To what Extent Can the Implementation of Public Health Measures such as Quarantine, Isolation and Social Distancing Slow the Infection Rate of Covid-19?

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The outbreak of the coronavirus, also known as COVID-19, has disrupted the social and economic life of humans globally. The virus was reported to have originated from Hubei Province of Wuhan in China, early November 2019 (Ma 2020). Health professionals initially thought it was common pneumonia and therefore treated it as such, however, the virus has taken the world by storm, infecting and killing millions of people (Worldometer 2020). Due to the contagious nature of the disease and the prevalent high rate of infections in Wuhan, the Chinese government implemented strict quarantine and social distancing measures in some provinces, which resulted in a significant drop in infection (Zengyun 239). Emulating China, countries worldwide started implementing lockdown and social distancing measures based on the World Health Organization's (WHO) directives. While social distancing measures have worked in some countries, it has not been successful in others.

Many ethical questions have been raised by health officials in finding an effective response to COVID-19. These include access to medication, resource management, managing essential services, human rights violations (implementation of lockdown and social distancing measures), and vaccine development to curb the infection rate of the virus. In responding to these questions, an ethical framework is crucial to maintain public trust, promote compliance while minimizing social disorder and economic loss. There are various moral theories such as deontology, egoism, and virtue ethics that can be applied to managing the pandemic. However, within the context of public healthcare measures, and the contagious nature of the virus, a Utilitarian framework will be a more plausible theory to justify the application of prioritization of resources, access to medication and restricting citizen's movement to reduce the spread of the virus. To achieve this goal, the paper is organized into five main sections, three of which have sub-sections. The first section provides a historical overview of the origin of COVID-19, its

definition, symptoms, and the number of cases worldwide. The second section discusses ethical concerns and a Utilitarian approach in the context of healthcare measures. The third section focuses on pandemic planning and distribution of resources. The final section provides recommendations to effectively manage restrictions related to COVID-19.

HISTORICAL OVERVIEW OF COVID-19

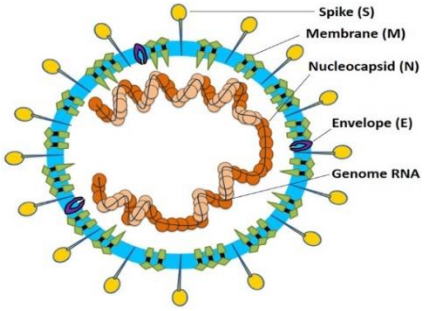
Chinese government records indicate that the first documented case of the novel coronavirus was a 55-year-old Wuhan citizen, tracing back between October and November 2019 (Ma 2020). The virus became public when Dr. Ai Fen, the alleged whistleblower, came out with concerns about a new novel virus (Ma 2020). After the first case, citizens of Wuhan started experiencing more of the flu-like symptoms. Patients who contracted the virus were diagnosed with pneumonia, but doctors concluded it was a different viral infection considering the rise in cases. Initial information indicated that the virus originated from a seafood market in the Wuhan province (Stanway, Wuhan's seafood market, believed to be the origin of COVID-19, remains sealed 2020). Other international bodies also speculate that the virus may have escaped from a high-containment laboratory (Staff 2020). These speculations have forced international bodies such as the World Health Organization (WHO) to pressure China to allow for an independent investigation. (Staff 2020). China has not been very cooperative and combative. With continues pressure by WHO they finally agreed to welcome a team of experts in Beijing early January 2021 (Stanway, Global News 2021). Unfortunately, a report by Aljazeera News reports that China has still not approved the team of experts' entry into China.

When the virus first hit, China eluded the rest of the world by closing its domestic borders. The country however, left its international borders open, which allowed the virus to spread widely, eventually leading to a pandemic (Sen 2020). Additionally, China withheld detailed information

such as the number of people infected and the exact time the epidemic started (Adam 2020). Considering the nature rate of infection a Public Health Emergency of International Concern was declared on March 11th, 2020 by WHO (WHO 2020). This untimely action by WHO contributed to the current rise in cases worldwide.

WHAT IS COVID-19?

COVID-19 is a respiratory disease caused by the Severe Acute Respiratory Syndrome coronavirus 2 (SARS-Cov-2) that disrupts the lungs' function (Li *et al* 424). The Virus looks like an enveloped, nonsegmented, positive-sense single-stranded Ribonucleic Acid (RNA) virus genomes (Li et al 424). Its virion composition has a nucleocapsid of genomic RNA and phosphorylated nucleocapsid (N) protein, which is buried inside phospholipid bilayers and covered by two different types of spike proteins: the spike protein (S) can be found in all CoVs, and the hemagglutinin-esterase (HE) that exists in some CoVs (Li *et al* 424). The membrane (M) protein (a type III transmembrane glycoprotein) and the envelope (E) protein are located among the S proteins in the virus envelope (Li *et al* 425). The Virus was named CoVs based on the characteristic crown-like appearance. The coronavirus subfamily is genotypically and serologically segregated into four genera, the α, β, ɣ, and δ coronaviruses (Li *et al* 425). According to Li *et al*, the β-coronavirus can be further classified into four viral lineages, namely lineage A-D. Over 25 recognized CoVs infect humans, mammals, fowls, and other animals. The figure below illustrates the structure of the Virus under a microscope.



Source: Journal of Medical Virology

Viral infections are generally associated with upper respiratory tract infections. However, some patients may have lower respiratory tract infections as well (Li *et al* 425). Symptoms and signs include fever, headache, cough, and difficulty breathing. Symptoms may vary from one patient to the other based on immune system response to the virus. A patient whose immune system is low and susceptible to viral infections may experience pulmonary tissue damage, functional impairment, and reduced lung capacity (Li *et al* 425). An overactive immune system, on the other hand, may induce immunopathological conditions such Type 1 diabetes, Addison disease and Celiac disease (Li *et al* 425). Early diagnosis of a patient is essential in treatment intervention.

Since the inception of COVID-19, 42,924,533 cases have been reported worldwide (Worldometer 2020). As of October 25th, 2020, there have been 1,154,761 deaths and 31,666,683 recoveries (Worldometer 2020). In North America, the total number of cases are 10,576,074; the United States having the most cases, followed by Mexico and Canada (Worldometer 2020).

ETHICAL CONCERNS

Since the inception of COVID-19, countries have followed recommended pandemic guidelines by the WHO. Some of these guidelines include hand washing, quarantining of infected individuals, travel ban, enforcing mask-wearing, closure of schools, and other social distancing measures. Canada, for example issued its travel ban on March 13th, 2020 (Global 2020).

The implementation of quarantine and social distancing measures have raised concerns for civil liberty groups and human rights activist (Rancourt 2020). Dr. D.G Rancourt, a notorious activist and volunteer researcher at the Ontario Civil Liberties Association, has criticized Canada's government for being irresponsible in managing the COVID-19 pandemic. According to him,

recent research indicate that a regulatory strategy to "flatten the curve" will risk causing additional cumulative COVID-19 deaths due to societal immunity delays (Rancourt 3). He argues that the Virus occurred in winter, when flu is very prevalent; therefore COVID-19 should be treated as the regular flu so society will become immune to it. Societal immunity is the only way the host(s) can be susceptible to the virus in order not to have an adverse reaction or show symptoms during infection.

Rancourt also claims that there is no scientific evidence in modern history after the 1918 influenza to support that a lockdown is the solution to curb the pandemic. He further argues that the general population lockdown measures to "flatten the curve" for the 2013-2016 Ebola and the SARS epidemic were inconclusive; hence there is no evidentiary information to conclude that complete lockdown and social distancing would mitigate COVID-19 (Rancourt 8). Further to his criticism, he argues that civil right is being trampled on and that people should have the right to evaluate the situation and choose if they will comply with social distancing measures and lockdown or not (Rancourt 10). He further advocates that use of masks in public must be a matter of personal choice and evaluation.

Dr. Knut M. Wittkowski, an epidemiologist and a senior research associate at Rockefeller University supports Rancourt's societal immunity argument. He gives an in-depth scientific evaluation of the effect of low immunity to the virus. He explains that if a disease causes resistance after an infectious period, it extinguishes itself as the proportion of immune people increases. He uses the **S**usceptible, **I**nfectious, or **R**ecovered (SIR) model to explain the stages viral infection (WITTKOWSKI 5). Viral infections he says, usually have a 7-day incubation period. COVID-19 has an additional 2 days. A single import of new cases will be visible between 60-120 days (WITTKOWSKI 5). A peak prevalence of infection is 5–22%, and the

number of people who will become immune is 55–90%. To allow for comparisons between models, an arbitrary proportion of symptomatic cases among those becoming infected (05%) is used, and 2% of cases are assumed to die. The figure below reflects milestones of the SARS epidemic, the turning point in infections (red, day 68), the turning point in the number of cases (day 75, orange), the peak in infections (day 83, red), the peak in cases (day 70, orange) and the peak in deaths (day 77, gray). Wittkowski explains that the noticeable part of the epidemic lasts about 90–45 days in a population of 10 million people. Infection is shorter for smaller, more homogenous, and longer for larger, more heterogeneous populations. Hence from a scientific lens, lockdown and social distancing measures are harming the society.

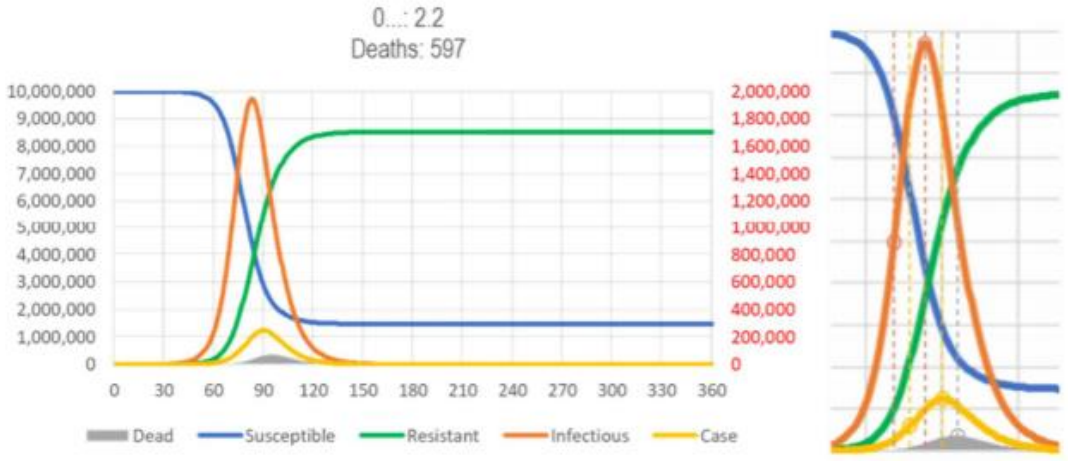


Fig 3: SIR Model of SARS. Number of susceptible (blue), infectious (red), resistant (green), case (orange) and dead (gray) people after a population of 10,000,000 susceptible people is exposed to 20 subjects infected carrying a novel virus. Assumptions: R_0 = 2.2, infectious period = 7 days, (available from https://app.box.com/s/pa446z1csxcvfksgi13oohjm3bjg86ql)

Source: medrxv.org

Economically, the imposition of lockdowns has also impacted the world economies gravely. The Center for Infectious, Research and Policy at the Minnesota University collected data on the number of jobs lost in the United States (US). Since March 2020, the US has seen a job loss of 20.6 million equating to 14.7% unemployment rate (Minnosota 2020). The numbers are quite overwhelming and incomparable to numbers seen in the 2007-2009 recession. The International

Labor Organization (ILO) has also estimated 130 million full-time job losses worldwide (ILO 4). The economic impact of the virus is even more staggering in the customer service industry. Most affected are small businesses, tourism, restaurants, spas, and in-person workers. Statistics Canada reports that airline passenger volume has reduced to 94% (Statistics Canada 2020). It is worthy to note that the economic impact has not only affected businesses, but also vulnerable Canadians, such as women, visible minorities, new immigrants, and low-wage workers. The percentage of young Canadians who reported unemployment in August was 23.1%, while visible minorities reported 12.7% to 17.9%, and 36% making up Indigenous Canadians (Statistics Canada 2020).

Physical distancing and lockdowns have a significant impact on society. Its effect is even worse for the homeless. While lockdowns are implemented, and social services are stretched thin, homeless individuals do not have anywhere to turn to. The very few shelters that are open for services have also become overcrowded, increasing the risk of infection (Buchnea et al 2020). Buchnea *et al* surveyed organizations serving homeless youth to identify some of the challenges they are face. In the survey, there were 60 service and advocacy organizations from 10 provinces. Urban and Indigenous-led organizations represented among the respondents (Buchnea 4), 44 of these provided housing to the youth. Two-thirds (66.7%) of the organizations stated that they were connected to the broader homelessness sector community response to COVID-19 (Buchnea et al 4). While some health and counseling services have switched to online platforms, it has become more challenging to stay in touch with youth who do not have access to reliable phones, and internet connection (Buchnea et al 5). There has also been an increase in financial and family crises. A cut in funding has also been an issue for some of the organizations that provide outreach services, they are also unable to provide personal protective equipment to support their staff, resulting in resignitions (Buchnea et al 5). Eighty percent (80%) of the organizations that provide face-to-face

outreach programs reported a significant impact of their services as some of the services cannot be done online. The overall survey indicated difficulty in accessing housing, health information, food, and income support (Buchnea et al 5). These real-time adjustments in communities highlight the pressing need for prevention-focused services and the ability to enhance the focus on supporting families.

The impact of the COVID-19 pandemic on population mental health is of great concern too. Statistics Canada conducted an online survey from April 24th to May 2020 evaluating the effects of lockdown measures on the mental health of Canadians (Statistics Canada 2020). The survey measured feelings of depression, grief, panic, anxiety, and fear. It was reported that 64% of participants between the ages of 15-24 had a negative impact on their overall mental health, ages 65 and older were 35% (Statistics Canada 2020). In terms of daily stresses, 6% reported no stress, 66% reported lower stress, and 28% reported higher stress. If the current trend of mental state continues to rise, it may lead to clinical diagnosis.

All the above ethical concerns are plausible. However, since social distancing measures were eased, COVID-19 cases have increased (Worldometer 2020). Without a clear solution and a vaccine combat to the virus, coupled with increased infection rate, morbidity, and mortality, the only option is to enforce social distancing measures to help curb the rate of infection while working together with epidemiologists and policy experts to map out a long term solution.

ETHICAL FRAMEWORK

COVID-19 has been compared to the 2003 SARS virus, which has similar characteristics. The only difference is that COVID-19 has a high rate of continuous spread (Goodwin 2020). Although both illnesses are caused by the coronavirus, individuals who get infected with COVID-19 experience mild to severe symptoms, whereas SARS patients experience very severe symptoms

(Goodwin 2020). COVID-19 transmits more easily to SARS because the viral load appears to be eminent in the nose and throat shortly after symptoms develop. Although patients may sometimes be asymptomatic after contracting the virus, its complexity is still under research to further determine its dynamics (Goodwin 2020).

In general, the creation of a public health system is to protect and enhance the population's health (Holland 121). In determining a practical and theoretical approach to managing the pandemic various theories such as deontology, virtue ethics, consequentialism, and utilitarianism can be applied. Deontology, which is related to Kant's work, states that making ethical decisions are "our obligation or duty" as humans (Kant 13). It holds the belief that adhering to a set of principles. The application of deontology in a public health crisis of this nature will mean implementing already existing policies to improve the health crisis to target a specific group of people at the expense of others (Holland 33). For example, if a vaccine is developed, per deontology guidelines, the most prominent will receive the vaccine as supposed to considering equal distribution to everyone irrespective of status. Virtue ethics on the other hand is a philosophical theory that originated with Socrates and developed by Plato and Aristotle. This theory places emphasis on character traits that is universally acceptable, these includes wisdom, honestly and bravery just to name a few (Hooft 2013). Consequentialism and Utilitarianism are interrelated. While consequentialism is based on actions and choices, utilitarianism rests on the “the greater good” as its goal based on consequences (Holland 17). The theory focuses on increasing the amount of happiness and pleasure and decreasing the amount of unhappiness and pain (Alfieri 21). Utilitarianism is mainly linked to the works of British philosophers Bentham (1748-1832) and John Stuart Mill (1806-1873).

From the above overview of the different theories, utilitarianism and consequentialism will be a more reasonable theory in a pandemic like this, where cost and benefits towards society must be calculated. The wellbeing of all individuals is of the same importance when it comes to a public health crisis of this nature. However, health officials, policy experts and government as a whole have it in their power to reduce the number of deaths by making impartial decisions for the greater good on the population.

In the book, *Public Health Ethics,* Stephen Holland illustrates a scenario where a moral agent running late for class saw an old fellow crossing the street. The agent quickly rushes to help the old fellow in hopes of saving him from being hit by a car. Unfortunately, a drunken driver crosses their path and hits the senior fellow injuring him (Holland 18). From a utilitarian standpoint, the moral agent had a good reason for helping the old fellow by sacrificing his time (the agent's goal was to save the older man). Even though the outcome was not expected, it can be argued that the agent's action was morally right (Holland 19). This principle can be applied to the current COVID-19 health crisis. The rate of infection is overwhelming on the healthcare system. If implemented, social distancing measures will cause unemployment, loss of businesses, and economic disparities (these losses will stand for the time lost by the moral agent); however, the goal is to limit the rate of infection and death while finding a solution to combat the virus in the long term. Holland provides another scenario, where he explores the term "the greatest good for the greatest number." A moral agent who has the last 5ml of a drug is faced with the decision to save five people who have a common cold by giving them 1ml each or save one person who has a life-threatening disease, by providing all the 5ml to that person. Here the question is, what is the best moral decision to take? Should we give the 1ml to save the five people (a most significant number) or give the 5ml to save the person with the life-threatening disease?

According to Holland, a natural line of thought will be to do the greatest good for the most significant number; therefore, the agent must save the five individuals (Holland 19). He explains that the Utilitarian theory seeks to maximize the greatest good for all, based on one's action and not the most significant number.

Increased mental health has been prevalent with the implementation of social distancing (Statistics Canada 2020). There is no doubt that mental health will rise if people are not allowed to go about their daily lives. Notwithstanding, imagine allowing people go about their normal duties in hopes that there will be herd immunity to the virus, only to lose more lives instead. This will be devastating to individuals who have lost loved ones. They may never recover from the loss, and this may have a more negative impact on their mental health. The economy will also suffer greatly as there will be more cases of COVID-19, hence people losing their jobs to seek treatment. It is very much of a struggle to restrict individual’s freedom in hopes to limit infection rate but from a utilitarian standpoint the more benefits (low infection rate) one enjoys matters to the amount of good produced (Holland 20).

There are two schools of thought when it come utilitarianism, act, and rule utilitarianism (Savulescu *et al.* 3). Act utilitarianism assumes the role of taking the right action in any situation that will yield the most benefit or consequences to other available actions. On the other hand, rule utility rests on general moral rules that are already in place and considered justifiable when applied, will yield the right consequences. Different situations may require the use of act or rule utilitarianism. However, there are certain circumstances that both theories must be combined to yield a better outcome.

There are a few rules of thumb that can guide decision-making using a utilitarian approach in managing COVID-19. Firstly, when deciding lockdown measures, policymakers

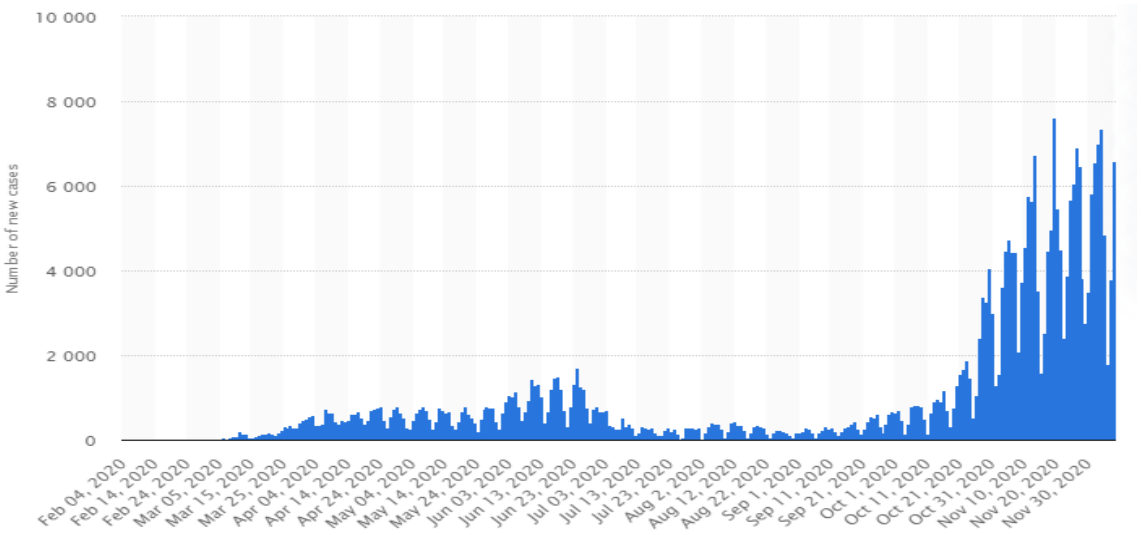
should assess the probability of lives that will be lost versus the probability of lives that will be saved considering available resources (Savulescu *et al* 4). This is when Richard Hare's decision-making analysis comes handy. Richard key figure in the utilitarian tradition, approaches decision making with critical analysis. He distinguishes two moral levels of thinking: intuitive thinking and critical thinking (Hare 2). The difference between the two is that intuitive thinking is done daily. Examples include stealing, showing kindness and respect for others' opinions. The intuitive level of thinking can be applied in this pandemic situation where frontline workers such as nurses and doctors are up to the task of waking up every day, attending to patients, and providing exceptional services. On the other hand, critical thinking requires more reflective and deliberative decision-making in complex situations.

Data collected by the website Statista in the beginning of the pandemic indicate that there was 1, 244 hospitals established in Canada in all 12 provinces, Ontario alone has 400 facilities making it the largest number province to have the most healthcare resources among the hospitals (Statista 2020). The province also has only 1,810 beds equipped with ventilators for COVID-19 patients (Mehdi 2020). Given Ontario's population of 14.7 million, the distribution of ventilators will be 12 to 100 000 people not factoring in other illnesses requiring the use of ventilators (Mehdi 2020). In a situation of scarcity, the duration of time on a ventilator has implications for the number of lives to be saved (Savulescu *et al* 3). As of October 3rd, the number of COVID-19 cases have risen exponentially, causing health officials to issue a second wave warning. Dr. Sinha, director of geriatrics at Sinai Health and the University of Toronto in an interview with CBC news, indicated that even though testing capacity has increased, hospitals are overwhelmed with patients infected with COVID-19 and other non-COVID-19 related illnesses (Miller 2020).

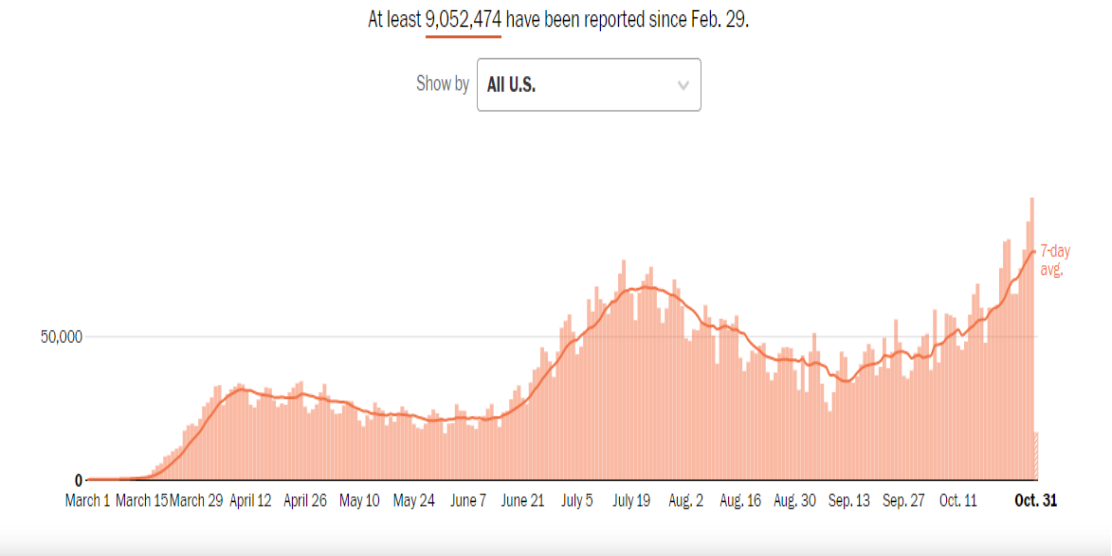
Another way to analyze the pandemic is to apply the rule of thumbs "the amount of time a good produced will be enjoyed". Treatment and policies that will save lives for a longer period should be considered over short-term solutions (Savulescu *et al* 4). This then calls for analyzing the quality-of-life individuals will have based on social distancing measures. The well-being of individuals and society is based on social, cultural, financial and the freedom to live. With restrictions, the quality of life is compromised. However, the virus is very contagious and can drastically change individual's way of living or die after they contract it. As humans we can adopt to change even if living in isolation. Though, quality of life will be affected when social distancing measures are implemented the benefits outweigh contracting the virus. It is also important to note that, utilitarians consider not just how long a person will live after treatment but how well they will live (Savulescu *et al* 4). The virus is still in its early research stages, therefore there is little information about the quality of life after infection. An analysis using triage will be relevant to examine two patients named Gorge and John. Gorge has respiratory failure but has great cognitive functions, whereas John has dementia (Savulescu *et al* 4). Doctors inform Gorge that he will still be able to live a normal life after treatment. On the other hand, John will not be conscious and will have gradual depletion of quality of life due to memory loss. If there was a choice to treat both patients with the same resources, utilitarians would suggest that Gorge be treated (Savulescu *et al* 4), this is because there is a higher chance of him living a quality life after treatment compared to John, who will have lots of difficulties enjoying life even after the best of treatment due to lack of cognition function.

Scientific analysis and evidence have shown that the population adhering to immunity via exposure to a new virus can help fight the negative impact of the virus but, this has not been the case for COVID-19 (Lu 572). Unlike other European countries that adhered to lockdown

measures, Sweden decided to go on the path of herd immunity. Unfortunately, the country has experienced negative impact of the virus. As of October 13th, 2020, Sweden's per capita death rate was 58.4 per 100,000 people (Bjorklund and Andrew 2020). Sweden relied heavily on previous scientific evidence that if 60% of the population gets immune to the virus, it will stop infection (Bjorklund and Andrew 2020). Their implementation of the "Darwin theory" which takes the survival of the fittest approach led and increased rate of infection. The “Darwin Theory” is a system that explains that all organisms have the tendency to adapt and survive in their environment based on evolution. This can be detrimental to those with low immunity and are vulnerable (Markgraf 2019). Research conducted by Stockholm and Nottingham Universities using a mathematical level of categorizing data by age and activity resulted in counter results of previous research of herd immunity (Icke 2020). According to the study, the herd immunity level will be the fraction of the population that must be immune for the virus to decline and stop spreading when social distancing measures are lifted. It can therefore be concluded that COVID-19 has a herd immunity of 43% and it is heavily based on social activity and different behaviors of individuals (Icke 2020).. Recent findings by the Journal of the American Medical Association indicate that Sweden and the U.S are the countries with the highest mortality rate, and this can be attributed to their failure to implement social distancing measures earlier in the pandemic (Bjorklund and Andrew). Countries like South Korea, Japan, Taiwan, Finland, Australia and New Zealand that locked down early, and implementing contact tracing did see improvement in infection rates and their economy (Bjorklund and Andrew 2020). There is no doubt that both Sweden and the U.S. put their citizen's first (sustaining the economy) in their approach in dealing with the virus, however it was not appropriately measured as the right approach to utility. The tables below indicate the rate of infection rate by month in Sweden and the U.S.



Source: Statista



Source: The Washington Post

It can be analyzed that Sweden had ongoing increase in infection rates each month without social distancing measures. The U.S. on the other hand implemented lockdown measure in the month of April but was quick to open which resulted in a surge in their cases (Bjorklund and Andrew 2020). Florida especially, was hit the most as most of the population are older and are susceptible.

For utilitarians, when a foreseeable and avoidable action can bring about less good in state of affairs, we are morally responsible and blameworthy (Savulescu *et al 5*). Practicing herd immunity or enforcing social distancing measures will yield different outcomes even though they all produce benefits to citizens (Holland 20). In making an informed decision on policies, resources should be considered in this pandemic. Resources such as facilities to cater to sick people, frontline workers and personal protective equipment must be considered. The consequences of our actions now will determine only what we can rely on, which is the different costs and benefits of action and policy. Citizens build their trust in their healthcare system if policies are for the benefit of the greater good. For every decision that our health officials make, there will be consequences. Until a vaccine is developed and tested, social distancing measures must be implemented to help minimize viral infection while maximizing the best outcome. Freedom and liberty can only be of importance when citizens are well catered for.

PANDEMIC PLANNING

Pandemics occur when a novel influenza virus infects people quickly and can spread from person to person in a sustainable way (Prevention 2019). When a new pandemic occurs, many people get sick because they do not have immunity to it. One of the deadliest pandemics in history is the 1918 H1N1 flu pandemic, also referred to as the "Spanish flu" (Prevention 2019). It was estimated that 500 million people were infected globally, and 50 million deaths recorded. Another pandemic that hit the globe was the 2009 H1N1 flu, also known as influenza A (H1N1)pdm09 virus (Prevention 2019). The Center for Disease Control estimates that there were 60.8 million cases globally with over 151,700,575 deaths. Pandemics rarely happen, but if they do, people's lives are disrupted and therefore a good preparedness plan must be put in place.

Based on previous epidemics and pandemics, the Center for Disease Control Unit of the World Health Organization came up with a checklist on how to respond and prepare for future pandemics. The pandemic plan was developed based on ethical considerations such as prioritizing limited resources, limitations on individual liberties, addressing the vulnerable population's needs, how to communicate with the affected population effectively, and lastly, indiscriminately distributing vaccines or antiviral drug (if available). WHO has been monitoring and has made recommendations on pandemic planning for large population countries such as the United States, Australia, Italy, and Canada, however other countries who have resources and capacity to implement a pandemic plan are encouraged to do so (WHO 2005). Pandemic planning involves "a multisectoral approach" which means all governmental entities and experts like policy analysts, public health officials, and communication experts must be involved to make the plan a success.

The checklist that needs to be followed are preparing for an emergency; surveillance, case investigation, and treatment; preventing the spread of the disease in the community (implementing social distancing measures and quarantine); maintaining essential services; research and evaluation; implementation, testing, and revision of the national plan.

Preparing for an emergency. Pandemic planning requires a lot a considerable amount of human resources, political and bureaucratic commitments to make it efficient. The first stage of planning requires allocating existing resources and structures to avoid overlap and enhance efficiency. Resources will include the right workforce and investments (WHO 1). All levels of governments and the community must agree to commit. There should also be a timeline for the pandemic preparation for effective execution. A national committee should be established, and individual roles assigned. Members of this committee must include healthcare officials, non-

governmental organizations, legal practitioners, manufacturers of pharmaceutical products, and academic institutions (WHO 2). Regular meetings should be held to discuss steps to take, and every individual should have a clear understanding of their role in case of a potential epidemic or pandemic. During the planning stage, policies established must contain competing interests and values, drawing on ethical principles that will benefit the community (WHO 2). Similarly, in planning and policy process, there should be an ethical risk assessment to estimate the potential pandemic's impact both in the healthcare sector and other services. This can be done by conducting model studies looking at previous epidemics or pandemics. Studies can be measured on number of available healthcare facilities, patient consultations, admissions, and deaths (WHO 3). A clear communication plan must also be established, this should include establishment of a website as a one-stop-shop where the public can find information and useful communication modes. The latter will help to disseminate accurate and timely information to the public. Nominating a pandemic spokesperson for daily and accurate briefing of events and strategies to the public is also essential. It will also be necessary to include a justifiable legal framework, coherent with international laws to overrule existing legislation. This would come in handy in the event of a quarantine act which would restrict the movement of individuals or even when a compulsory vaccination law is passed. To firm up the planning stage, all optional alternative resources must be in place in case the original plan is considered invalid.

Surveillance. The surveillance stage is when an actual pandemic happens, and action needs to be taken. The process consists of ongoing data collection, interpretation, and dissemination of information to enable the development of evidence-based interventions (WHO 8). There are three levels of surveillance. These are interpandemic surveillance, enhanced surveillance, and

actual pandemic surveillance. Each surveillance activity should have clear objectives. However, each objective may differ at each level depending on the seriousness of the infection.

Under interpandemic surveillance, a country must establish a National Influenza Centre, which will act as an early warning system should a pandemic occur. They must consider joining the Global Influenza Surveillance Network (GISN) to send early detection of an epidemic or pandemic. This establishment will include laboratory technicians and a response team trained to monitor the surveillance system (WHO 9). There must therefore be a clear objective towards the policy development with goals and strategies specifically set in place for epidemiological and potential outbreak. Progress of which would go a long way to help measure advancement to reaching the larger end goal (WHO 9).

The enhanced surveillance level is dependent on whether a potential strain has been detected (WHO 10). It involves early warning of a potential threat of viral infection, monitoring incoming travelers, surveillance of specific risk groups, and monitoring healthcare workers taking care of patients. It is essential in this stage to follow WHO's directives while implementing already established objectives and implementations.

The final level of surveillance will be collecting of data and managing of resources once a pandemic has been declared. This will include monitoring suspected cases and hospital admissions, monitoring deaths, workforce, vaccine usage, and its effectiveness, recovery cases, and implementation methods (WHO 11).

Case investigation and treatment. This stage requires the use of scientific methods and expertise to carry out tests. WHO recommends that every country establishes a laboratory with trained experts in immunofluorescence and Reverse Transcriptase-Polymerase Chain Reaction (RT-PCP) (WHO 13). In the absence of a laboratory, there should be a commercial antigen testing kit

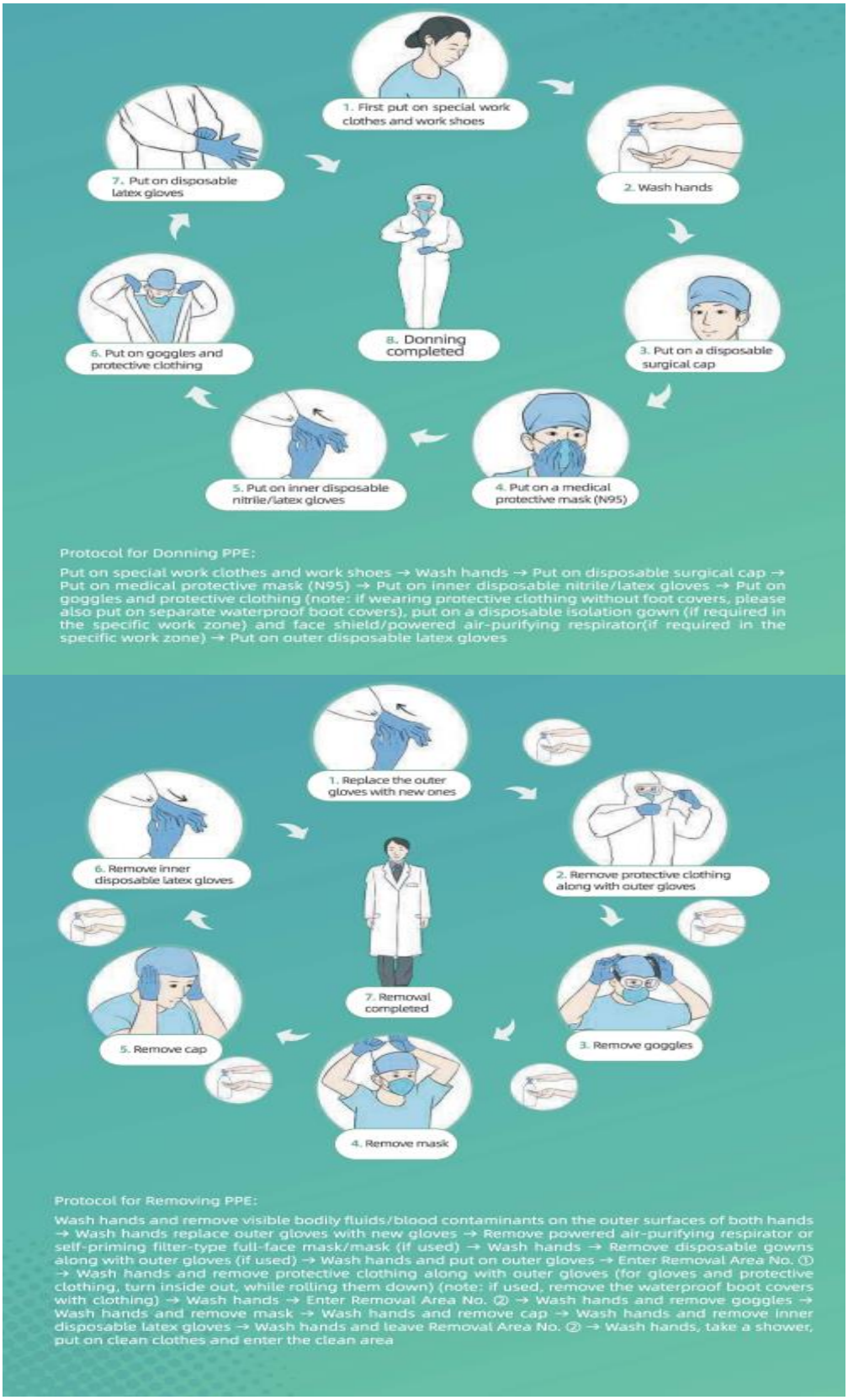
that may only be used for outbreak investigation. While running these laboratories, it is vital to follow all biosafety protocols. The initial inception of a pandemic will require increased testing; therefore, it essential for laboratories to be prepared for the influx. Effective policy on material and information sharing should be developed and implemented both locally and internationally. The laboratory will be a great communication point to reach WHO for all guidance and directives.

Treatment and case investigation go hand in hand with managing health facilities efficiently. Because hospitals are prone to high infection rates, there must be an establishment of healthcare facilities to treat cases (Liang 2020). This will involve making sure the facility has an exclusive one-way passage at the entrance with a visible sign (Liang 1). People's movements should follow the principle of "three zones and two passages": being a contaminated zone, a potentially contaminated zone, a clean zone that is properly demarcated, and two buffer zone between the infected area and the potentially contaminated zone (Liang 1). The facility must have an independent examination room, a laboratory, an observation room, a bathroom, and a resuscitation room to receive patients of suspected cases for observation. In terms of patient management, those showing signs of fever must wear medical masks. To prevent cross-contamination, only patients should be allowed into the waiting room to reduce overcrowding (Liang 2). While it is crucial to enforce protocols with patients, it is also vital to ensure each staff has the proper protective equipment and training to enable them to do their work efficiently (Liang 4). Protective gear will be based on the level of protection needed. It is also important to follow appropriate procedures to put on and take off their protective equipment. This will involve assigning infection and control technicians to oversee the process (Liang 1). The

diagrams above and below are detailed graphical steps in donning and removing Personal Protective Equipment (PPE).

COVID-19 Related Personal Protection Management

Protection Level	Protective Equipment	Scope of Application
Level I protection	• Disposable surgical cap • Disposable surgical mask • Work uniform • Disposable latex gloves or/and disposable isolation clothing if necessary	Pre-examination triage, protection general outpatient department
Level II protection	• Disposable surgical cap • Medical protective mask (N95) • Work uniform • Disposable medical protective uniform • Disposable latex gloves • Goggles	• Fever outpatient department • Isolation ward area (including isolated Medical protective mask (N95) intensive ICU) • Non-respiratory specimen examination Disposable medical protective of suspected/confirmed patients • Imaging examination of suspected/ Disposable latex gloves confirmed patients • Cleaning of surgical instruments used with suspected/confirmed patients
Level III	• Disposable surgical cap • Medical protective mask (N95) • Work uniform • Disposable medical protective uniform • Disposable latex gloves • Full-face respiratory protective device or powered air-purifying respirator	• When the staff performs operations such as tracheal intubation, bronchofibroscope, gastroenterological endoscope, during which, the suspected/confirmed etc., patients may spray or splash respiratory secretions or body fluids/blood



Source: Handbook of COVID-19 Prevention and Treatment

Preventing the spread of the disease in the community (implementing social distancing measures and quarantine). When a new strain of virus hits the globe, it is difficult to manufacture a vaccine in a short time. Therefore, it is crucial to implement interventions that will slow down the spread of the virus, especially in developing countries where vaccine distribution and resources are limited. These interventions may benefit the community but may override human rights, which may further require legal backing to prevent lawsuits. The legal framework which was created in first stage of pandemic planning will be useful at this stage. This will include enforcing social distancing measures, a travel ban, implementing quarantine, and introducing a vaccine program (WHO 18).

Some of the interventions to implement will be to enforce and educate the community about personal hygiene, such as frequent hand washing, establishing handwashing stations for easy accessibility. Putting social distancing and quarantine rules in place is also a necessity, and can be done by closing schools, churches, and limiting the amount of social gathering. uarantine, facilities must be established for infected individuals with the provision of medical supplies, food, and counseling. Travel must be regulated and limited to only essential services.

Maintenance of essential services. It is imperative to maintain essential services such as functional medical facilities, organize rotational healthcare workers to various facilities, recruit volunteers from the military and other sectors to assist with basic services within the health sector. Collaboration with organizations that can provide assistance and support is also essential. Protective equipment and supplies should be readily available. Food is considered essential, so a plan must be in place to provide food for the least fortunate and most vulnerable. Another important service to provide is testing and contact tracing. This must be done to detect ongoing infection to implement isolation strategies (WHO 2020).

WHO also recommends a recovery plan to be put in place and implemented when the pandemic is over. The plan will include rebuilding society by providing financial support to those who have lost their jobs, providing funding for businesses who have been affected by the pandemic, mental health counseling, and ongoing support for the community.

In response to COVID-19, WHO has collaborated with United Nation agencies in Costa Rica and other countries to provide more than 20000 units of humanitarian aid to indigenous communities. Some of these supplies includes masks, cleaning supplies, gloves, mobile phones, clothing just to name a few (WHO 2020). The organization has also supported a mobile team in Syria to deliver mental health. It was reported that in 2016 there were only 4 psychiatrists serving a population of 4 million, WHO has significantly upscaled the training of 160 physicians and over 400 social workers to help support psychosocial services during the pandemic (WHO 2020).

All the above notwithstanding the organization has nominated some of its member to participates and represent them on various Government committees in different countries to oversee health policies and implementation.

POLICY FRAMEWORK AND RECOMMENDATIONS

While enforcing social distancing measures to reduce the spread of COVID-19, it is also imperative that public officials, healthcare, and policymakers work together to provide the necessary economic and social support for the masses to aid its effectiveness. Australia is one of the countries that has been successful in managing the spread of COVID-19. The country issued special funding for research (Foundation 2020), and provided financial relief of up to 90% of lost wages for their citizens (Government 2020). It is encouraging to see that Canada has similarly followed suit.

The Canadian government introduced the Canada Emergency Response Benefit (CERB) to support employed and unemployed Canadians who have been impacted by COVID-19 (CFIB 2020). Eligible individuals can receive up to $2000 monthly. The federal government also announced funding for small businesses that have had to shut down due to the impact of the virus (CFIB 2020). One of these funding programs is the Canada Emergency Wage Subsidy (CEWS). This subsidy, available until December 19th, 2020, is geared towards helping employers (keep employees on the payroll) who faced declining revenue up to 30% or higher (CFIB 2020). There is also the Canadian Emergency Business Account (CEBA). This lending program is offered through financial institutions in collaboration with Canada's government to support small businesses with expenses that cannot be deferred. The loans are interest-free if paid by December 31st, 2020 (CFIB 2020).

The government also modified policies that encourages employers to pay employees up to three months in lost wages on the onset of the pandemic. Work from home options was also recommended for businesses that can be conducted remotely. Food distribution at food banks to feed the less privileged has also increased capacity (Food 2020).

The hardest sector hit by the COVID-19 pandemic is the healthcare sector. The Canadian Institute for Health Information has reported a total of 19.4% COVID-19 cases related to healthcare workers (CIHI 2020). In an interview with the Chronicle Journal, Linda Silas, President of the 200,000-member Nurses' Federation said that Canadian hospitals dealt with COVID-19 based on the 2003 government commission on SARS. Canadians did not prepare adequately in terms of resources to tackle the pandemic. Health facilities experienced a shortage of protective equipment. There are a lot of patient influx in healthcare facilities who may have been carrying the virus unknowingly, therefore spreading to other patients who have other

illnesses (CIHI 2020). As a policy recommendation, hospitals must have separate designated wards for suspected COVID-19 cases. Public and some private buildings should be converted into treatment centers. There should also be increased testing and triaging of patients who may have contracted the disease.

Another sector affected by the pandemic is nursing homes. In Canada, Quebec's province has suffered the most in the number of cases in nursing homes. The five nursing homes with the highest number of cases had 1,013 patients by the end of March 2020 (Riga 2020). People with pre-existing conditions and people over the ages of 70 are most at risk to the virus. This is partly due to the fact that caregivers in nursing homes work on rotation at different locations and in this way contract and spread the virus as they move around. To curb the virus's spread, employees must work with one nursing home instead of rotating between different nursing homes This will not only help with contact tracing, but also aid in monitoring the activities of those who come in and out of the care homes.

A crowdsourcing survey carried out by Statistics Canada from March to June on the impact of COVID-19 related crime issues saw an increase in service calls to police. Calls related to general wellbeing increased by 12%, domestic disturbance was also 12% more, and mental health related needs increased to 11%. The report indicated that those experiencing violence, prominently in the home, had difficulty accessing help because of restricted contact to networks and formal support from counselors, schools, and victim services. The government has the social responsibility of strengthening the social protection floors that can proactively identify and protect the vulnerable sector groups (Statistics Canada 2020). I therefore propose a policy where the government will work with other stakeholders in the technology industry to develop applications that are easily accessible for victims as and when needed.

Shelters within Canada have seen a surge in numbers and a decline in volunteers who are afraid of contracting the virus (Buchnea 2020). This has resulted in overcrowding and insufficient service provision. I recommend that hotels, abandoned rehabilitation, and community centers be converted to shelters for the homeless. This will eliminate overcrowding and limit movement of people. Additionally, working collaboratively with non-profit organizations to provide mental health counseling, food security, and community resource sharing will be a significant step.

Pandemic planning following WHO guidelines is a collective and shared responsibility. During a pandemic like COVID-19, society may be under undue stress and threat owing to fear of the unknown. It is therefore imperative to have an open government policy and effective communication between countries and partners. This will help clarify confusion in strategies that have worked for other countries. Communication also comes with building public trust. Fractured communities with distrust towards one another are not conducive to a significant public health response to the pandemic. Social media reports on the virus have skyrocketed with lots of conspiracy theories. It is the government's mandate to engage and educate its citizens every step of the way in distinguishing between right and false information shared in the public domain. This can be done by directly working with major media outlets in publishing the correct information and sifting out the wrong ones.

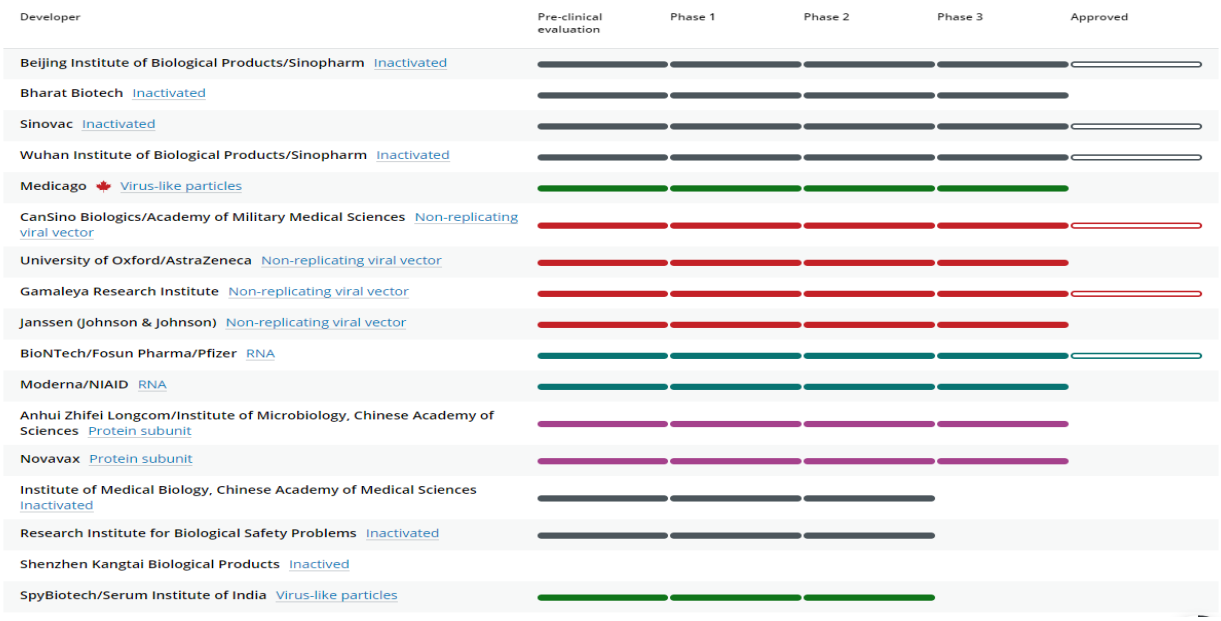
We are in the age of technology where almost every business transaction can be done virtually; I recommend that some businesses be modified to meet the current trend of technology. Also, the government must invest in the retraining of individuals who have lost their jobs in certain sectors and place them in establishments that require workers.

Immunization and Vaccine Development. Primary health prevention measures aim at preventing the onset of a disease, whereas secondary measures aim at identifying individuals who are asymptomatic who may be at risk of developing the disease, which in turn leads to early intervention (Holland 186). Immunization is one of the major measures used in controlling infectious diseases. This is because it has been one of the successful endeavors in public health and has gained public support (Holland 186). COVID-19 is one of the diseases that will require mass vaccination (WHO 2020). Whereas mass vaccination is accepted, there have been concerns raised about the ethics of vaccination. Holland explains that some of the dissidence raised against vaccination are based on religious beliefs and misconceptions about the harms of vaccines. Different countries will have different policies on vaccine implementation (Holland 189). While some countries will allow for voluntary vaccination, others will have a more aggressive approach to encourage people to partake in vaccination programs. When it comes to the ethics of immunization, the question that is raised is if it is feasible for the government to impose compulsory vaccination on the general populace or individuals should have a choice to vaccinate (Holland 189). Holland argues that in a situation where voluntary non-immunization threatens the lives of others, the government is within its rights to enforce people against their will to be immunized hence making compulsory immunization justifiable (Holland 190).

The development of a vaccine takes a long time, on an average of about 10 years. A case in point is the first vaccine developed for Ebola, which took 43 years (Mullard 2020). There are over a hundred pharmaceutical companies competing to find a vaccine for COVID-19, with some of the vaccines under clinical trials (Mullard 2020). Moderna, one of the leading companies in vaccine development, has developed the mRNA-1273. It was manufactured 66 days after the emergence of COVID-19. The vaccine delivers a genetic sequence into a host cell

and co-opts the host machinery to express antigens of interest (Mullard 2020). The vaccine uses a synthetic lipid nanoparticle to carry mRNA templates instead of using a weakened COVID-19 as a transport code (Mullard 2020). The goal is to train the immune system to recognize COVID-19's spike protein, which is used to bind and enter the host cells. Subsequently, it prevents the victim from getting any more symptoms and eliminates the Virus from the body.

AstraZeneca, in collaboration with Oxford University, has also begun phase 3 studies of their trial. They have developed a vaccine called AZD1222 that will achieve a similar effect as Moderna's. They, however, use a chimpanzee adenovirus to carry the DNA for the spike antigen (Mullard 2020). Their focus is on healthy adults aged 18–65 who work in frontline healthcare settings (Mullard 2020). Researchers at WHO are considering other options such as vaccinating volunteers with live viruses to speed things up (Mullard 2020). There are, however, concerns raised as to whether this is a winning strategy as its advantages are still questionable (Mullard 2020). Below are some vaccine developers in the stages they have reached with their vaccine testing.



Source: World Health Organization

The most recent successful vaccine that was approved is by Pfizer and Biontech. The vaccine was submitted to the Food and Drug Administration (FDA) in the United States, for Emergency Use Authorization (EUA) so they can test the BNT162b2 against SARS-CoV-2 on candidates (Pfizer 2020). This vaccine was expected to be used to vaccinate high-risk populations in the United States by the middle to end of December 2020. The vaccine is in its phase 3 clinical study and has been applied to volunteers who did not have COVID-19 as well as those who have had the Virus. The companies have attested that the vaccine has an efficacy rate of 95% ($p<0.0001$) (Pfizer 2020). Results were measured from 7 days after the second dose.

The Phase 3 clinical trial began on July 27th and has enrolled 43,661 participants to date. 41,135 have received a second dose of the vaccine as of November 13th, 2020 (Pfizer 2020). The BNT162b2 (vaccine), which is based on BioNTech's proprietary mRNA technology, conducted 150 clinical trial sites in the United States, Germany, Turkey, South Africa, Brazil, and Argentina. According to the study, the first primary subject analysis was based on 170 confirmed cases of COVID-19 (Pfizer 2020). The submission also is supported by solicited safety data from a randomized subset of about 8,000 participants ≥18 years of age and unsolicited safety data from roughly 38,000 trial participants who have been followed for a median of two months following the second dose of the vaccine candidate (Pfizer 2020). The submission also includes solicited safety data on around 100 children 12-15 years of age. The participants were of various ethnic backgrounds, of which 42% were global participants and 30% from the United States. The median age was 56-85 years, of which 41% are a global participants and 45% from the United States. So far, the Monitoring Committee (DMC) has not reported any profound adverse effects of the vaccine (Pfizer 2020). The companies are very grateful to the study volunteers and investigative site staff in the clinical trial program, as their involvement was an essential

milestone in the companies' efforts to address the COVID-19 global pandemic (Pfizer 2020). Pfizer and BioNTech plan to submit the efficacy and safety data from the study for peer-review in a scientific journal once the analysis of the data is completed. Participants will continue to be monitored for long-term protection and safety for an additional two years after their second dose.

The collaboration of Pfizer and Biontech will see a potential supply of up to 50 million vaccine doses globally in 2020 and up to 1.3 billion doses by the end of 2021 (subject to clinical success, manufacturing capacity, and regulatory approval or authorization) (Pfizer 2020). The companies have already initiated rolling submissions with several regulatory agencies worldwide, with countries like Canada, Australia, United Kingdom, Europe and Japan (Pfizer 2020). While they anticipate potential authorization from regulatory agencies, the companies continue to collaborate with governments and Ministries of Health globally to distribute the vaccine, upon approval, to help ensure it can reach those most in need as quickly as possible (Pfizer 2020).

The recommended temperature for the vaccine under acceptable storage conditions are (-70°C ±10°C) up to 15 days. Pfizer has a history of expertise in cold-chain shipping and has an established infrastructure to supply the vaccine worldwide, including distribution hubs that can store vaccine doses for up to six months. They have developed specially designed, temperature-controlled shippers for the BNT162b2 vaccine candidate, which can maintain recommended storage conditions (Pfizer 2020). Each shipper will have a GPS-enabled thermal sensor to track the location and temperature of each vaccine shipment. Once defrosted, the vaccine vial can be stored for up to 5 days at refrigerated (2 - 8^{o}C) conditions (Pfizer 2020). From the start of the research program earlier this year, Pfizer and BioNTech have successfully supplied and distributed their investigational vaccine to more than 150 clinical trial sites across the United

States, as well as Europe, Latin America, and South Africa. Based on their collective experience, the companies are positive in their ability to distribute the vaccine globally.

Ethical values and principles must be considered in the distribution of COVID-19 vaccines. This consideration is relevant because the pandemic has highlighted systemic social and health inequalities. For example, Morderna a leading manufacturer in vaccines has opted out in distributing vaccines to Africa. The Globe and Mail reported that more than 12 million doses of COVID-19 vaccines have been supplied to about 33 countries globally, but Africa is not on the list. Since supply of the vaccine is limited and can affect allocation, a clearly outlined vaccine program should be in place to clarify who gets priority.

The Advisory Committee on Immunization Practices (ACIP) at the Center for Disease Control and Prevention recommends that initial allocations of COVID-19 vaccine during the period of constrained supply should be based on information as is available. It should also be based on the vaccine's characteristics to safety and efficacy in older adults and epidemiologic risk as well as the feasibility of implementation, including storage and handling requirements. The recommendations by ACIP are based on four ethical principles for four groups. Firstly, to maximize benefits and reduce harm (utility), promote justice, eliminate health inequalities, and to promote transparency.

The allocation of the COVID-19 vaccine should maximize the benefits of vaccination to both individual recipients and the population overall (McClung *et al* 1). The benefits must be aimed at reducing infections of COVID-19–associated morbidity and mortality, which will in turn, reduce the burden on strained health care facilities and capacity. This is important because the maintenance of essential services for a functional society is more critical at this time (McClung *et al* 1). When identifying eligible individuals for vaccine receipt, consideration

should be given to those who are at high risk of infection. Health care workers are considered high risk, and this is because their job prevents them from maintaining limited distance. It is important for these frontline workers to remain healthy in order to protect the lives of the general population so as to minimize social and economic disruption (McClung *et al* 1).

The ACIP also recommends the promotion of justice. The wellbeing and health of all persons is an obligation to protect to advance equal opportunity. The goal of promoting justice is to remove unfair and avoidable barriers that affect groups that are economically and socially marginalized to ensure a successful implementation process. The distribution and allocation of COVID-19 vaccines should promote justice by purposely ensuring that all persons have equal opportunity to receive the vaccine as it becomes available (McClung *et al* 2). The process would include collaboration with community representatives, health care partners, and external entities to develop allocation and distribution plans.

The disparities created by the COVID-19 pandemic has reduced the achievement of full potential based on certain social determinants. Among these determinants are racially profiled individuals such as minorities and low-income families (McClung *et al* 2). The ACIP recommends allocation strategies that will aim at dismantling existing disparities and not creating new disparities. The distribution should also be made available to residents and people living in hard-to-reach areas or with limited access to health care.

More than ever, transparency and public trust have become eminent, especially in a world where social media has created so much misinformation. The response to COVID-19 has been evolving as new information emerges calling for transparent, evidence-based decision-making in allocating vaccines (McClung *et al* 3). ACIP encourages the public's participation in the creation and review of the decision-making process. The public's involvement will be to track the

vaccine's administration, effectiveness based on evidence and communicating progress, and recommendations on time (McClung *et al* 3). Below are some questions to consider.

Table 1

Ethical principle	**Essential question**
Maximize benefits and minimize harms	• What groups are at highest risk for SARS-CoV-2 infection, COVID-19 disease, hospitalization, and death? • What groups are essential to the COVID-19 response? • What groups are essential to maintaining critical functions of society? • What are the important characteristics of these groups (e.g., size or geographic distribution) that might inform the magnitude of benefit based on the amount of vaccine available or its characteristics?
Promote justice	• Does the allocation plan result in fair and equitable access of the vaccine for all groups? • How do characteristics of the vaccine and logistical considerations affect fair access for all persons? • Does allocation planning include input from groups who are disproportionately affected by COVID-19 or face health inequities resulting from social determinants of health, such as income and health care access?
Mitigate health inequities	• Does the plan identify and address barriers to vaccination among any groups who are disproportionately affected by COVID-19 or who face health inequities resulting from social determinants of health, such as income and health care access? • Does the allocation plan contribute to a reduction in health disparities in COVID-19 disease and death? • What health inequities might inadvertently result from the allocation plan, and what interventions could remove or reduce them? • Is there a mechanism for timely assessment of vaccination coverage among groups experiencing disadvantage and the possibility for course correction if inequities are identified?
Promote transparency	• Are the allocation plan and evidence-based methods publicly available? • How does development of the allocation plan include diverse input, and if possible, public engagement? • What is the process for revision of allocation plans based on new information?

	• Are the allocation plan and evidence-based methods publicly available? • Is there a mechanism to report demographic data elements for vaccine recipients (e.g., age, race/ethnicity, and occupation) to support equitable vaccination coverage?

Source: Center for Disease Control and Prevention

Table 2

Application of ethical principles to four groups of candidate group for initial COVID-19 vaccine allocation

Principles (with transparency across the decision-making process)	**Candidate groups* (approximate no.)**			
	Health care personnel† (21 million)	**Other essential workers† (87 million)**	**Adults with high-risk medical conditions§ (>100 million)**	**Adults aged ≥65 years (53 million)**
Maximize benefits and minimize harms	Preserves health care services essential to the COVID-19 response and the overall health care system.	Preserves services essential to the COVID-19 response and overall functioning of society.	Reduces morbidity and mortality in persons with high incidence of COVID-19 disease and death.	Reduces morbidity and mortality in persons with high incidence of COVID-19 disease and death
Promote justice	• Addresses elevated occupational risk for SARS-CoV-2 exposure for those unable to work from home. • Promotes access to vaccine across a spectrum of HCP job types and settings	• Addresses elevated occupational risk for SARS-CoV-2 exposure for those unable to work from home. • Promotes access to vaccine and reduces barriers to vaccination in occupations with low vaccine uptake	Will require focused outreach to vaccinate persons in this group who have no or limited access to health care or experience inequities in social determinants of health	Will require focused outreach to vaccinate persons in this group who have no or limited access to health care or experience inequities in social determinants of health

Mitigate health inequities	Racial and ethnic minority groups are disproportionately represented in low-wage HC	• Racial and ethnic minority groups are disproportionately represented in many essential industries. • Approximately one quarter of essential workers live in low-income families	• Increased prevalence of obesity and diabetes (most prevalent conditions in this group) among some racial and ethnic minority groups; increased prevalence of some medical conditions for persons in rural areas. • Could increase health inequities because diagnosis of high-risk medical conditions requires access to health care	• Although racial and ethnic minority groups are underrepresented among adults aged ≥65 years, certain groups have disproportionate COVID-19–related hospitalization and death rates. • Strict age-based criterion could increase disparities due to racial and social inequities, such as occupation, income, access to health care

Source: Center for Disease Control and Prevention

CONTINOUS TESTS

Continuous tests for contact tracing is essential as vaccines are in the trial and approval stages. This will help manage the pandemic. The main methods to determine the presence of a virus is through Polymerase Chain Reaction tests (PCR), antibody test and antigen test.

Polymerase Chain Reaction tests involve collecting specimen from an infected patient done through a nose swab. Technicians use reverse transcriptase polymerase chain reaction at the

lab to look for the coronavirus (Azad 2020). Specimen collection methods and timing are important to improve detection sensitivity. This can be done through nasal or pharyngeal swabs (Liang 19). If the specimen cannot be collected in the upper airways, secretions such as urine, feces can be used. After the collection of the specimen virus must be pre-processed to extract nucleic acids (Liang 19), the nucleic acid is then examined under fluorescence intensified laboratory equipment.

Antibody tests, also known as serology tests, do not discover the virus itself but are done after a patient contracts the virus. The method used to determine the antibody is called colloidal gold immunochromatography or chemiluminescence (Liang 20). A positive serum-specific lgM, or specific lgG antibody titer in the recovery phase >4 times higher than that in the acute phase, can be used as a diagnostic criteria for suspected patients with negative nucleic acid detection. During follow-up monitoring, lgM is detectable 10 days after symptom onset and lgG is detectable 12 days after symptom onset (Liang 20). The viral load gradually decreases with the increase of serum antibody levels.

Lastly the antigen test is done to determine foreign substances in the blood (Nazario 2020). This can be done at a doctor's office with a test strip, and results are read in minutes. This test is similar to pregnancy tests done at home. This type of test is yet to be developed for COVID-19 testing (Nazario 2020).

In conclusion, COVID-19 is a relatively new pandemic requiring more scientific research, ongoing data collection and epidemiological analysis is necessary, in assessing the impacts of mitigation strategies, alongside clinical research on how to best manage the spread of COVID-19. Also, the pandemic is a global issue that must be addressed by all countries. I recommend that countries like Canada and Australia who are financially stable, extend a helping

hand to countries who may be struggling with essentials such as food and health supplies. Within Canada, individuals who have disposable income and are lucky to have secured jobs give a helping hand to the most vulnerable and those in need.

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