Preparing for COVID-29

What can technology-enabled disruption teach us about preparing for pandemics?

Joshua Gans, October 2022
COVID-19 disrupted supply chains, investment, labour markets, education and credit markets

Why was COVID-19 disruptive (really)?
Is it different from “Silicon Valley” type disruption?
Can you be reactive?
What does preparation look like?
Why was COVID-19 disruptive (really)?
Why was COVID-19 disruptive (really)?

Public health answer: because people were or were scared of becoming sick
Why was COVID-19 disruptive (really)?

Public health answer: because people were or were scared of becoming sick

Real answer: because people do not know who was infectious
THE PANDEMIC INFORMATION GAP

THE BRUTAL ECONOMICS OF COVID-19

JOSHUA GANS

MIT Press, 2020
The Testing Economy

The cows were not safe. They were mad. But what made them unsafe was that anyone consuming them may well become mad. That is what the United Kingdom discovered in the 1990s. It was found that cattle affected by bovine spongiform encephalopathy (BSE) could cause a variant of Creutzfeldt-Jakob disease in humans. That disease would mentally impair its victims and eventually take their lives. As of 2013, 177 people in the United Kingdom had died. Not surprisingly, no one wanted to consume cattle that might have BSE.

The reaction of the United States to cases of BSE is instructive. In 2003, a cow imported to the United States from Canada was found to have BSE. Imports were banned. In Canada, cattle prices fell by a half and retail beef prices by 14 percent. Canada’s annual beef export revenues to the United States fell by two thirds. At the time, Canadian beef made up three quarters of US beef imports, so this imposed costs on both countries, with losses estimated in the billions. When, later in 2003, an infected cow was discovered in Washington State, the trade bans fell on the other foot.

As internal bans were neither palatable nor practical, the US Department of Agriculture (USDA) ramped up testing. It favored what was argued to be a less accurate “rapid” immunologic test (with results delivered in hours rather than weeks). The cost of these tests was about $200 million, but the positive impact on reviving the US beef export industry was far in excess of this.

This chapter is about the value of testing and how it can improve the functioning of markets when there are infectious diseases. The BSE example indicates the value of testing for the beef trade and has strong lessons in the wake of COVID-19 for how the testing of humans can make it safe for people to interact with one another. But before getting to the meat (I) of the issue, there was one more twist in the USDA’s handling of BSE testing. Having successfully demonstrated the economic value of tests, the USDA promptly banned them.
The pandemic information problem is that we do not know at any given moment who is infectious and should be isolated.

Without a solution, we treat everyone as equally infectious, which is when a pandemic becomes disruptive.
Daily new confirmed COVID-19 deaths per million people
7-day rolling average. Due to varying protocols and challenges in the attribution of the cause of death, the number of confirmed deaths may not accurately represent the true number of deaths caused by COVID-19.

Source: Johns Hopkins University CSSE COVID-19 Data
Daily new confirmed COVID-19 deaths per million people

7-day rolling average. Due to varying protocols and challenges in the attribution of the cause of death, the number of confirmed deaths may not accurately represent the true number of deaths caused by COVID-19.

Source: Johns Hopkins University CSSE COVID-19 Data
Daily new confirmed COVID-19 deaths per million people
7-day rolling average. Due to varying protocols and challenges in the attribution of the cause of death, the number of confirmed deaths may not accurately represent the true number of deaths caused by COVID-19.

Source: Johns Hopkins University CSSE COVID-19 Data CC BY
South Korea

Retail and Recreation -17%
Groceries and Pharmacies -14%
Parks +48%
Transit Stations -14%
Workplaces -13%

Spain

-94%
-77%
-90%
-89%
-68%

Sources: Tomas Pueyo analysis, Google: https://www.google.com/covid19/mobility/
Tests conducted per confirmed case of COVID-19
7-day rolling average. The number of tests divided by the number of confirmed cases. Comparisons across countries are affected by differences in testing policies and reporting methods.

Source: Official data collated by Our World in Data
Note: Our data on COVID-19 tests and positive rate is no longer updated since 23 June 2022.
Is it different from “Silicon Valley” type disruption?
Many Incumbents Saw Disruption Coming

... but failed to adjust.
Emerald Sea
“We needed a code name that captured the fact that either there was a great opportunity to sail to new horizons and new things, or that we were going to drown by this wave.”

Vic Gundotra
“We needed a code name that captured the fact that either there was a great opportunity to sail to new horizons and new things, or that we were going to drown by this wave.”

Vic Gundotra
Power and Prediction
The Disruptive Economics of Artificial Intelligence

AJAY AGRAWAL
JOSHUA GANS
AVI GOLDFARB
Prediction Machines

The Simple Economics of Artificial Intelligence

Ajay Agrawal | Joshua Gans | Avi Goldfarb
Can you be reactive?

Designing systems on the fly is hard
Politics

Feds announce plan to buy 7.9 million rapid COVID tests as Health Canada defends slow response

Health Canada has not yet authorized Abbott Laboratories’ ID NOW test

John Paul Tasker · CBC News · Posted: Sep 29, 2020 12:42 PM ET | Last Updated: September 29, 2020

People wait in line for hours at a COVID assessment centre at St. Michael’s Hospital in Toronto on Monday, September 28, 2020. (Nathan Denette/The Canadian Press)

The federal government today announced a plan to buy 7.9 million point-of-care COVID-19 tests in the months ahead — and defended a Health Canada regulatory process that has left the country with few rapid testing devices to deploy as cases mount.
Is it different from "Silicon Valley" type disruption? You can prepare if you have a system AI — Power and Prediction
COVID-19 PREVENTATIVE MEASURES

Layers of Protection

- Rapid Screening System
- Physical Distancing
- Use of Masks
- Hand Washing Stations
- Symptom Check
**WORKPLACE**

**EMPLOYEES GOING INTO WORK**

Infectious employee who does not know they could infect others (asymptomatic)

**EMPLOYEES IN WORKPLACE ARE INFECTED**

**WORKPLACE OUTBREAK**

**WORKPLACE WITH RAPID SCREENING SYSTEM**

**EMPLOYEES GOING INTO WORK**

Infectious employee who does not know they could infect others (asymptomatic)

**EMPLOYEES IN WORKPLACE ARE NOT EXPOSED TO INFECTIOUS CO-WORKER**

**SAFER WORKPLACE**

Employees are rapid screened before entering the workplace (2x per week)

1 employee screens presumptive positive

Employee exits workplace to obtain confirmatory PCR test

1 employee isolates
Why do focus on regularly screened (2x per week)?

Rapid antigen screens are useful for detecting infectiousness. People can be infectious 2-3 days before symptom onset.

Screening employees 2x per week ensures detection during the infectious stage.

Modelling studies show to control transmission it is better to screen more frequently (i.e. at least 2 days a week) with a less sensitive test than less frequently (i.e. only once per week or ad-hoc) with a more sensitive test.*

*Larremore et al Sci Adv 2021
Rapid Antigen Screening

Dinnes et al. Cochrane Database Syst Rev 2020

Reference: American Society for Microbiology: Rapid Antigen Testing (Point-of-Care)
MOLECULAR DIAGNOSTIC TEST

PCR Testing (NOT for workplace rapid screening)

(i) Nasopharyngeal or and oropharyngeal (throat) swab <10–15 min

(ii) Sample storage at 2–8°C for up to 3 days and RNA extraction

(iii) RNA extraction and purification process ~45 min

Deactivated virus

Purified RNA

(iv)

(v) RT-qPCR real-time test results


CDLRAPIDSCREENINGCONSORTIUM.COM
Rapid screening systems are operational in a diverse constellation of workplaces across Canada.
Screening Sites Across Canada

- # of Screening Sites live: 3,550
- # of orgs in CDL RSC: 1,987
  - Cohorts #1 - #50

*Information as of Mar 31, 2022*

"CDLRAPIDSCREENINGCONSORTIUM.COM"
CDL RAPID SCREENING CONSORTIUM

CDL RSC Growth (Active Organizations)

National Implementation

Week Starting

Number of Screens Administered

- Screens Administered
- Active Organizations
- Active Sites

Number of Organizations / Sites
CDL RAPID SCREENING CONSORTIUM

Summary Data (March 31, 2022)

Province
- Regularly Screened Participants Last Week
  - ON
  - AB
  - QC
  - BC
  - MB
  - NS
  - NB
  - SK
  - NL
  - PE
  - QC
  - SK

Organization
- # of Regularly Screened Participants by Week
- # of Regularly Screened Participants Last Week
- # of Presumptive Positives
- # of Presumptive Positives Last Week
- # of Screens
- # of Active Organizations
- # of Active Sites
Contribution to Provincial Analyses

Ontario Science Advisory & Modeling Tables

CDL RSC workplace screening data compared with:

- Hospital administration screening
- Wastewater signal
- Repeat testers

for analysis & surveillance of the COVID-19 pandemic in Ontario (March 17, 2022).
**Letters**

**RESEARCH LETTER**

**False-Positive Results in Rapid Antigen Tests for SARS-CoV-2**

Concerns have been raised whether rapid antigen tests for SARS-CoV-2 can result in false-positive results and can undermine public health efforts to control the spread of COVID-19. We therefore assessed the prevalence and impact of false-positive results in rapid antigen tests for SARS-CoV-2 in a large population in a hospital setting.

**Methods** Rapid antigen tests for SARS-CoV-2 were implemented in a large hospital setting in Canada. All patients admitted to the hospital for suspicion of COVID-19 were tested using rapid antigen tests. The prevalence and impact of false-positive results were assessed by comparing the results of rapid antigen tests with results of PCR tests performed on the same samples.

**Results** Among 10,000 patients tested, 150 false-positive results were identified. The prevalence of false-positive results was 1.5% (95% CI 1.3% to 1.7%). The impact of false-positive results was limited, as only 5% of patients who tested positive on rapid antigen tests were confirmed positive on PCR tests.

**Conclusions** The prevalence of false-positive results in rapid antigen tests for SARS-CoV-2 is low and does not appear to undermine public health efforts to control the spread of COVID-19 in this hospital setting.

**References**


CDL operates five sites in Canada; three in the United States; and four in Europe.
## Increase Probability of Success

<table>
<thead>
<tr>
<th>Equity Value Creation</th>
<th>Sites Focused on Global Impact</th>
<th>Participating Companies</th>
<th>Streams</th>
</tr>
</thead>
</table>
| $24B                  | 12                            | 675+                    | • Agriculture  
|                       | CDL operates ten sites, each tied to a top tier research institution and business school | 675+ companies were accepted into the 2021/22 CDL Program Year | • Artificial Intelligence  
|                       |                               |                         | • Blockchain  
|                       |                               |                         | • Climate  
|                       |                               |                         | • Commerce  
|                       |                               |                         | • Compute  
|                       |                               |                         | • Digital Society  
|                       |                               |                         | • Energy  
|                       |                               |                         | • FinTech  
|                       |                               |                         | • Health  
|                       |                               |                         | • Manufacturing  
|                       |                               |                         | • Matter  
|                       |                               |                         | • Neuro  
|                       |                               |                         | • Oceans  
|                       |                               |                         | • Prime  
|                       |                               |                         | • Quantum  
|                       |                               |                         | • Risk  
|                       |                               |                         | • Supply Chain  
|                       |                               |                         | • Space  
|                       |                               |                         | • Web3 |
What does preparation look like?
What does preparation look like?

Answer: Winnipeg
Duff Roblin
1962 - 1966 Constructed the Red River Floodway at a cost of $63 million.

More earth moved than for the Suez Canal
“Duff’s Folly”
Red River Floodway

One of the most significant flood protection measures in Manitoba is the Red River Floodway, which protects the City of Winnipeg. Starting in 2005, Canada and Manitoba invested $665 million to further expand the Red River Floodway.

- The original floodway was built between 1962 and 1968 and cost $63 million.
- At the time, excavation of the floodway channel was the second largest earth moving project in the world (second only to the Panama Canal and larger than the Suez Canal project).
- Since 1968, it has prevented more than $40 billion (in 2011 dollars) in flood damage in Winnipeg.
- It is often referred to as Duff's Ditch in recognition of then-Premier Duff Roblin, who spearheaded the development of the floodway.

The expansion of the current floodway system (including the West Dike and channel outlet) began after the 1997 flood, to protect the City of Winnipeg from a one-in-700-year flood. It increased the floodway's capacity - from 90,000 cfs (cubic feet per second) to 140,000 cfs. The floodway operates by diverting a portion of the Red River flow around Winnipeg through the floodway channel. During flooding, as the river naturally rises, it spills over the floodway channel entrance and flows down the floodway channel. When this happens, the river water flows through two routes - through the city and through the floodway. At the same time, it drops below its natural level, south of the floodway inlet.

- When the floodway gates are raised, the water level south of the floodway inlet is restored to its natural level which, in turn, allows more water to spill into the floodway. As Red River flows continue to increase, the level south of the inlet drops below natural again and the gates are raised further. This process continues as long as the flow in the Red River continues to increase.

- During the majority of floods, the floodway is operated to ensure that the water level south of the city is maintained at the natural level - that is the level that would occur if the flood control works did not exist.
What does preparation look like?
What does preparation look like?

Answer: South Korea
SNAPSHOT OF AN OUTBREAK

Cases of Middle East respiratory syndrome (MERS) reported in South Korea and China.

Number of cases

Date of symptom onset

As of 9 June, 12 cases are missing a date of onset.
Summary
Preparing for disruption — technological or biological — is possible
Summary

Preparing for disruption — technological or biological — is possible.
History tells us it requires investing in a system.
Preparing for disruption — technological or biological — is possible.
History tells us it requires investing in a system
That takes time and effort
Preparing for disruption — technological or biological — is possible.
History tells us it requires investing in a system
That takes time and effort
It requires sacrificing short-run benefits as the premium paid on insurance
Preparing for disruption — technological or biological — is possible.

History tells us it requires investing in a system

That takes time and effort

It requires sacrificing short-run benefits as the premium paid on insurance

but …
Why Are There Almost No Memorials to the Flu of 1918?

A restaurant owner in Vermont and a professor from New Zealand are among the few to commemorate the most lethal pandemic since the bubonic plague.

By David Segal
May 14, 2020

At Hope Cemetery in Barre, Vt., a five-ton granite bench sits on a triangle of grass. It is a mere five feet high and three feet deep, which seems modest in scale relative to the calamity it commemorates.

“1918 Spanish Flu Memorial” reads an inscription on the front. “Over 50 million deaths worldwide” is chiseled on the back.
Web: www.joshuagans.com
Twitter: @joshgans
Newsletter: joshuagans.substack.com