

# Preparing *before* the next pandemic: proposals for an action plan based on lessons learned from Covid-19

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## Summary

In this white paper, I propose ways for Canada to learn from experience during the Covid-19 pandemic both in Canada and in other countries, and to improve our responses to future pandemics. This action plan is urgently necessary. The Global Preparedness Monitoring Board, a unit of the World Health Organization, urges nations to prepare for another, worse global pandemic:

“There is a very real threat of a rapidly moving, highly lethal pandemic of a respiratory pathogen killing 50 to 80 million people and wiping out nearly 5% of the world’s economy, with potentially more than 50 million deaths. This might be a new H1N1 influenza as early as the 2021–2022 winter, a more virulent strain of SARS/Covid virus, or a tropical disease like ebola that reaches North America.”  
(GPMB 2020)

This is supported by a recent paper (Carlson et al. 2022) that reports a growing risk of animal viruses affecting humans. The problem is sufficiently serious that some authors have proposed calling this new era of elevated risk “the Pandemicene” (Yong 2022).

Covid-19 has taught us we must respond more rapidly, consistently, and effectively when this happens. We must acknowledge the 2021 Canadian Auditor General’s report (OAGC 2021), which notes that since 2003, we have known of the risk of SARS, MERS, and H1N1 flu, *but have not acted*. Covid-19’s most important lesson is that no matter what plan we develop, it will be useless if it does not become a “living document”—part of standard government operating procedures, with dates and deadlines and frequent updates, and not a document that is shelved and forgotten. In particular, the plan must define specific, quantifiable objectives; provide explicit dates (deadlines) for achieving each objective; and name the individuals (or their functional positions or roles) who are responsible for achieving each objective. Anything else is not an action plan; it is an *inaction* plan. New ministers and senior staff such as deputy ministers and associate deputy ministers must be briefed on the plan and required to review it when they begin their job.

A second key lesson is the crucial importance of clear and consistent communication (Oshitani 2022). When the Canadian Covid-19 outbreak began, doctors around the country complained that they had no idea of how to respond. When the pandemic swept across Canada, every province provided different, mixed messages that led to confusion and distrust of the government

response. The next pandemic will require clear, calm, rational, effective, consistent ongoing communication from a single trusted source to minimize the confusion created by conflicting messages.

A third lesson is the urgency of clarifying the scope of the federal government's freedom to act during a pandemic. This is crucial given the overlaps and contradictions between federal and provincial authority over health issues. The federal government's constitutional authority to control responses in a pandemic must be clearly defined and confirmed by the Supreme Court *now* rather than waiting until the next pandemic to clarify that authority. [The 2007 Emergency Management Act](#) gives the federal government [authority to declare a national emergency and subsequently act without provincial co-operation](#) and provides a framework for such action.

In this white paper, I propose a national action plan based on what we've learned both domestically and elsewhere in the world. In Appendix 1, I have listed more than 20 internationally renowned experts whose writing have formed the basis for the white paper. My recommendations largely agree with those in *COVID-19: Make it the Last Pandemic*, created by [the Independent Panel for Pandemic Preparedness and Response](#), which provides more details related to international cooperation; my emphasis is instead on Canada's domestic responses. The key action items are presented in the headings, each supported by facts and literature citations. Where relevant, I'll emphasize the communication aspects, as communication is my area of expertise. However, even where I discuss aspects other than communication, there will be an important communication component to ensure that everyone understands their role and responsibilities.

**Note:** Medical and other professionals must review my suggestions so they can be generalized to account for emerging disease problems, such as the mosquito-borne diseases that are migrating north due to climate change. Many experts have noted that it will be difficult to predict which diseases and modes of transmission will cause the next pandemic, so we must build flexibility into our plans.

## **Establish a domestic monitoring group with teeth**

- Pandemic monitoring is the World Health Organization's responsibility, but their response was weak and ineffective—sometimes because of political pressure from countries such as the U.S. that provide WHO's funding. Canada must reinvigorate the federal [Global Public Health Intelligence Network](#) (GPHIN) to create an agency that is entirely under our own control, and not affected by international politics. A model such as that used for Crown corporations might protect GPHIN against domestic political interference. To further protect the independence of this agency, appointments should be made by experts outside of the government. For example, the relevant medical boards of each province and territory should annually nominate one of their members to serve on the board of this agency (to ensure full national representation and to reduce the risk of political interference). In May 2022, Quebec's coroner Géhane Kamel emphasized that [the public health director must be more independent so they “can exercise their functions without political constraints”](#) (Stevenson 2022).

- GPHIN should monitor hotspots in regions such as South America, China, India, and Africa by means of ongoing communication with local experts to detect new disease outbreaks as quickly as possible. (This would replace the currently passive and voluntary self-reporting mechanism, which lets countries delay reports that would be politically inconvenient. This is what happened in China at the start of the Covid-19 outbreak.) Such an international network should rely on personal relationships among researchers, which will be less vulnerable to funding cuts and politically motivated interference.
- Warnings from GPHIN should be treated as *de facto* emergencies and both federal and provincial governments should begin their response immediately, following a national “best practices” guide that is prepared and tested well in advance, and that is updated annually or with each change of government. (See the next section for details.) It’s worth noting that one reason Newfoundland was able to respond successfully to the influx of grounded airplanes after the 9/11 terrorist attacks was because they not only had a plan in place; [they also tested the plan to ensure that it worked and revised it as necessary](#). This approach is not sufficiently common. Devin Jopp, an infection control specialist, reiterates the importance of this step in [his article for Forbes](#).

## Prepare a “best practices” action plan

- Canada needs a plan that can be implemented rapidly, based on knowledge of what works (i.e., best practices). This plan must emphasize, clearly and repeatedly, that a rapid response is essential and must provide specific deadlines and benchmarks for success. Weasel words such as “with all due haste” must be eliminated. For a disease that spreads as fast as Covid-19 or H1N1 influenza, even a 1-week delay can lead to thousands of additional infections and thus, hundreds or thousands of additional deaths before the pandemic ends. For something that spreads faster, like measles or the Omicron BA.2 strain of Covid-19, rapid action is even more important.
- This plan and any supporting guides should represent the consensus of the international community of experts, but modified to account for unique Canadian constraints. The division of powers related to Canada’s medical systems between federal and provincial governments is a significant problem that must be solved. We must update the 2007 Emergency Management Act to unequivocally define the federal government’s authority to declare a national emergency and act without provincial approval. The Supreme Court must be asked *now* to define this authority to avoid delays when the next pandemic hits.
- The action plan must be updated regularly—at least with every change of government, and ideally annually, to account for new knowledge as it becomes available.
- The federal government must negotiate an interprovincial consensus on how provinces will respond when the federal government declares a state of emergency. The best practices guide must be designed around a phased response, so that governments can implement initial measures *immediately* and escalate rapidly if necessary. For example, if an epidemic begins in a given city and experts believe it will spread, all travel from that city should be immediately suspended until mitigation measures can be implemented; [travel bans by themselves are generally ineffective during the initial spread of a disease](#), but they can buy time for governments to respond more effectively. If the outbreak spreads, all travel from that city’s province should be immediately suspended (again, until mitigation measures can be implemented). If a foreign outbreak expands beyond its

region of origin, all international travel from that region should be immediately suspended (again, until mitigation measures can be implemented). Conversely, restrictions on travel to the outbreak region must be imposed immediately.

- To accommodate reasonable disagreement, there could be two tiers for all recommendations: first, the national best practice; second, acceptable alternatives, negotiated with the provinces, that permit responses that meet unique local needs. A single Canada-wide response would be ideal, but realistically, the provinces won't accept any option in which the federal government imposes a solution unless this solution is negotiated in advance or its constitutional status is clearly defined by the Supreme Court.
- In addition to being frequently revised, the guide should be tested periodically through simulation exercises to detect and solve problems. As the social and technological contexts change, the action plan and all associated guides must be updated.
- The guide must include clear instructions for when and how social and economic activities must be paused, and when and how they can be resumed; this is commonly referred to as a "circuit breaker". For example, some provinces relaxed their lockdowns when the number of Covid-19 cases decreased to 800 per day; international results suggest that a far lower level (perhaps as low as 100 cases per day) would be more defensible. These levels should not be left to the discretion of municipal and provincial governments. With Covid-19, every level of administration made its own decisions, often poorly informed, leading to many preventable deaths. In addition to supporting a more consistent and effective response, setting a quantitative threshold relieves government officials of the stress involved in making such an important decision on their own, and therefore gives them confidence to act quickly. The numeric value should be revised as new knowledge becomes available, but at least initially, it should not be negotiable.
- To support the ability to implement "circuit breakers" and define when to implement and release a lockdown, the predictive models currently used to calculate a disease's rate of spread must be improved. A particular problem is that when the underlying conditions and context used to develop a model change, the model must be updated to account for that change. For example, [the Omicron variant of Covid-19 multiplies up to 70 times as fast as the Delta variant](#), depending on the study, leading to proportionally faster spread. Models based on the slower Delta spread rate failed to predict the spread of Omicron. This problem has not been adequately considered; based on my more than 35 years of working with scientists who develop models, I would estimate that perhaps one in three of these scientists forget this crucial point.
- It's important to note that as China learned in 2022, lockdowns are not sustainable long-term measures. They can unquestionably reduce infections, hospitalizations, and deaths, but different types of lockdown have different effectiveness; as Lewis (2022) notes, limiting small and large gatherings seems most effective. At their best, lockdowns buy time for governments to mobilize resources (medical staff, equipment, protective materials such as masks, vaccines and medicines) and give hospitals and their support systems time to prepare. However, to be effective, lockdowns need to be implemented rapidly, before the disease spreads too far to control (Lewis 2022). And they are not without consequences, including economic impacts, increased domestic violence, and difficulties obtaining food and medicine. These consequences must be planned for (e.g., to ensure that pharmacies can deliver essential medicines to those who need them).

- To account for government planning horizons, the guide should define a clear mechanism for smooth transfer of governance after elections. However, during the American transfer of power from the Obama administration to the Trump administration, politics outweighed science and common sense. This is another reason to support the creation of a quasi-independent agency such as a Crown Corporation that has some political independence and preserves continuity of expertise between governments.

## **Provide guidelines and training for clear communication**

- The lack of a national communication plan with a consistent message has meant that every administration, from national to municipal levels, has communicated its own message instead of a consensus message based on science and the need to coordinate action nationally. This created confusion, a lack of trust in governments, and ill-considered and poorly implemented responses. Obtaining a consistent, effective response requires a single carefully crafted message, validated by both medical and communication experts. Coleman (2023) provides a comprehensive discussion of the requirements for effective crisis communication.
- Federal and provincial spokespersons must be identified and trained by the [Centers for Disease Control \(CDC\) Epidemic Intelligence Service](#) or a Canadian equivalent so they understand best communication practices. The [CDC Crisis and Emergency Risk Communication manual](#) provides a good starting point. It's crucial to communicate the problem of uncertainty, particularly during the early stages of a pandemic, so that citizens will understand why recommendations will change as more knowledge becomes available.
- Mechanisms must be implemented to ensure smooth communication between federal and provincial governments (at the level of Minister or Deputy Minister) and between provincial and municipal governments, free of political interference to the greatest extent possible. That is, the content and manner of communication should be determined by experts in risk communication, not by politicians.
- That being said, the response guide described in the previous section must contain guidelines for politicians on how to communicate the need for unpopular and disruptive measures (e.g., quarantine, economic shutdowns, gym and restaurant closures, mask mandates) in a way that lets them receive credit for the good consequences. That minimizes the fear of making necessary but unpopular decisions.

## **Implement a consistent national testing and contact tracing system**

- Testing is essential, since a rapid increase in positive tests strongly predicted (for Covid) a rapid increase in hospitalizations roughly 2 weeks later, and therefore provided 2 weeks of time to prepare hospitals for the increased case load and to implement mitigation measures, such as reintroducing mask mandates. The currently popular approach of only recording hospitalizations is primarily a money-saving measure, not effective public health management. Monitoring the presence of viral genetic material in waste water is an acceptable way to detect increasing case loads, but doesn't support contact tracing.

- Covid-19 demonstrated the importance of contact tracing. However, this was implemented incompletely and inconsistently because each province developed their own system. All governments must adopt a single consistent Canada-wide system, ideally supported by a mechanism such as open-source software that provides both security of personal information and transparency. An advantage of open-source software is that it would support a consistent international approach. Contact tracing saved lives, but development work on this technology appears to have stopped. It should be restarted so that it will be available during the next pandemic (Salathé 2023).
- This system must be consistent throughout Canada, and must be managed nationally to ensure that it works in every province.
- It's necessary to develop a tracking mechanism that accounts for international travel. This is a challenging problem: once a foreign visitor enters Canada, their subsequent movements become difficult to trace. Scans of Canadian passports at airports and international borders let us efficiently track our own citizens, but it's not clear how this can be expanded to include foreign visitors.

## **Identify and support special-needs communities**

- Our First Nations people, the poor and homeless, people with pre-existing conditions (including both physical and psychological disabilities), and seniors are highly vulnerable to pandemics. First Nations people are particularly vulnerable because of their disproportionate existing health challenges, a lack of access to medical resources, and decades of neglect by governments. Special measures must be considered for each of these populations, and others. We need to ask these people to tell us their needs, and include those needs in our plans.
- Schools serve many non-obvious needs for school-age children. For example, schools can be a major source of meals for students who might otherwise suffer from malnutrition, and school nurses often provide critical services such as insulin injections and help with medication timing. Canada's national system is patchwork and underfunded, and must be improved. This will require negotiation with the provinces, who are primarily responsible for education in Canada.
- The pandemic revealed that working parents are a community with special needs. Schools provide a crucial "daycare" service that must be replaced if we close schools. If we want parents to continue working, they must have options to keep their children safe while they work.

## **Identify a list of critical medical supplies**

[This list should be prepared in cooperation with the Public Services and Procurement Minister based on what is learned from the National Supply Council's work in April/May 2020 and thereafter.]

- Critical medical supplies include masks, face shields, gloves, gowns, respirators, and drugs used in intubation. For each of these materials, we must establish basic stockpiles, and increase their scope if expert advice suggests this is necessary. Existing databases for

tracking this material are non-functional; a national system must be implemented that provides rapid access to both inventories and expiry dates for the stored materials.

- We must establish an oversight committee that meets regularly to ensure that the stockpiles are updated before materials reach their end-of-life and to update the list of required materials. Material expiry dates must be used to ensure that materials are transferred to hospitals while they are still usable; the stockpiles should then be immediately replenished. Currently, the status of stockpiles is unknown because there is no consistent system for tracking inventories and no responsibility for doing so.
- Covid-19 demonstrated the danger of relying on international supply chains during a pandemic. A more serious epidemic, such as the one predicted by GPMB (2020), could impede or eliminate international transport of essential goods, including medical supplies. We must therefore find ways to implement domestic production—either as a standard, ongoing practice, or as something that can be implemented and scaled up rapidly. This could be achieved by providing incentives to domestic manufacturers to deliver such services. Domestic vaccine production is currently being explored by the federal government, in partnership with Moderna, but past experience (e.g., with [Connaught Labs](#)) suggests that measures must be taken to ensure that the pharmaceutical company maintains its ability to provide the necessary services between pandemics, when vaccine production will be less necessary or unnecessary. These efforts must be strongly supported both for vaccines (the current focus) and other essential supplies such as medicines.
- We need better alternatives to some materials. In particular, materials that can be cleaned and reused would reduce pressure on the supply chain. For example, [as an alternative to classic N95 masks, elastomeric respirators may be a good option](#) if modified for medical use. In particular, [they offer the advantage of being reusable](#).

## Establish emergency production centers

[This section should be prepared in cooperation with the Public Services and Procurement Minister based on what is learned from the National Supply Council's work in April/May 2020 and thereafter.]

- I'm not aware of any Canadian equivalent to [the U.S. Defense Production Act](#), which allows the U.S federal government to focus industrial production on the materials required during an emergency. If such an act does not exist in Canada, one should be created, perhaps as an amendment to the 2007 Emergency Management Act.
- Foreign supply sources for key materials such as vaccines are vulnerable: if enough people get sick, non-domestic supply chains will break. This will also happen if politics intervene (e.g., if India decides to punish Canada for our support of their striking farmers by halting vaccine exports). If foreign suppliers are ordered to prioritize their own citizens, the supply chain would also break (as we saw when the EU slowed vaccine exports in March 2021).
- Emergency production centers should be established: these would be facilities that are left idle or used for other purposes until they are needed, but that are maintained at a high standard of readiness so they can be brought online and can begin production within days or weeks rather than months. These centers will let us produce supplies more quickly



than they can be obtained from foreign sources, and should be scalable so they can cope if foreign supply chains break down completely. These centers must have priority access to the chemicals and other materials needed to produce medical supplies on a large scale.

- Establishing a Canadian vaccine production facility in cooperation with Moderna is a good first step, but we must find ways to ensure that the facility remains economically viable between pandemics. Moderna should be allowed to shift to the production of more profitable products so long as they can demonstrate (annually) to the federal government that the facility remains ready and able to produce vaccines without the delay involved in rebuilding production infrastructure from scratch. Prices must be negotiated and reviewed in advance to allow manufacturers a socially acceptable profit, without permitting the rapacious price gouging that has occurred in the U.S. pharmaceutical industry. Other initiatives such as that by the [University of Saskatchewan's Vaccine and Infectious Disease Organization](#) should be investigated to provide redundancy (e.g., perhaps creating one such facility in each province and territory).
- Manufacturers that accept government funding should have their facilities inspected annually to ensure their compliance with government guidelines. Experience with long-term care facilities shows that self-regulation will not succeed. The government must take responsibility for these inspections, and must define appropriate penalties for companies that fail to meet government standards.
- Although this proactive approach will be expensive, it is likely to be considerably less expensive than a purely reactive approach. A recent report by Quebec's auditor general revealed that [Quebec spent on the order of \\$1 billion more than necessary on personal protective equipment](#) because they had inadequate stocks at the start of the pandemic and were forced to purchase these materials by bidding against others who needed the equipment. Costs are likely to have been similarly high for other governments.

## **Establish specialized pandemic hospitals**

- Modern hospitals often have specialties (e.g., cardiac care, cancer treatment), but are most often treated as general-purpose facilities that treat all diseases and injuries. However, as “jacks of all trades”, they become masters of none. As Covid-19 demonstrated, hospitals can be overwhelmed by a pandemic and unable to care for the population's everyday and ongoing medical needs. Creating specialized pandemic hospitals would reduce the risk of this collateral damage.
- One solution would be to establish centers of excellence for pandemic response in each province, or perhaps in each big city, so that other hospitals can be reserved for other urgent care. During an outbreak, uninfected patients would be moved to generalist hospitals to make room for patients in the specialist hospitals. This should be a phased system so that as the specialist hospitals become saturated, second-tier hospitals can begin accepting pandemic patients. This seems to have been partially implemented in Montreal, but if it worked as well as the government hoped, it should be implemented more widely. If it worked less well than desired, the “lessons learned” should be applied to improve the approach.
- Another alternative borrows from the American experience, in which satellite clinics (some from the private sector) are established around or near hospitals, but outside the hospitals, to perform routine medical procedures that do not require full hospital



facilities. For example, I received a colonoscopy for cancer screening during the pandemic at such a clinic; the clinic was established by my gastroenterologist, but the procedure cost was paid by the provincial healthcare system.

- Although the initial approach should focus on respiratory pandemics such as Covid-19 and influenza, since these diseases spread rapidly, medical experts should identify other types of future disease risks that could be addressed by specialist hospitals (e.g., to treat the mosquito-borne tropical diseases that are migrating north under climate change).

## **Cross-train medical professionals and add paramedical workers**

- We must identify the gaps in our healthcare system that have resulted from underfunding (e.g., insufficient nursing staff) and a lack of targeted training (e.g., to increase the number of respirologists). Doctors, nurses, and others who served on the front lines during the Covid-19 pandemic must be interviewed to learn the gaps they encountered; we can then fill those gaps (e.g., provide scholarships to nurses seeking advanced training). We must hire more professionals such as nurses (who are so overworked they can barely meet existing non-pandemic needs) to increase the healthcare system's capacity, as is being done in the U.S. (White House 2021).
- Medical specialists who are also MDs (e.g., surgeons, dermatologists) should be offered cross-training to refresh their skills for dealing with infected and recovering patients. The goal would be to relieve the pressure on specialists such as ER and ICU doctors and nurses by providing trained experts who can handle non-specialist issues and care for patients after they have been stabilized by the specialists.
- When non-specialist doctors and nurses are furloughed because their hospitals have been closed, which happened in several Canadian jurisdictions, they could (for example) be asked to provide services at long-term care facilities or to assist in triage (e.g., to provide supportive care until a patient requires a specialist caregiver such as a respirologist).
- Professionals from medical-related fields (paramedical workers) must also be recruited. For example, both recovering patients and families who have lost loved ones will need PTSD counselling, grief counselling, psychological counseling, and help from social workers who can facilitate access to home care and government services. Social workers must be prioritized; even in the absence of a pandemic, there are too few to meet the need.
- Recovering patients may need rehabilitation and occupational therapy for weeks or months, so those resources must also be increased. ["Long Covid" \(post-Covid syndrome\)](#), which refers to long-term medical problems in patients who have recovered from an acute infection, will create large needs for medical and other assistance. Employers will also need assistance [developing strategies to help their employees who suffer from Long Covid](#). Staffing at seniors' residences must also be protected and funded. (See the next section for some details.)

## **Identify and train volunteers to relieve the pressure on medical and paramedical workers**

- Although I have focused on “volunteers” in this section, full-time workers are a valuable asset. For example, [members of the U.S. National Guard are being trained to help nurses](#), and Canada had good success using its armed forces to provide medical support. Civilians should also be trained and (ideally) employed full-time. Outside of a pandemic, these people can be employed in long-term care facilities, and can be used to deliver medical and public health services in underserved areas (e.g., inner-city environments, remote communities).
- Volunteers must be trained to take over routine patient care duties such as cleaning bedpans and feeding patients so that nurses and doctors are free to focus on tasks that only they can do. The goal of this training would be to relieve the pressure on medical orderlies, since there are insufficient orderlies to cope with a full-blown pandemic.
- Volunteers may be able to assist with simple medical duties such as bathing and changing dressings, provided that suitable patient-protection measures can be implemented. This could follow and expand the model of the CPR and first aid courses that are offered in most cities. Lessons learned from training members of the Canadian Armed Forces to work in seniors’ residences and to administer Covid-19 tests in remote communities during the Covid-19 pandemic must be applied.
- Training could be provided for free, as is done for many first aid courses, or could be subsidized, perhaps in exchange for a commitment to spend 1 or 2 weeks per year, outside of emergency periods, providing those services, to ensure that skills are maintained. Training must be renewed periodically, particularly for activities that require significant practice.
- Volunteers should include people who can provide key non-medical services, such as delivering groceries to people who cannot leave their homes (e.g., some seniors).

## **Encourage companies to continue letting employees work from home**

- Covid-19 revealed that surprising amounts of work can be done using telephones and computer teleconferencing. We must encourage companies to develop telecommuting programs, and provide implementation support, until they gain comfort and proficiency with remote work. If it becomes necessary to shift many employees to working from home, employers will be better able to scale existing telecommuting systems rather than having to invent such systems from scratch during an emergency.
- A best-practices guide should be prepared to help companies plan for this shift, and the government should work with telecommunications providers to ensure that these systems scale up gracefully rather than being overwhelmed.

## **Develop open-source and licensed solutions**

[This section should be prepared in cooperation with the Public Services and Procurement Minister in light of what is learned from the National Supply Council’s work in April/May 2020 and thereafter.]

- [Open-source solutions](#) must be investigated and encouraged, both for software and for hardware, where commercial alternatives don't exist or cannot be produced sufficiently rapidly during an emergency. For example, several groups around the world are working to develop open-source ventilator/respirator designs that can be quickly and inexpensively produced. This mitigates the high cost of specialized medical equipment and avoids bottlenecks in the manufacturing chain. Ideally, such designs should allow manufacturing using off-the-shelf parts to avoid the bottlenecks that can develop for devices that rely on proprietary parts.
- For proprietary materials such as pharmaceuticals that are currently protected by patents, with no generic or open-source alternatives available, the federal government must negotiate an "emergency" license that specifies fair "royalty" payments. Under that license, the government could ask manufacturing facilities to immediately begin manufacturing drugs, vaccines, and other pharmaceuticals at the agreed-upon price, rather than having to negotiate a license during a crisis. The profits from such activities will also motivate cooperation from manufacturers more strongly than current efforts to remove intellectual property protections for vaccines without providing compensation.
- As I noted earlier, manufacturers should be given government subsidies to establish manufacturing infrastructure for critical drugs and other materials. However, they must then be monitored by the government to ensure that the funds are being used for the agreed-upon work.

## Identify weak logistics links

- Logistics chains must be safeguarded so they won't collapse during a pandemic. We have seen warnings of what might occur when food production facilities, such as meat processing plants, were forced to shut down or reduce shifts, thereby putting pressure on food supplies. We have also seen this with farmers who rely on migrant laborers and who were unable to hire the workers they needed to plant, tend, and harvest their crops.
- Food becomes an important concern for people who lose their jobs, yet early in the pandemic, we saw news stories about farmers being forced to discard tons of potatoes because the restaurants that normally bought them were closed, and stories of farmers flushing thousands of gallons of milk into sewers because they had no way to repackage the milk and transfer it to families. We need alternatives that will let producers repackage these materials and divert them to food banks and families.
- [We must learn from the Sikhs and other groups](#) who provide free meals as part of their cultural practices; they can teach us how to move large amounts of food to those who need it during a crisis.
- [Farmers face a significant risk of bankruptcy](#) if large customers such as restaurants can no longer buy their products or if supply chains break, leading to rapid price increases for agricultural inputs such as fertilizer (which was a problem in the spring of 2022). We must plan a funding program to keep farmers in business until they can sell their produce, whether locally or internationally.
- Canadian agriculture depends heavily on foreign workers. We must improve the existing legislation to ensure that migrant workers can cross the border, and be housed safely, without hindering planting or harvesting. Current legislation looks good on paper, but its implementation must be improved to protect these workers; many have been infected as a

result of high-density housing that provided inadequate protection against disease. Government supervision of those who hire migrant laborers has been inadequate and must be improved.

- Road and rail transport are also essential links. Some solutions are obvious. For instance, if truckers are hit hard by a pandemic, Canadian Armed Forces personnel who are licensed to drive large vehicles might be able to replace them. Other links are more subtle and difficult to protect. Logistics experts must be hired to identify them.

## **Implement corporate pandemic response rules**

- Companies should be required to set aside some percentage of their net profits, before paying CEO bonuses and dividends, to establish a pandemic reserve fund. (The amount would be defined by the government.) This fund would be used to cover costs (e.g., payroll) for some defined period of time before a company is allowed to request a federal bailout. This money must be invested conservatively and sequestered, following the model of pension plans.
- If government bailouts become necessary, they should take the form of stock purchases, at the current stock market price, rather than cash grants with weak strings or no strings attached. This gives the government (as a major stockholder) a voice in how companies treat their employees during the pandemic, and Canadian taxpayers are better protected against poor choices by a company's managers. In addition, the government can sell the stock at an appropriate date to make the money available for funding government programs. For privately held companies, an alternative such as government-secured loans or appointing a government representative to sit on the board of directors might be appropriate.

## **Enhance economic and social support services**

- Supply chain problems led to large increases in food prices in 2020–21 and shortages of many materials and products (e.g., Pittis, 2020). Such price inflation must be accounted for by financial support programs. For example, basic welfare payments and payments such as the Canada Emergency Response Benefit program should be indexed to food prices. In addition, the current application process must be reviewed and streamlined so nobody is forced to wait for support payments to arrive before they can afford to eat. Canada's response in 2020 was admirable, but was delayed many weeks by the government's need to decide how to act.
- A universal basic income would mitigate the delay problem. Such programs may prove to be cheaper in the long run than the high cost of implementing emergency funding that was not included in government budgets. (This hypothesis should be examined by experts; it lies outside my area of expertise.) That being said, universal basic income has worked well where it has been tried, and [there have been surprisingly many trials](#). There's much we can learn from those trials. Stanford University maintains [a database of trials of basic income programs](#) that's also worth a look.
- Legislation must be created that, when invoked in an emergency, lets the federal government suspend loan payments (e.g., mortgages, credit cards), freeze rents (including

a ban on evictions), and compensate banks, other lenders, and landlords until the situation stabilizes. It will be much easier and less expensive for governments to work simultaneously with the leaders of (for example) five national banks to ensure they remain economically viable than it would be to work with millions of citizens who have deposits in those banks. Similarly, it will be easier to work with each landlord to ensure they aren't bankrupted by rent freezes than it would be to work independently with all of their tenants.

- Paid sick leave must be extended and improved so essential workers aren't forced to work when they're sick. The Canada Sickness Recovery Benefit has been criticized for being too slow, and has created conflicts with provinces (e.g., Ontario) over who is responsible for providing the payments and how. During a pandemic, the duration should *start* at 1 week, with the option of extending this period based on the advice of medical professionals. The federal government should become the sole source of funding to eliminate jurisdictional disputes with the provinces, perhaps by expanding existing unemployment insurance and related programs.

## **Teach Canadians emotional and psychological resilience**

- Pandemics are highly stressful, and many people lack the necessary coping skills. The incidence of domestic violence and mental health problems such as anxiety and depression increased greatly during the Covid-19 pandemic. Grade school and high school curricula must be developed to teach children how to manage stress, to respect and help each other in times of crisis, and where and how to seek help when they need it. The crisis has been particularly severe for children, and they will need considerable help (Vaillancourt et al. 2021). Johns Hopkins University has created [a free “psychological first aid” course](#) that could be the basis for this training. Outside a pandemic, this will create resilient citizens who can respond more effectively to personal or societal traumas, such as job loss or a natural disaster.
- Similar educational programs could be offered to adults, on the model of existing CPR and first aid courses. The social benefits of this training should more than repay the costs.

## **Improve the current system for voting by mail**

- The current system for absentee ballots should be examined so that it can be rapidly expanded and deployed universally if in-person voting becomes an unacceptable health risk. Democracy is a fundamental Canadian value that should be bolstered, not threatened, in a national emergency.

## **Consider the impacts of climate change**

- Climate change will exacerbate the risks posed by both new and familiar diseases. For instance, extreme weather events sometimes require people to gather in shelters; this happened during the 1998 ice storm that paralyzed Quebec and other parts of eastern Canada. Crowded shelters will promote the spread of respiratory diseases such as influenza and Covid-19, as well as other types of disease. The ice storm was particularly

hard for seniors, many of whom feared to leave their homes; the situation was catastrophic for seniors with dementia. Global climate models predict an increasing frequency of extreme climate events such as ice storms. The logistical, social, and psychological consequences of such events must be considered so that appropriate resources can be allocated to meet these needs.

- We must plan to supply protective equipment (e.g., masks, hand sanitizers) to shelters. This material could come from the national stockpiles that I described earlier in this white paper.
- Severe weather can also damage the infrastructure that provides necessities of life such as food, water, and electrical power. Planning must account for these needs; for example, more gas-powered electrical generators must be purchased, strategically allocated, and maintained so that they remain in good operating order.

## **Review and update the science**

- One serious problem that led to the preventable deaths of many people was an unwillingness to review the science and challenge its underlying assumptions. For example, the World Health Organization failed to provide good advice (improve ventilation and wear masks) because they based their assessment on outdated and incorrect science (Molteni 2021). As Molteni showed, it's extremely difficult to identify problematic science, since scientific paradigms are based on rigorous testing and proven knowledge; as a result, they *should not* be dismissed casually. Nonetheless, creating a diverse and multidisciplinary team to discuss the logic behind health guidelines can sometimes reveal problems that require further study. For example, evidence of the spread of Covid-19 by aerosols was clear early in the pandemic (Greenhalgh et al. 2021), but did not affect government plans or responses until nearly a year later. Dyani Lewis, writing in *Nature* (Lewis 2022), provides confirmation and additional insights.
- Once best practices have been identified, they should be implemented quickly rather than taking half measures in a misguided attempt to save money. For example, researchers studied all the main methods that have been proposed to limit the spread of virus particles in enclosed spaces, and found that upward ventilation (i.e., removing viruses from the air that people breathe) was most effective, particularly when combined with masking (Nie et al. 2022). However, jurisdictions such as Quebec instead purchased carbon dioxide sensors for classrooms to detect when ventilation was inadequate; for not much more money, they could have simply improved the ventilation systems, which most teachers would have pointed out were badly in need of improvement.
- Governments must be reminded of the well-established “precautionary principle” (Goldstein 2001). In summary, if we have a plausible mechanism for spread of a disease and a potential solution that is likely to reduce the spread without causing other forms of harm, we must implement that solution rather than waiting until better data and a better solution become available.

## **Perform a functional and economic post-mortem**

- The response to the 2020 pandemic was largely *ad hoc* and often poorly considered. The government programs implemented in 2020 and 2021 must be carefully analyzed to see which ones worked, which ones might have worked if implemented differently, and which ones did not work, probably cannot work in the future, and must be replaced with more effective alternatives. The economics of these programs must also be evaluated. For example, would a universal basic income be less expensive, more cost-effective, or both than the Canada Emergency Response Benefit?
- There is considerable agreement globally on what needs to be done (Lazarus et al. 2022). Has Canada set a national goal of adopting all the consensus practices in this article and a schedule for achieving them? If not, why not?

## Learn from history

- Carefully thought-out plans were developed after the MERS and SARS outbreaks (e.g., Health Canada 2004, PHAC 2015), but were apparently forgotten by governments. As a result, as late as April 2020, more than 2 months after the Covid-19 pandemic arrived in Canada, no government had effectively communicated with its citizens to explain the situation and provide recommendations about the necessary responses. The fact that many doctors had no idea what they were supposed to do or how to do it was a particularly egregious failure. Such failures must not happen again. For example, we must develop and then maintain a list of all hospitals and all doctors so that updated information on how to respond can be rapidly distributed. Provincial medical associations and licensing authorities can help with this task.
- One thing we have learned is that people are willing to follow government recommendations, but only if they trust governments, and that maintaining a high level of trust has been essential for achieving good outcomes (Bollyky et al. 2023). Building trust takes considerable time. We therefore need to act immediately to review the issues that have reduced or are currently reducing trust so we can begin taking the necessary measures to regain lost trust. When trust is low, people tend to push back against even sensible measures such as mask mandates. Improving community engagement may be one of the most effective approaches because it enlists trusted people who are known to the community.
- Someone must be made responsible, as part of their job description, for ensuring that whatever action plan the federal government develops is kept up to date, tested periodically, and made ready to implement rapidly when the next pandemic strikes. Because a single person represents a single point of failure, multiple individuals should be responsible for ensuring that the delegated person continues to meet their responsibility. One solution would be to assign this responsibility at the Deputy Minister level both nationally and in each province, since this provides high continuity of expertise. The Canadian news media might also help, since a government's success or failure in meeting the responsibility to protect Canadians is highly newsworthy, particularly before and immediately after an election. This assignment of responsibility within the government, combined with independent monitoring of that responsibility, is necessary to transform the action plan from something that sits on a shelf and collects dust into a living document (i.e., something that is part of ongoing government operations).



- Learning from history means examining and learning from previous pandemics and other disasters so we can avoid repeating previous mistakes. As Kelman et al. (2023) demonstrate, "disasters avoided" are better than disasters that we retroactively respond to.
- An underappreciated problem is the difficulty of communicating complex science to the governments that will be required to base their policy decisions on that evidence. Most scientists lack the training to succeed in this communication, and the problem is exacerbated by the fact that politicians often lack sufficient science education to understand what the scientists are trying to say (Sanderson 2023). We will need skilled communicators capable of communicating both the urgency of the need to act and the evidence that justifies the need for action.

## Concluding remarks

Interestingly, Canada's Chief Public Health Officer Dr. Teresa Tam wrote about several of the issues discussed in this white paper only 2 years before the pandemic (Tam 2018) but 14 years after Health Canada (2004) presented some of the same suggestions I have included here. TIP (2021a,b) provides an assessment of the successes and failures of the World Health Organization in responding to the Covid-19 pandemic. Many of these criticisms have lessons for Canada, and support my recommendations. Historically, the problem with "action" plans is that they have been all plan, with no action. That must change.

An additional problem with all of the measures I have recommended, necessary though they are, is that they are *reactive*: they respond to an emergency instead of trying to prevent it. Prevention is far more difficult, but actions such as increasing Canadian participation in international efforts to reduce deforestation in the tropics and mitigate the effects of climate change are examples of steps we must take if we want to reduce the frequency of future pandemics. This could be done within the context of Canada's foreign aid program. (Our ethical responsibility to developing nations is beyond the scope of this white paper, but is something we must urgently consider once the current crisis is past.) In short, we must develop the approach described in this white paper so that we are *proactive* (Kelman et al. 2023). The following words of wisdom are worth pondering:

"Disaster preparedness is not, in the end, the same as disaster prevention. The latter would require something that is, from our current vantage, inconceivable: the political will to abandon the pernicious practices [such as deforestation in tropical countries] that currently support our economy. It would require reckoning with human agency, and acknowledgement that no matter the scope of the disaster, no matter the exertions of essential workers, no matter how many times we bleach and scrub, rinse and disinfect, all of this is merely triage. We keep washing, but our hands are not clean."—Barrett Swanson, *This Is Not a Test*

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## Appendix 1: List of experts

In addition to the cited references and Web sites, this white paper is based on the opinions of and data provided by the following experts:

- Al-Aly, Dr. Ziyad (<https://publichealth.wustl.edu/people/ziyad-al-aly/>): Physician and epidemiologist, Washington University of St. Louis

- Allen, Dr. Joseph (<https://www.hsph.harvard.edu/joseph-allen/>): Harvard University exposure assessment expert
- Bhattacharya, Dr. Jay ([https://healthpolicy.fsi.stanford.edu/people/jay\\_bhattacharya](https://healthpolicy.fsi.stanford.edu/people/jay_bhattacharya)): Stanford School of Medicine
- Black, Dr. Tyler B. (<https://psychiatry.ubc.ca/person/tyler-black/>): psychiatrist, University of British Columbia
- Bright, Dr. Rick (<https://www.rockefellerfoundation.org/pandemicpreventioninstitute/>): immunologist and virologist at the Rockefeller Foundation
- Caballero, Dr. Jorge (<https://stanfordhealthcare.org/doctors/c/jorge-caballero.html>): Stanford University
- Feigl-Ding, Dr. Eric (<https://scholar.harvard.edu/ericfeiglding/bio>): epidemiologist
- Gonsalves, Dr. Greg ([https://medicine.yale.edu/profile/gregg\\_gonsalves/](https://medicine.yale.edu/profile/gregg_gonsalves/)): Yale University epidemiologist
- Gurdasani, Dr. Deepti (<https://www.qmul.ac.uk/whri/people/academic-staff/items/gurdasanideepti.html>): clinical epidemiologist, Queen Mary University of London
- Hoshino, Dr. Risa (<https://www.instagram.com/dr.risahoshino/>): public health and vaccine expert
- Huffman, Dr. Alex (<https://sites.google.com/site/huffmanlabdu/home>): bioaerosol researcher, University of Denver
- Jha, Dr. Ashish K.: MD, MPH, White House COVID-19 Response Coordinator
- Jüni, Dr. Peter (<https://www.linkedin.com/in/peterjuni/?originalSubdomain=ca>): epidemiologist, University of Toronto
- Karaan, Dr. Abraar (<https://profiles.stanford.edu/abraar-karan>): Stanford University infectious disease specialist
- Leonardi, Dr. Anthony J.: immunologist, Johns Hopkins University
- Madad, Dr. Syra (<https://www.scty.org/syra>): epidemiologist
- Murray, Dr. Ellie (<https://sites.bu.edu/causal/>): Boston University epidemiologist
- Popescu, Dr. Saskia (<https://schar.gmu.edu/profiles/spopesc2>): infectious disease epidemiologist
- Prather, Dr. Kimberly (<https://kprather.scrippsprofiles.ucsd.edu/>): masks and aerosols expert, University of California San Diego
- Rasmussen, Dr. Angela (<https://angelarasmussen.org/>): virologist, University of Saskatchewan
- Rubin, Dr. Zhacary (<https://www.oakbrookallergists.com/our-team/zachary-e-rubin-md/>): Immunologist
- Sanders, Erin C. (<https://erinsandersnp.org/>): nurse and MIT clinical scientist
- Topol, Dr. Eric (<https://www.scripps.edu/science-and-medicine/translational-institute/about/people/eric-topol/>): precision medicine expert, Scripps Research Translational Unit
- Tufekci, Dr. Zeynep (<https://journalism.columbia.edu/faculty/zeynep-tufekci>): journalist and sociologist, Columbia University
- Yong, Ed (<https://www.theatlantic.com/author/ed-yong/>): Pulitzer-prize winning investigative reporter (<https://www.pulitzer.org/winners/ed-yong-atlantic>)

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