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Covid-19 and the Lack of Public Health and Government Preparation

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Abstract:

Much has been revealed recently regarding the relative unpreparedness of Public Health Authorities and their governments in many countries. We show that a lack of preparedness for the Covid-19 pandemic resulted from four major types of shortcomings. First, even when there were problems noted in previous epidemics, clear plans were not put in place to deal with similar situations. Second, there was a lack of transparency through the years about whether plans had been implemented after they were written. Third, it wasn't clear that authorities had considered *ex ante* the effects of pandemic policies on overall health (including mental health). Fourth, governments were largely unprepared to consider the interdependence of health and economic factors in a pandemic and how appropriate "lockdown", income transfer, and loan policies could be implemented in practice. These shortcomings have increased the economic, health, and social costs of the pandemic. Because pandemics differ significantly, models have a very limited role early in a pandemic. To be the most useful later in a pandemic, they need to incorporate important heterogeneities across age groups and types of location. Importantly, to be useful in examining which policies might be best, they need to incorporate not only the way the disease spreads, but the interdependent effects on overall health and the economy.

Keywords: Covid-19, economic policy, medical policy, pandemic models, lockdown.

JEL Codes: I18, H12, H51,H84, G21

1. Introduction

Much has been revealed recently regarding the relative unpreparedness of Public Health Authorities and their governments in many countries, even in those where extensive reports were written in response to earlier pandemics or epidemics. In a series of four papers, and drawing on experience with the unpreparedness of financial regulators prior to the Global Financial Crisis of 2008-2009, we explore ways to reduce the severity of a pandemic. We focus on health-sector preparedness, developing better pandemic models, and the role of government beyond public health—including holding pandemic wargames. Such wargames are exercises that test personal, communication and physical systems in a simulated pandemic.

In this first paper in the series, we focus on weaknesses in the planning and preparation of the Public Health Authorities—and associated weaknesses in government planning and preparations—given what has been revealed by the Covid-19 pandemic. Weaknesses in planning and preparation have likely significantly increased the health, economic, and social costs of the Covid-19 pandemic.

There is pervasive uncertainty in a pandemic, regarding important details about the transmission of the disease and who is at greatest risk of dying: elements of that uncertainty can last for several months. Another fundamental uncertainty is how the public will react to any policy that has never been put into place before. It is impossible to define optimal policies *ex ante*. However, uncertainty can be magnified if known existing vulnerabilities (such as inadequate hospital space and inappropriate conditions in long-term care facilities) have not been dealt with or if appropriate planning is not done in advance. Key areas need to be covered in such a planning exercise, including:

- Allocations of responsibility
- How key actions would be carried out
- Requirements for equipment, personnel and space in worst-case scenarios
- Expectations of the public at large and private-sector organizations
- Communication procedures with the public at large and private-sector organizations, as well as among governments, public health authorities, and medical personnel.

In undertaking planning, authorities need to be cognizant of the fact that the response of the public to the perceived seriousness of disease (not only the probability of death, but the probability of severe illness) will lead to changes in behaviour even in the absence of any policy implementation by public health authorities or government. These changes could include reducing travel (local public transport, national, and international), avoiding crowded situations (including non-essential shopping), pulling children out of school, and refusing to work in situations that are felt to be unsafe.

Section 2 of our paper deals with the health-sector short-comings of the response to the Covid-19 pandemic include the **absence** of the following:

- A plan for sufficient availability of personal protective equipment, ventilators, other equipment, workers, and hospital space during a pandemic
- Clarity of governance regarding the responsibility of updating plans and checking that they are being followed before a pandemic, as well as transparency regarding those plans and whether supplies are at targeted levels
- Clarity of expectations for non-health-sector employers regarding personal protective equipment
- Clarity in federations or countries with regional health authorities of the role of the national government in providing additional personal protective equipment and ventilators
- Clarity of policy tools regarding closure of borders to people
- Examination of operational risks in important elements of the health care sector
- Clear strategy for testing for a disease and contact tracing in the case of communicable diseases
- Clear standards for rapid detailed data collection and report dissemination regarding (i) disease and (ii) total deaths in the economy
- Ex ante consideration of possible policies to contain the disease may have on (i) mental health and (ii) delaying surgeries for serious health conditions
- Ex ante consideration of how messages should best be communicated to the public, for example to limit unwanted effects on mental health and physical exercise

- Ex ante consideration of how to deal with workplaces, especially in key industries, where physical distancing is difficult given current work practices (especially where a "production line" is involved).

We illustrate many of these shortcomings with experience from around the world, with particular attention given to Canada and the province of Ontario.

Models are always simplifications of the real world. However, severe oversimplifications can lead to poor policy and poor forecasts, as we discuss in section 3. We are particularly concerned that prior to the pandemic there were few models that (i) emphasized important heterogeneities across the population and locales, and their implications for policy; and (ii) could be used to examine overall economic and social costs—as opposed to just the direct impact of a pandemic on morbidity and mortality—associated with policy responses.

In section 4 of the paper, we deal with the lack of appreciation by most governments of how they would be pulled into key decision-making when a pandemic broke out. There was often little ex ante appreciation (1) that there were economic preparations that governments needed to make to deal with a variety of major shocks, especially pandemics; and (2) that health and economic factors are interdependent. Examples of the first are lack of consideration of how to get income and loans to a huge number of people; and lack of more explicit planning to understand economic linkages and to list those industries that are absolutely essential. Examples of the second are lack of joint consideration by public authorities on limiting social interaction (outdoors and inside) versus limiting economic interaction (workplace and marketplace); absence of stress testing using stresses at least as great as those experienced over long historical periods; absence of pandemic wargames that included governments and economic concerns in addition to public health concerns; and failure to incorporate learning from wargames into subsequent planning.

2. Short-comings in Public Health Preparation for Pandemics

In principle, pandemics can occur in many types of infectious diseases (communicable diseases). They can be contagious diseases spread by contact with infected individuals or their bodily fluids

or discharges, by contact with objects or surfaces that have been contaminated by such fluids or discharges, or by ingesting contaminated water or food. They can also be the type of infectious diseases that arise from direct or indirect contact with insects (e.g. mosquitoes or fleas) or animals (mice). In the advanced world, pandemics have been in contagious diseases spread by contact with infected individuals or their bodily fluids or discharges (directly or indirectly through contaminated objects or surfaces). Most pandemics in advanced economies since the beginning of the 1900s have been from contagious viruses, particularly influenza viruses and coronaviruses. Pandemics from these two types of virus will be the focus of much of our paper, but much of our writing applies to pandemics more broadly.

We outline twelve major shortcomings in preparation for a pandemic in Canada and many other countries.

2.1 Plans for Equipment, Buildings and Labour Not Made or Not Implemented

Dealing with risks of any kind typically requires a plan (not just a report) that is adopted by the relevant authority or board. A key element of this plan is specifying how the additional services required when a pandemic occurs will be produced from equipment, buildings, and labour. This would often involve establishing a stockpile of required equipment and, often, excess accommodation for patients. This should include plans specifying under what conditions additional personnel will need to be hired, and existing personnel redeployed. The plan needs to be updated annually.

In the Covid-19 pandemic in a number of jurisdictions, many health workers have not had sufficient personal protective equipment (PPE)[1] such as N95 masks, shields, and gowns. As well, there was a perceived lack of ventilators[2] to treat the very sick. There was also a lack of testing kits, in part because of a shortage of key inputs into those kits such as swabs and reagents

[1] See Rachel Gilmore and Mahima Singh, "Feds continue to seek masks, other PPE after admitting stockpile 'likely' not enough," CTV News, April 2, 2020. https://www.ctvnews.ca/health/coronavirus/feds-continue-to-seek-masks-other-ppe-after-admitting-stockpile-likely-not-enough-1.4880269

[2] See Kerri Breen, "Coronavirus pandemic puts Canada's supply of ventilators in the spotlight," Global News, March 17 (updated March 20), 2020. https://globalnews.ca/news/6682780/coronavirus-pandemic-ventilators-canada/

(testing chemicals).[3] (Furthermore, there was not a plan as to how domestic production of needed equipment could be ramped up immediately.)

In this pandemic, a number of jurisdictions, including many Canadian provinces, started with hospitals very close to full capacity. To make hospital beds available for what might be needed for Covid-19 patients, this meant that all elective surgeries were cancelled. Although some new hospital rooms were constructed, in places such as Wuhan, China;[4] Hamilton, Ontario;[5] and London, England and other spaces converted to provide testing facilities, such as Brewer Arena in Ottawa, Ontario (The Ottawa Hospital 2020). There was an attempt to expand the capacity in New York in cooperation with the U.S. military, but the initial stages of the expansion were botched.[6]

Also, in many Canadian provinces, there was already a shortage of personal support workers, especially in long-term care facilities (nursing homes). In part this was because of poor working conditions, low pay, no benefits, and the hiring of many part-time workers who had two or three jobs in different long-term facilities (Dijkema and Wolfert 2019, Working Group on Long-Term Care 2020). When some personal support workers caught Covid-19, there were not enough other personal support workers to replace them. This led to hospitals having to lend personnel and Quebec and Ontario requiring support from the Canadian Armed Forces.[7]

As new information becomes available (e.g. from epidemics elsewhere, and the availability of new types of equipment), plans need to be revised to take this information into account.

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[3] See Andrew Russell, "Coronavirus: How rapid testing kits could lead to more targeted screenings," Global News, April 6 (updated April 13), 2020. https://globalnews.ca/news/6785112/coronavirus-rapid-covid-19-test-kits-canada/

[4] See BBC News, "Coronavirus: The hospital built in a matter of days," February 2, 2020. https://www.bbc.com/news/in-pictures-51280586

[5] See Dan Taekema, "How to build a hospital wing for a pandemic in just 14 days," CBC News, April 2. https://www.cbc.ca/news/canada/hamilton/covid-joseph-brant-blt-construction-pandemic-unit-1.5518090

[6] See The Washington Post. https://www.washingtonpost.com/national/javits-center-comfort-new-york-covid-patients/2020/04/10/edeb002e-7a82-11ea-b6ff-597f170df8f8_story.html

[7] See Emma McIntosh, "Ottawa to send military to help in Ontario nursing homes hit by COVID-19," Canada's National Observer, April 23, 2020. https://www.nationalobserver.com/2020/04/23/news/ottawa-send-military-help-ontario-nursing-homes-hit-covid-19

2.2 Insufficient Governance and Transparency

Best practice in organizations requires good governance and transparency to both employees and the public.

Good governance and public transparency in pandemic planning appears to have been missing in Canada. Although there were a number of reports since the SARS epidemic of 2003, the key elements of pandemic plans do not appear to have been approved by governments on a regular basis. Plans, or informative summaries, were not made available to the general public. Targets for the size of stockpiles of PPE and ventilators were not made public, nor were the actual sizes of those stockpiles. As out-of-date equipment was destroyed, it was not replaced.[8]

As a pandemic unfolds, governments and public health authorities need to be clear about their specific objective — even if that has to shift as more information becomes known about the disease. For some diseases, virtual eradication may be possible before a vaccine, but often that will not always be the case. It is very unlikely to be the case for Covid-19. If the initial objective is to "flatten the curve" and protect vulnerable populations, then that should be declared as the official goal. Subsequent changes in the goal need to be clearly changed and fully justified.

Some "objectives" are derived from more fundamental values. The intermediate objective is derived from fundamental objectives, evidence and theory. Evidence and theory are subject to considerable uncertainty. With new information or more accurate theories, the intermediate objective may need to change to accommodate the new theories and evidence.

2.3 Unclear Public Health Authority Expectations for the Non-health-care Sector

The assumptions that authorities make about the behaviour and preparedness of the public need to be communicated clearly to the public.

In many (especially non-Asian) countries, members of the public were unaware of the potential advantages of non-medical masks and so did not generally own any. Some large employers in Canada did own significant numbers of non-medical masks and PPE, for example Bell Canada (2020), but this was the exception rather than the rule. Even long-term care homes did not have

[8] See Global News Staff and Canadian Press, "Trudeau vows Canada's PPE stockpile policies will be overhauled to prevent waste," Global News, April 20 (updated April 30), 2020. https://globalnews.ca/news/6844277/coronavirus-trudeau-stockpile-waste/

sufficient PPE for their employees. It is not clear that employers in the food, agricultural and fishing industries had ever been asked to think about acquiring PPE for the employees prior to Covid-19.

2.4 Absence of Clarity of Stock-piling Roles of Various Levels of Government

Clarity of roles in a federation or in a country where there are regional authorities needs to be established.

Although constitutions lay down the responsibilities for health, even where the responsibility for health is a state/provincial one, the federal government often takes on certain roles, even if it is a coordinating one. From an insurance point of view, it is cheaper for some of an equipment stockpile to be held at the federal level so that the equipment can be made available to the states or provinces needing it. However, there needs to be clarity ex ante into the appropriate sizes of stockpiles so that one level of government is not assuming that the other will be doing nearly all of the provision of equipment. Such ex ante clarity is also important when there is only one level of government, but regional health authorities exist and have been given some role in targeting and holding stockpiles of needed equipment. The purpose of stockpiles also needs to be made clear. A Canadian government official argued that the federal government's stockpile was not designed for a pandemic.[9]

2.5 Insufficient Advance Discussion of Policy Tools Regarding Borders

No matter what topic we are talking about, a large percentage of shocks come from abroad. Therefore, border policies are an important issue.

Pandemics by their very definition start in one country and spread abroad. Pandemics of contagious diseases, especially influenza and coronavirus diseases, are almost always going to be spread by international travellers. Thus, countries need to think ex ante about prohibition of travel versus quarantine. In the latter case, they need to think about how quarantine is to be implemented (including reports, location, and enforcement). It is unclear if many countries had made plans ex ante, especially on what should guide the decisions to prohibit certain types of

[9] See Ryan Tumilty, "Government officials say national stockpile not designed for pandemic: 'We do not focus on PPE'" *National Post*, May 15, 2020. https://nationalpost.com/news/government-officials-say-national-stockpile-not-designed-for-pandemic-we-do-not-focus-on-ppe

travel and the type of quarantine that should be implemented. In the current pandemic, a number of "island nations" such as New Zealand and Australia moved fairly quickly to close borders, while other countries (e.g. the United Kingdom) were much slower in closing borders. There are various policy options available and some may be more successful than others. Some have pointed to Hong Kong's model, involving testing and quarantine, as being preferable to Canada's.[10] Because of the potentially important economic and diplomatic effects of border closures or restrictions, national governments need to be prepared to take decisions in a timely fashion.

Restricting travel across state or provincial boundaries or across regions within geographically large provinces or states should also be considered ex ante. Several Canadian provinces and territories have either closed their borders or are requiring a two-week quarantine.[11] The province of Quebec[12], the Australian state of Victoria, and the country of Italy are three other examples, among many, which restricted travel across regions.

2.6 Insufficient Consideration of Operational Risks

Any firm or government needs to consider operational risks.

There are some key operational risks presented by contagious diseases when health care workers work in two or more locations and/or come into contact with many people outside of work. In Canada, there are many nurses and personal support workers, as well as some doctors, who work in more than one hospital or long-term care facility. This has helped the spread of Covid-19. Such work arrangements do not appear to have been considered ex ante in Canada. The Office of the Public Health Officer (2020) in British Columbia banned personal support workers from working in more than one facility early in the pandemic. It took other provinces, such as Ontario,

[10] See The Globe and Mail, "Hong Kong stopped a pandemic at the border. The Trudeau government has to do the same," May 14, 2020 for May 15 newspaper. https://www.theglobeandmail.com/opinion/editorials/article-hong-kong-stopped-a-pandemic-at-the-border-the-trudeau-government-has/

[11] See CBC News, "As provincial governments ease lockdowns, man travel restrictions remain," May 11, 2020. https://www.cbc.ca/news/canada/provinces-travel-restrictions-border-checkpoints-1.5561074

[12] CBC News, "Quebec restricting travel to 'vulnerable regions' as it works to contain COVID-19," March 28, 2020. https://www.cbc.ca/news/canada/montreal/covid19-march28-1.5513555

longer.[13] There also should be ex ante advice for health-care workers as to their contact with people outside their facility, considering the possibility of contagion in both directions.

Another operational risk is not having enough laboratory capacity to process tests for a disease. This was a problem in Ontario.[14]

2.7 Insufficient Planning for Testing and Contact Tracing

All organizations should want to know the size of the problem, how fast it is growing and how the problem is spreading (both the big picture and the details).

For contagious diseases, health authorities need to know the total number of cases, how fast cases are growing and how the disease is being transmitted (both person-to-person and at particular locations such as conferences, workplaces, and long-term care facilities). This requires both lots of testing and tracing the contacts of those who test positive.

Lack of test kits can be a problem in doing adequate numbers of tests. Initially this can be because of the time it takes to develop an adequate test and make sufficient test kits. But later, it can be because of poor preparation in having the materials and manufacturing capacity necessary to make the test kits and having enough laboratory capacity to process the tests. This appears to have been the case in both Canada and the United States—at least in some provinces and states. The amount of testing has varied greatly across provinces,[15] states (Johns Hopkins Coronavirus Resource Center 2020), and countries (Our World in Data 2020).

Testing should ideally be given to all persons experiencing symptoms, health care workers who are in contact with those who have been infected, and samples of people who reside or work in risky facilities (long-term care facilities, retirement homes, grocery stores, meat processing plants.) As well, there should be a daily random sample from the general population so that the true spread in the population can be known, as well as the proportion of those infected who are

[13] DeClerq, Katherine, "Ontario restricts long-term care home workers to one facility amid COVID-19 pandemic," CTV News, April 14, 2020. https://toronto.ctvnews.ca/ontario-restricts-long-term-care-home-workers-to-one-facility-amid-covid-19-pandemic-1.4895852

[14] The Globe and Mail, April 16, 2020. UPDATE

[15] CBC News "Regional Testing" May 28, 2020, updated daily, https://newsinteractives.cbc.ca/coronavirustracker/

showing no symptoms.[16] In Canada[17] and many other countries, this standard has not been consistently met throughout the crisis. In principle, widespread random testing can provide data useful for building better models of the spread of a pandemic.

When there are few cases and they have mostly come from abroad, contact tracing can be easier because there are lots of public health resources available (and new cases often know if they've been in contact recently with someone who has returned from abroad). However, if the disease spreads rapidly, border quarantines have been loose, and physically distancing has not being enforced, contact tracing becomes much harder and public health tracers become overwhelmed. Thus, policies to limit the speed of the spread of the disease have significant implications for being able to trace a larger percentage of contacts, which in turn can reduce the future spread of the disease. When the number of new cases fall and physical distancing guidelines are generally followed, it becomes easier to trace the contacts of new cases.

2.8 Insufficient Consideration of Data Needs, Collection, and Dissemination

Good decision-making requires good data and the rapid dissemination of that data.

To understand how a disease is spreading and who is particularly affected, many kinds of information need to be collected from those who are being tested and those tests need to be linked to those who are admitted to hospital, put in the intensive care unit and/or die. It is extremely useful if these data are collected on a uniform basis across provinces/states and countries and rapidly disseminated, not only to public health authorities but, subject to ensuring personal privacy of those tested, to all researchers. In Canada, a recommendation to ensure that data was consistent across provinces was not acted upon in a timely manner.[18]

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[16] Eric Hoskins, "Is COVID-19 less lethal than we thought?", Opinion, The Globe and Mail, published May 14 (online) and May 15 (print), 2020. https://www.theglobeandmail.com/opinion/article-could-covid-19-be-less-dangerous-than-we-thought/

[17] Michael Wolfson, "During the pandemic, why has Canada's data collection lagged so far behind?", Opinion, The Globe and Mail, published April 13, 2020, updated April 14, 2020. https://www.theglobeandmail.com/opinion/article-during-the-pandemic-why-has-canadas-data-collection-lagged-so-far/

[18] Ryan Tumilty, "Report's lessons not learned," Ottawa Citizen, May 21, 2020.

While age and location seem to have been almost universally collected, it is not clear that information such as pre-existing medical conditions, type of domicile (single-family house, apartment, or condo), type of work, and race[19] have been collected.[20]

As well, data on total deaths by week, by province and cause of death need to be collected and disseminated rapidly so that one can determine whether "excess deaths"—which measures the difference between total deaths and what is the normal death rate for that time of year[21]—are being captured by the public health statistics on death from the disease.

2.9 Insufficient Consideration of Other Health Effects of Lockdowns and Quarantines

Consideration of policies needs to take into account that there may be unintended consequences for other things that are important for policymakers.

Policies that deal with lock-downs and quarantines need to take into account that these could (i) have serious effects on mental health; and (ii) result in hospitals delaying surgeries for serious health conditions. These could lead not only to extended poor health, but also death through either suicide or severe worsening of diseases such as cancer and heart disease. In the Covid-19 pandemic, it is not clear that there was ex ante consideration of this issue. Reportedly there has been a rise in mental health problems. As well, it has been estimated that globally some 28 million operations will have been cancelled or postponed over a peak 12-week period (Nepogodiev and Bhangu 2020). In many Canadian provinces, almost all non-essential surgeries delayed from mid-March through May. It has been estimated that it may take a year or more before the backlog of Canadian surgeries is cleared.

Further unintended health consequences of the lockdowns and other policies put into place include: (iii) a decline in routine vaccinations for children, which could lead to increased disease and deaths in the future;[22] (iv) a delay in tuberculosis and HIV treatments in developing

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[19] Christine Ro, "Coronavirus: Why some racial groups are more vulnerable," BBC, April 20, 2020. https://www.bbc.com/future/article/20200420-coronavirus-why-some-racial-groups-are-more-vulnerable

[20] Wolfson, Op. Cit.

[21] The Economist, "Tracking covid-19 excess deaths across countries," May 27, 2020, updated regularly. https://www.economist.com/graphic-detail/2020/04/16/tracking-covid-19-excess-deaths-across-countries

[22] Carly Weeks, "Doctors report decline in routine child vaccinations," The Globe and Mail, May 21, 2020. https://www.theglobeandmail.com/canada/article-doctors-across-canada-seeing-a-drop-in-number-of-routine-child/

countries,[23] which could lead to earlier deaths; (v) overly restrictive birth policies leading to mother stress which could have effects on their baby's health later in life;[24] and (vi) the emphasis on the protection of hospitals leading to worsening crises in long-term care facilities.[25]

2.10 Insufficient Consideration of Communication of Various Messages

Communication of policy can have significant effects on the effectiveness of policy. Even worse, poor communication can lead to unintended consequences.

In pandemics, there is a difference between communicating "stay at home" or "only go out to exercise and buy essentials, while physically distancing." In the Covid-19 pandemic, there have been differences across countries and regions in the "lockdown" or "stay at home" policies that have been put into place, but even within the same policy, there have been different ways that those policies have been communicated. Initially in Canada, the message was "stay at home" instead of "stay at home *except* to get daily outdoor exercise, while keeping 2 meters apart, and it's okay to talk to neighbours at a distance." Communicating a policy in a way that minimizes the importance of exercise and mental health has serious drawbacks, although the shock and simplicity value of "stay at home" message may be useful for the first few days of a lockdown policy so that the new recommendations are taken seriously by the general public.

2.11 Insufficient Consideration of Communicable Diseases in Particular Workplaces

Policies need to take into account particular situations that need to be dealt with explicitly.

Health authorities should know how to prevent the spread of communicable diseases in health facilities. Covid-19 shows that they also need to take into account ex ante that there are particular types of workplaces that are likely to exacerbate the transmission of contagious diseases: therefore, authorities should introduce regulations to reduce that risk. These include meat and

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[23] Geoffrey York, "The COVID-19 pandemic could be 'devastating' for battles against tuberculosis, HIV and malaria," The Globe and Mail, May 22, 2020. https://www.theglobeandmail.com/world/article-the-covid-19-pandemic-could-be-devastating-for-battles-against/

[24] Michael Unger and Suzanne King, "Will pandemic babies live with the effects of their mothers' stress," The Globe and Mail, May 19, 2020. https://www.theglobeandmail.com/opinion/article-will-pandemic-babies-live-with-the-effects-of-their-mothers-stress/

[25] Kelly Grant and Tu Thanh Hu, "How shoring up hospitals for COVID-19 contributed to Canada's long-term care crisis," *The Globe and Mail*, updated May 21, 2020. https://www.theglobeandmail.com/canada/article-how-shoring-up-hospitals-for-covid-19-contributed-to-canadas-long/

poultry processing plants (Center for Disease Control and Prevention 2020a), and perhaps especially workplaces that have not passed other types of health inspections.[26]

2.12 Advanced Warning Systems

There are some crises or disasters for which there can be advanced warning systems. Such is the case, for example, for tsunamis.

Pandemics, by definition, start in one country and spread to many others. Thus, the identification that there is a new disease that has the potential to spread can be very useful for a number of reasons, including containing the spread, beginning to gear up to counter the pandemic using previously formulated plans, and starting work on developing treatments and vaccines. In Canada, the Global Public Health Intelligence Network was put into place to gather intelligence and to find pandemics early. It worked very well for many years. However, its foreign intelligence operation was effectively shuttered in May 2019 as priorities within the Public Health Agency of Canada shifted to more domestic issues and away from foreign threats, reflecting the priorities of senior officials in the Agency.[27] Many personnel were reassigned to other work in the Agency. As a result, Canada was not on top of the situation as it had been in other outbreaks of disease internationally. It was not the only country in which close monitoring of disease outbreaks was downgraded and/or ignored over the years.[28]

3. Construction and Use of Models

Models are essential for understanding policy and making predictions, but they are always simplifications of the real world. Indeed, severe oversimplifications can lead to poor policy and poor forecasts. Modelers of contagious diseases face many challenges that are not faced in in

[26] Justine Hunter, "Covid-19 puts unsafe working conditions at meat-processing plants," The Globe and Mail, May 17, 2020. https://www.theglobeandmail.com/canada/british-columbia/article-covid-outbreaks-shine-light-on-meat-production-in-canada/

[27] See Grant Robertson, "'Without early warning you can't have early response': How Canada's world-class pandemic alert system failed," The Globe and Mail, July 25, 2020 (updated July 28, 2020). https://www.theglobeandmail.com/canada/article-without-early-warning-you-cant-have-early-response-how-canadas/

[28] See Betsy McKay and Phred Dvorak, "Why was no one ready for coronavirus?", The Wall Street Journal, August 14, 2020.

other domains: each disease has some unique elements and the ways in which the disease is different from, or similar to, previous diseases are only revealed by the data over time.

In this section, we discuss the uncertainty in modeling and the need to incorporate certain heterogeneities in models to obtain good forecasts and provide good advice. The development of heterogeneous models, prior to the recent pandemic, could have been used to examine overall net economic and social costs associated with governmental policy responses. We recognize that pandemic modeling will always be very difficult, especially for models designed specifically for forecasting many weeks into the future.

3.1 Fundamental Uncertainties in Estimating and Calibrating Models

A major difference between forecasting pandemics and other phenomenon (such as economic crises or depressions) is that there are no leading indicators that there will be a new disease in the near future. Indeed, it may take a while to identify that there actually is a new disease. Subsequently, one must identify the exact nature of the virus, develop a test for the virus, and prepare test kits so that one can collect data. All this could take several weeks. In the interim, all that is available are data on deaths from the new disease, and these may be under-reported, as they could be attributed to pneumonia or some other condition.

It will take time to identify lags that are inherent in the nature of the virus. Those lags, which could be significantly different across viruses, could include the lag:

- From infection to showing symptoms
- From infection to being infectious to others
- From showing symptoms to time hospitalized (for those who are eventually hospitalized)
- From showing symptoms to time of death (for those who eventually die)
- From showing symptoms to time symptoms typically end (for survivors)
- From showing symptoms to time one is no longer infectious to others

The greater the variance in these lags, the greater the possible importance of heterogeneities (across age, sex, race, location) in affecting these lags. The lower the rate of testing, the longer it will be before there are decent estimates of the mean lags.

Prior to having decent estimates, modelers will typically calibrate some of the parameters in their models to earlier diseases, which may or may not have close similarities to the current disease. That said, most models for prediction are a variant of the SIR model (for Susceptible, Infectious, Recovered) which, in its very simplest form has only two parameters (and requiring data at least on S and I and their rates of change).

Furthermore, even several months after the first detected case, there may be important elements affecting its transmission that are unclear. For example, even in August 2020, there is much uncertainty regarding Covid-19: the percentage of people getting the disease who remain asymptomatic,[29] the length of time that people getting the disease remain immune (Alberta Health Services 2020), how the "viral load" affects transmission (including severity of the disease and probability of dying),[30] and whether there are certain conditions under which people have partial immunity to the disease before ever having the disease.[31] All these uncertainties greatly increase the uncertainty of forecasts regarding the number of deaths to be expected from the disease. In turn, this affects advice regarding the optimal policies to be put into place. Forecasting is not the only reason we have models, however. Knowing very little about many of the parameters of a mathematical model does not mean that models of viral behaviour have no important insights about appropriate health preparations and low-cost policies to implement almost immediately—such as handwashing and physical distancing wherever possible.

3.2 Important Heterogeneities

There are three important types of heterogeneities that are relevant for modeling the spread of a contagious disease: (i) locations within a given geographic area, (2) the geographic location and (3) characteristics of people.

Because the spread of contagious diseases depends on close contact with others, one can look at the probabilities of close contact within a geographic area by workplace, residence, place of

[29] Roz Plater, "As Many as 80 Percent of People with COVID-19 Aren't Aware They Have the Virus," Healthline, May 28, 2020. https://www.healthline.com/health-news/50-percent-of-people-with-covid19-not-aware-have-virus
[30] Ananya Mandal, "Does high COVID-19 viral load mean more risk of infection?" News Medical Life Sciences, April 21, 2020. https://www.news-medical.net/news/20200421/Does-high-COVID-19-viral-load-mean-more-risk-of-infection.aspx
[31] Freddie Sayers, "Karl Friston: up to 80% not even susceptible to Covid-19," report on an interview with Karl Friston, UnHerd, June 4, 2020.
https://unherd.com/2020/06/karl-friston-up-to-80-not-even-susceptible-to-covid-19/

leisure, and type of transportation. In the current pandemic, there is much evidence that rates of infection have been much higher at specific places. Some workplaces by their very nature—many of them involving "line" work—lead to workers being very close to one another. In the current pandemic, this has been very evident in meat and poultry processing plants (Centers for Disease Control and Prevention 2020a). Residences involving close proximity also lead to greater possibilities of disease transmission. Such locations would include prisons in Canada (Correctional Service Canada 2020) and the United States, migrant worker dormitories (such as for migrant agricultural workers in Canada and migrant workers in Singapore),[32] crowded housing of low-income families, and perhaps apartment buildings. Then there are residences that involve close contact with workers, especially medical personnel and personal support workers, such as long-term care facilities, seniors' residences, hospitals and group homes. As noted earlier in the paper, this can be more dangerous when workers are employed at more than one of these locations. Places of leisure, involving large numbers of people, would include spectator sporting facilities, beaches, concerts, conventions, religious services (Centers for Disease Control and Prevention 2020b), funerals[33] and weddings, theatre, and cinema. Local transport by subway or light-rapid transit is suspected of having increased infection rates in large cities such as New York, but buses and taxis also could have similar effects.

Any of these places of close contact with large numbers of people are potential "super-spreading locations." Their existence opens the potential for surges in the number of cases and deaths, as well as making modeling very difficult. On the other hand, without knowing very many details, one can implement policy to minimize the probability that super-spreading will occur in such locations. Thus, closing places of leisure has been one of the earliest steps taken in earlier pandemics (such as the "Spanish 'flu" of 1918-19, Jones 2007)[34] and was one of the earliest

[32] Michael Bociurkiw, "An infection surge has exposed Singapore's migrant-worker blind spot," The Globe and Mail, May 15, 2020. https://www.theglobeandmail.com/opinion/article-a-covid-19-surge-has-exposed-singapores-migrant-worker-blind-spot/

[33] See, for example, Holly McKenzie-Sutter, "Anxiety Lingers as N.L. officials trace bulk of COVID-19 cases to funeral home", The Canadian Press in National Post, April 5, 2020. https://amp.flipboard.com/@NowYouKnow/anxiety-lingers-as-n-l-officials-trace-bulk-of-covid-19-cases-to-funeral-home/a-5JsqARHdTuOdMX5EO5rX2w%3Aa%3A220507260-ef119214bf%2Fnationalpost.com

[34] Esyllt W. Jones (2007) *Influenza 1918: Disease, Death, and Struggle in Winnipeg*, Toronto: University of Toronto Press.

steps taken in the current pandemic. Focus on large gatherings of any kind and super-spreading locations needs to be a focus of policy right from the beginning.

In the very early period of modeling a pandemic in a given country or region, the lack of data means that many of the parameters will have to be taken from the behaviour of disease spread in other countries. However, one needs to recognize that geographic location is itself a source of heterogeneity, because of varying population density, the percentage of commuters who use subway and bus, the degree of contact with those who have recently travelled abroad or are visiting from abroad (especially from countries where the disease is pronounced), cultural norms (such as the normal degree of social distancing and the use of masks when ill)[35] and the average characteristics of the population.

Characteristics of individuals, such as age, sex, pre-existing medical conditions and race, can have pronounced effects on their death rates and even their likelihood of infection. The relative death rates by age of those infected can be very different across contagious diseases. Typical influenza epidemics most affected the old and very young. However, the Spanish 'flu had very large death rates for those in their twenties and thirties. The current pandemic has extremely low death rates for those under forty, with increasing rates for older people, especially for those in their seventies, eighties, and nineties.

Heterogeneities can also arise from differing abilities of medical facilities to handle a surge in cases (thus potentially affecting death rates), the dosage of exposure ("viral load"), and potentially from multiple strains of a virus (Avery et al. 2020).

In terms of prediction models within a given region or country, the heterogeneities that are the most important are likely differences across sub-populations *i* in the mean number of people (R_{0i}) that an infected person will infect directly at a time when everyone is susceptible. This is inextricably linked with the sub-populations inhabiting or frequenting the "super-spreading locations" discussed above. Thus, for example, health care workers and personal support workers who do not have the proper personal protective equipment are likely to have a higher R_{0i} than retired persons living in their own home, physically distancing, and wearing masks in crowded

[35] Lin and Meissner (2020) show that countries or U.S. cities that had higher mortality to the Spanish 'flu in 1918 were more likely to have higher initial mortality in the Covid-19 pandemic.

places. The implementation of good health policies (e.g., hand washing, physical distancing, mask wearing, the wearing of personal protective equipment by health and other personnel), as well as various lockdown policies, can reduce the effective R_{0i}'s of subpopulations. It turns out that expanded SIR models that incorporate heterogeneities across people which focusing on sub-populations with different R_{0i} have very different implications both for forecasting and policy than the simple SIR model (Ellison 2020). The implications of such models include:

- It might take a long time to have a good understanding of the dynamics of a pandemic
- It might be very difficult ex post to get good estimates of the effects of lockdown policies and re-openings (and might overestimate the impact of both—meaning, among other things, that re-openings may have lower effects than some fear)
- Herd immunity effects may slow a pandemic's spread at levels of prevalence in the overall population lower than the simplest SIR models would predict
- Keeping high-contact subpopulations (high R_{oi}) from contracting the disease can be extremely important in reducing the spread of the disease. (This argues for more preparation in regard to the superspreading locations mentioned in the early part of this sub-section.)
- Lockdowns could well be more effective in cutting total deaths over the full length of the pandemic than simple SIR models would claim
- Keeping policies that eliminate activities that cause high spread rates would be important (this could include forbidding certain inside activities without wearing masks and forbidding large gatherings).

In many jurisdictions, it is not clear that prior to the current pandemic the authorities had in place a suite of models, some of which could have been, with some tweaking, helpful for understanding the spread of the virus. That suite of models should have included models with heterogeneities important for understanding some of the key features of the dynamics of previous epidemics or pandemics, such as the Spanish 'flu, SARS, MERS, and 2009 H1N1 'flu.

3.3 Modeling economic, overall health and social effects of pandemics

Although there were a number of models designed to explain and predict infection and deaths from pandemics prior to Covid-19, these were generally not integrated into models of the

economic, overall health, and social effects of pandemics. The optimal policy to combat a pandemic is not the one that minimizes deaths from the pandemic. Rather, it needs to take into account the overall welfare of the population, which would be a function of its overall deaths and health, social well-being, and consumption over time.

The concept of "excess deaths" tries to estimate the marginal impact on deaths of both the virus and the policies that have been put into place because of the virus. It captures the effects on death of worsened mental health, delays in seeking medical attention, delays in non-critical surgeries, a worsened economy, changes in stress levels, potentially lower levels of other communicable diseases, lower traffic accidents, and potentially other factors as well. Most of these factors would affect overall health and social well-being as well as deaths.

Social well-being is also affected by restrictions in freedom of movement and opportunities to participate in certain prohibited events.

After the current pandemic was well underway, there were many useful models created to explore some of the effects on both deaths and consumption (or GDP) of various policies (including doing nothing). These models examine effects on overall welfare of the population as a whole or various groups within that population. Most of the theoretical core of these models depend heavily on key properties of the current pandemic, such as a very high percentage of the deaths in the population occur among older people, a group that has very low labour force participation. Thus, without significant tweaking, they may not be useful for future pandemics whose features could be very different. Nonetheless, they point to some key elements that may be useful in models of future pandemics that would capture economic, overall health, and social effects: age groups, labor-force participation by age-group, and employment in industries deemed "essential" or "non-essential."[36] As these elements, as well as the effects of different R_{0i}'s across key subpopulations, were also important in the Spanish 'flu, it is unfortunate that no one tried to calibrate a model for that pandemic in one or more countries, trying to mimic some of its key features. That would have provided some insights into places to start modeling far earlier in the current pandemic even though, as mentioned earlier, the Spanish 'flu differed

[36] The following papers examine policies and their effects on both the economy and health in the context of models that contain one or more of the key heterogeneities mentioned in the text: Glover et al. (2020); Rampini (2020); Aum, Lee, and Shin (2020); and Acemoglu et al. (2020).

markedly from Covid-19 in the age groups that suffered high death rates. Thus, Covid-19 requires different policies to deal with subpopulations most at risk. Spanish 'flu was quite lethal for a much younger working population than is the case for Covid-19. But this observation must be tempered by other important demographic factors (such as poverty and crowded living conditions) when formulating a policy response.

4. Government Preparation Methodologies and Their Weaknesses:

4.1 Overview:

Although many Western governments had run pandemic wargames and had reports detailing lessons from previous epidemics, the Covid-19 epidemic showed only too clearly their lack of preparation and detailed playbooks as the crisis intensified. Far too often governments appeared to be struggling to formulate appropriate responses to the crisis. In this section we will provide a brief summary of evidence of earlier epidemic reports and wargames.[37] We will argue that these reports and recommended procedures were largely ignored. Furthermore, this material appeared to be too narrow in only considering medical preparation, ignoring the heavy costs of some governmental policy responses – particularly the economic and financial implications of a range of lockdown policies.

4.2 Previous Reports and Wargames:

In April 2020 a Canadian magazine article revealed a long history of national and international pandemic wargames beginning with the HIV outbreak in the 1980's.[38] The article summarizes some of the games and responses. It is not clear that these games explored social, economic, financial and fiscal implications of some of the strategies. But it does quote a number of senior health and political figures involved in the games, who said that little was done in many countries using the games to influence policy and organisational structures. Nor were the games used consistently to prepare senior policy makers for implementing the best policy responses in various plausible scenarios. These revelations should trigger forensic reports by independent teams of professionals in the relevant areas recommending remedial action.

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[37] See Longworth and Milne (2020) for a detailed discussion of these reports and wargames.
[38] See https://www.macleans.ca/news/world/the-doomed-30-year-battle-to-stop-a-pandemic/

4.2.1 Some Countries Have Annual Drills for Major Disasters:

The Republic of Korea and Japan have annual disaster drills that test civilian and Government procedures for a national disaster. [39] Most of these drills have a military component and are focussed on missile attacks, earthquakes, tsunamis, typhoons and floods. The drills have a health component to deal with casualties.

For example, Japan has as part of its public health policy, plans for pandemics and disease outbreaks.[40] September 1st is Disaster Prevention Day when the government, public and private sector organisations and the population prepare for events like earthquakes, missile attacks, nuclear disasters, floods and typhoons. All systems, organisations and equipment are tested. In particular, the health system is tested for a pandemic. Previous epidemic episodes are used as templates for preparing medical and ancillary organisations at local and national levels. An additional benefit is that the population are included in these preparations, so that if a major disaster occurs, the populace is physically, organizationally and psychologically prepared.

4.3 Economic, Financial and Fiscal Preparation:

As far as we can discern from public sources, countries have not prepared for the economic, financial and fiscal impact of the response to the crisis. The direct costs of medical assistance and preparation for the infected are relatively small in relation to national budgets. But the more stringent quarantine and lockdown policies have had significant implications for national economies, unemployment, financial sectors and fiscal policies. The impact of these changes in national policies has been magnified by international long-term lockdown policies that have induced major reductions in international trade, travel, migration and tourism. This severe

[39] For a brief summary see McCormack (2020) https://www.aspistrategist.org.au/australia-needs-to-train-for-disasters-like-this-one/

[40] For a detailed discussion see Chapter 4 in the OECD Reviews of Public Health: Japan: A Healthier Tomorrow (2019) https://www.oecd-ilibrary.org/docserver/9789264311602-en.pdf?expires=1589781897&id=id&accname=guest&checksum=5A12682D7AFDA228007666B69847FA05

decline in international economic activity has been reflected in rising bankruptcies and financial distress that could well exceed the costs of the Great Financial Crisis of 2007-9.[41]

In response to private sector real and financial distress governments have taken unprecedented fiscal and monetary actions.[42] In later papers we will explore these actions in detail. All we need to observe here is the lack of economic, financial and fiscal analysis in the exercises, wargames and reports that many countries had created preparing for an epidemic or pandemic. There appears have been no preparation for, or analysis of:

(i) The private sector implications and costs associated with various types of lockdown policies.

(ii) The dependence of economic costs on the duration of the lockdown.

(iii) Major declines in trade, tourism, international supply chains, migration and international investment stemming from a variety of national lockdown and border policies of varying severity and longevity around the world

(iv) The effects of real sector declines on asset markets, financial markets and credit markets

(v) Government fiscal, financial and monetary interventions

(vi) Various types of government policy interventions and their relative efficiency and effectiveness.

5. Conclusion

A lack of preparedness for the Covid-19 pandemic resulted from four major types of shortcomings. First, even when there were problems noted in previous epidemics, clear plans were not put in place to deal with similar situations. Second, there was a lack of transparency

[41] It is obvious that the social (mental health and other social disruptions), economic and financial costs of a lockdown policy rise exponentially with the length of time of the lockdown. Even when a lockdown is lifted, expectations of a future lockdown (induced by a virus surge) will be reflected in expectations, delaying real investment, and flowing through into lower asset prices and other precautionary behaviour.

[42] See the 2020 BIS Annual Report on the economic, financial and fiscal consequences of the Covid-19 policy interventions. https://www.bis.org/publ/arpdf/ar2020e.pdf

through the years about whether plans had been implemented after they were written. Third, it wasn't clear that authorities had considered *ex ante* the effects of pandemic policies on overall health (including mental health). Fourth, governments were largely unprepared to consider the interdependence of health and economic factors in a pandemic and how appropriate "lockdown", income transfer, and loan policies could be implemented in practice. These shortcomings have increased the economic, health, and social costs of the pandemic.

Because pandemics can be so different from one another, models have a very limited role early in a pandemic. However, to be the most useful later in a pandemic, they need to incorporate important heterogeneities across age groups and types of location. Importantly, to be useful in examining which policies might be best, they need to incorporate not only the way the disease spreads, but the interdependent effects on overall health and the economy.

References

Acemoglu, Daron, Victor Chernozhukov, Ivan Werning, and Michael D. Whinston (2020) "Optimal Targeted Lockdowns in a Multigroup SIR Model," NBER Working Paper 27102, May. https://www.nber.org/papers/w27102

Alberta Health Services (2020) "Topic: Can people with previous COVID-19 infection become re-infected by the SARS-CoV-2virus?" Updated May 12. https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-reinfection-rapid-review.pdf

Aum, Sangmin, Sann Yoon (Tim) Lee, and Yongseok Shin (2020) "Inequality of Fear and Self-Quarantine: Is There a Trade-off between GDP and Public Health?" NBER Working Paper 27100, May. https://www.nber.org/papers/w27100

Avery, Christopher, William Bossert, Adam Clark, Glenn Ellison and Sara Fisher Ellison (2020) "Policy Implications of Models of the Spread of Coronavirus: Perspectives and Opportunities for Economists," NBER Working Paper 27007, April. https://www.nber.org/papers/w27007.pdf

Bell Canada (2020) “Bell acquires 1.5 million protective face masks to support frontline healthcare and other essential public workers throughout Canada,” press release, April 17. https://www.bce.ca/news-and-media/releases/show/bell-acquires-1-5-million-protective-face-masks-to-support-frontline-healthcare-and-other-essential-public-workers-throughout-canada-1

Centers for Disease Control and Prevention (2020a) “COVID-19 Among Workers in Meat and Poultry Processing Facilities—19 States April 2020,” *Morbidity and Mortality Weekly Report*, May 8 (posted online May 1). https://www.cdc.gov/mmwr/volumes/69/wr/mm6918e3.htm

Centers for Disease Control and Prevention (2020b) “High COVID-19 Attack Rate Among Attendees at Events at a Church—Arkansas, March 2020,” Morbidity and Mortality Weekly Report, May 22 publication (posted online May 19). https://www.cdc.gov/mmwr/volumes/69/wr/mm6920e2.htm

Correctional Services Canada (2020) “Inmate COVID-19 testing in federal correctional institutions June 11, 2020” and other dates. Accessed June 12. https://www.csc-scc.gc.ca/001/006/001006-1014-en.shtml

Dijkema, Brian and Johanna Wolfert (2019) “People Over Paperwork,” Cardus, November 12. https://www.cardus.ca/research/work-economics/reports/people-over-paperwork/

Ellison, Glenn (2020) “Implications of Heterogeneous SIR Models for Analyses of COVID-19” NBER Working paper 27373, June. https://www.nber.org/papers/w27373.pdf

Glover, Andrew, Jonathan Heathcote, Dirk Krueger, and José-Víctor Ríos-Rull (2020) “Controlling a Pandemic,” NBER Working Paper 27046. http://www.nber.org/papers/w27046

Johns Hopkins Coronavirus Resource Center (2020) Johns Hopkins Coronavirus Resource Center, “All State Comparison of Testing Efforts,” May 28, 2020, updated daily, https://coronavirus.jhu.edu/testing/states-comparison

Jones, Esyllt W. (2007) *Influenza 1918: Disease, Death, and Struggle in Winnipeg*, Toronto: University of Toronto Press.

Lin, Peter and Christopher Meissner (2020) "Note on the Long-Run Persistence of Public Health Outcomes in Pandemics," NBER Working Paper No. 27119, May. https://www.nber.org/papers/w27119.pdf

Longworth, David and Frank Milne (2020) "Preparing for Future Pandemics: Stress Tests and Wargames", QED Working Paper.

Nepogodiev, Dmitri and Aneel Bhangu (2020) "Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans," *British Journal of Surgery*, May 12. https://bjssjournals.onlinelibrary.wiley.com/doi/full/10.1002/bjs.11746

Office of the Provincial Health Officer, British Columbia (2020) "Order of the Provincial Health Officer to licensees of long term care facilities and private hospitals," March 27. https://www2.gov.bc.ca/assets/gov/health/about-bc-s-health-care-system/office-of-the-provincial-health-officer/reports-publications/covid-19-pho-order-movement-health-care-staff.pdf

Our World in Data (2020) "How Many Tests are Performed Each Day?" May 28, updated daily, https://ourworldindata.org/coronavirus-testing

Rampini, Adriano (2020) "Sequential Lifting of Covid-19 Interventions with Population Heterogeneity," NBER Working Paper 27063, April. https://www.nber.org/papers/w27063.pdf

The Ottawa Hospital (2020) "Ottawa's first COVID-19 Assessment Centre opens today," press release, undated (about March 13). https://www.ottawahospital.on.ca/en/newsroom/ottawas-first-covid-19-assessment-centre-opens-today/

Working Group on Long-Term Care (2020) "Restoring Trust: COVID-19 and The Future of Long-Term Care," A Policy Briefing, Royal Society of Canada, June. https://rsc-src.ca/sites/default/files/LTC%20PB%20%2B%20ES_EN.pdf