
<tr>
<td>S2</td>
<td>Workplace Closing</td>
<td>1- Recommend</td>
</tr>
<tr>
<td>S3</td>
<td>Cancel Public Events</td>
<td>2- Require/Restrict</td>
</tr>
<tr>
<td>S4</td>
<td>Close Public Transport</td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>Public Info Campaigns</td>
<td>0- Targetted</td>
</tr>
<tr>
<td>S6</td>
<td>Restrictions on Internal Movement</td>
<td>1- General</td>
</tr>
<tr>
<td>S7</td>
<td>International Travel Controls</td>
<td></td>
</tr>
<tr>
<td>S8</td>
<td>Fiscal Measures</td>
<td></td>
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<tr>
<td>S9</td>
<td>Monetary Measures</td>
<td></td>
</tr>
<tr>
<td>S10</td>
<td>Emergency Investment in Health Care</td>
<td></td>
</tr>
<tr>
<td>S11</td>
<td>Investment in Vaccines</td>
<td></td>
</tr>
<tr>
<td>S12</td>
<td>Testing Policy</td>
<td></td>
</tr>
<tr>
<td>S13</td>
<td>Contact Tracing</td>
<td></td>
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</tbody>
</table>

0 – Normal (no intervention)  
100 – Full Intervention

[https://www.bsg.ox.ac.uk/sites/default/files/2020-04/BSG-WP-2020-031-v4.0_0.pdf](https://www.bsg.ox.ac.uk/sites/default/files/2020-04/BSG-WP-2020-031-v4.0_0.pdf)
Oxford Stringency Index March 1

https://covidtracker.bsg.ox.ac.uk/stringency-map
Oxford Stringency Index March 15

https://covidtracker.bsg.ox.ac.uk/stringency-map
Oxford Stringency Index March 29

https://covidtracker.bsg.ox.ac.uk/stringency-map
Current SI Indices

Financial Post
April 16, 2020

https://business.financialpost.com/opinion/this-index-helps-compare-countries-differing-covid-19-policies
Current SI Indices vs Mobility

https://www.apple.com/covid19/mobility

- 82%
Current SI Indices vs Mobility

-70%

https://www.apple.com/covid19/mobility
Current SI Indices

[Graph and chart showing mobility trends and indices for various countries, with a specific focus on Sweden with an index of -20%]

https://business.financialpost.com/opinion/this-index-helps-compare-countries-differing-covid-19-policies
British Columbia: Projections
(Released April 17)

0% (Return to Normal)

Contact-Reduction from Normal

Number of Patients in Critical Care

COVID-19 IN BC
# BC Intervention Time Line

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
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</thead>
<tbody>
<tr>
<td>March 12</td>
<td>Travel not recommended unless Essential</td>
</tr>
<tr>
<td>March 12</td>
<td>Gatherings of More than 250 Banned</td>
</tr>
<tr>
<td>March 13</td>
<td>Returning International Travel required to remain away from work/school for 14 days. Voluntary self isolation.</td>
</tr>
<tr>
<td>March 13</td>
<td>University move courses online</td>
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<tr>
<td>March 16</td>
<td>Strict Physical Distancing—work from home if able</td>
</tr>
<tr>
<td>March 16</td>
<td>Gatherings of More than 50 Banned</td>
</tr>
<tr>
<td>March 17</td>
<td>K-12 Schools Closed</td>
</tr>
<tr>
<td>March 17</td>
<td>Bars and Nightclubs Closed</td>
</tr>
<tr>
<td>March 18</td>
<td>Province-Wide Public Health Emergency Declaration</td>
</tr>
<tr>
<td>March 18</td>
<td>Restaurants, cafes, and other businesses can remain open if 2 m distancing can be maintained</td>
</tr>
<tr>
<td>March 19</td>
<td>Moratorium on Evictions</td>
</tr>
<tr>
<td>March 20</td>
<td>Restaurants closed for dining in. Take out only.</td>
</tr>
<tr>
<td>March 20</td>
<td>Playgrounds closed</td>
</tr>
<tr>
<td>March 21</td>
<td>Personal Services Closed (Hairdressers etc.)</td>
</tr>
<tr>
<td>March 22</td>
<td>Airport Closed to all but Canadian/US Citizens and Permanent Residents</td>
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<tr>
<td>March 26</td>
<td>Indoor gyms and fitness centres closed</td>
</tr>
<tr>
<td>March 26</td>
<td>Mandatory 14-day Quarantine for International Travellers</td>
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</tbody>
</table>
High Risk

- Cruise Ships
- Long-term Care Facilities (Seniors)
- Hospitals
- Meat Processing Plants
- Construction/Mining Camps
- University Residences (?)
Ken Lord: Virology 101
Some context for understanding the pandemic

* just a nerd, not a virologist
What is a virus?

- not living organisms, no metabolism
- can do nothing outside of a cell
- consist only of:
  - a protective capsid shell and/or envelope
  - surface proteins that can trigger a cell to bring it inside
  - the viral genome

- Once inside a cell, cellular machinery can't tell that the viral genome is foreign, uses it to replicate the genome and proteins that can assemble into new virus particles
How do Vaccines work?

- They show your immune system what a pathogen looks like without getting you sick, and with extremely low risk compared to getting sick

- Immune system responds to pathogen or vaccine by creating antibodies that block it, and memory cells that provide future immunity

- Immune system memory cells stand ready to make more antibodies in case of future exposure

- Flu (shot) vaccine: contains no viable virus only parts of the virus that can't infect

- Some vaccines contain weakened 'live' virus that can't cause disease (measles, chicken pox, mumps)

- mRNA vaccines: Getting your cells to make the antigens
What about mutations and new strains? - Corona VS Flu

SARS-CoV-2

- Genome: Single strand of RNA
- has an RNA proof-reading enzyme
- One virus particle can cause infection
- Not as prone to mutations
- Only one strain (so far)
- 30,000 base pairs
- 25 base pair substitutions per year

Type A Influenza (Seasonal Flu)

- Genome: Segmented into 8 packages
- No RNA proof-reading enzyme
- Often several virus particles required for infection
- Highly prone to random mutations
- Large genetic shifts caused by recombination of different strains
- 13,600 base pairs
- 50 base pair subs per year

Credit: www.scientificanimations.com/ CC BY-SA 4.0

https://nextstrain.org/ncov

Credit: https://www.sciencedirect.com/topics/medicine-and-dentistry/influenza-virus
Reopening the world -  
- For SARS (2003), the virus simply died out, not sufficiently infectious  
  - Mostly just infectious while symptomatic  
  - Isolating symptomatic patients ended transmission  
  - With no pathogen, vaccine research eventually ended

Because SARS-CoV-2 can be transmitted asymptotically we need  
- Herd Immunity to protect the vulnerable  
  - either by **vaccine** or eventually by **most people getting infected**

Protecting people from the hazards of getting the disease by having everyone get the disease: **FAIL!**

Resources:

This Week in Virology – Senior virologists discuss science and news
https://www.microbe.tv/twiv/

MedCram.com – Layperson Medical Lectures
https://www.youtube.com/user/MEDCRAMvideos

Scientific Skepticism / Medical conspiracy debunking
https://sciencebasedmedicine.org/

Tracking SARS-CoV-2 vaccine candidates:

Sheldon North
Potential for SARS-CoV-2 Testing at BGC
Potential Testing Scenarios

• Clients requesting field staff are tested
  o General assessment of potential exposure
  o Potential information on herd immunity

• Voluntary testing field staff
  o Antibody presence – you should have immunity
  o Antibody titer - how long might you have immunity

• Voluntary office testing

• Broader family and community testing
Challenges of Current Tests

1. Validity of tests
2. Availability of tests
3. Credibility of tests
Jarod Broadwater: Why does Pepsi cost more than oil?
Economics Update

Things you can now buy for a dollar now...

#OilPrice #OilPrices #crudeoil


https://goldprice.org/gold-price-history.html
How’s China Recovering?

- Property transactions are resuming, signaling that confidence isn't broken. 47%
- Coal consumption is increasing, which indicates that production is resuming. 43%
- People and goods are starting to move again. 73%

Real estate floor space sales:
- Jan 1: 100
- Wuhan shutdown: 2020
- Apr 16: 62

Power plant coal consumption:
- 100
- 72

Traffic congestion:
- 100
- 96

Sources:
- https://www.ft.com/content/f47a39ea-6a66-11ea-a3c9-1fe6fedcca75
- https://hbr.org/2020/03/how-chinese-companies-have-responded-to-coronavirus
Latest Projections – JP Morgan

We see three potential recovery paths
U.S. GDP (indexed, 2019 = 100)


How many quarters might it take to recover back to the prior peak?
U.S. GDP (indexed, pre-recession peak = 100)

Latest Projections - IMF

Thank you.

Questions?

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