

# Analysis and Recommendations on Implementation of Non-Pharmaceutical Interventions in Different Countries under COVID-19

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**Abstract.** As an emerging disease, effective drug interventions are not expected to be available for several months and medical resources to treat cases will be limited. Therefore, non-pharmaceutical interventions (NPI) are an important part of the public health response to the epidemic. But different countries have different strategies, resulting in different situations of intervention implementation and different epidemic development. These interventions are implemented differently in different countries, and several factors limit their development. In this article, these will be summarized from policy, economy, society, and legal system aspects, hoping to provide advice for countries that do not do well in the intervention strategies of COVID-19 by analyzing the reasons.

**Keywords:** COVID-19, Non-pharmaceutical Interventions, Implementation.

## 1. Introduction

The SAR-CoV-2 is a new member of the coronavirus family, and the pneumonia it causes is called coronavirus disease 2019 (COVID-19). The main mode of transmission is droplet transmission, which is rapid and difficult to detect. The younger hosts may be fit enough to survive, while many older hosts may fail become respiratory, heart, or kidney failure and quickly die [1, 2].

This outbreak is also being handled in a more sophisticated way than it was 18 years ago. It took only a few days from getting a pneumonia sample carrying the SAR-CoV-2 to identify the full genome of the virus, and then quickly isolated the virus strain. In the face of infectious diseases, the most effective way for mankind to take is to make vaccines [3], and the more commonly used are live attenuated vaccines and inactivated vaccines. Vaccines are lagging behind viruses in mutating. The other is to manufacture drugs using master proteases and RNA polymerases as drug targets, as these proteins play a key regulatory role in the replication and transcription of the SAR-CoV-2 genome, and there are no similar proteins in the human body. In this outbreak, scientists found several lead drugs with significant inhibitory effects on the main protease and novel coronavirus, including Ebulose and disulfiram, etc. But these drugs are not yet available, and the most advanced are just entering clinical trials.

As an emerging disease, effective drug interventions are not expected to be available for several months and medical resources to treat cases will be limited [4]. Therefore, non-pharmaceutical interventions (NPI) are an important part of the public health response to the epidemic. These measures include patient isolation, contact tracing, travel restrictions, school and workplace closures, cancellation of mass gatherings, and hand washing. These measures aim to reduce transmission, thereby delaying the timing and size of the peak of the epidemic, buying time for the preparation of health care systems, and providing potential for the use of vaccines and drugs later.

These effective interventions can effectively suppress the spread of COVID-19, but different countries have different strategies, resulting in different situations of intervention implementation and different epidemic development. An increasing number of countries/regions have moved from a single outbreak to a local rebound, a second outbreak, or a third wave, indicating that the epidemic has been repeated in many countries and has not been fundamentally controlled. Among the 214 countries/regions affected by the epidemic, countries/regions represented by China have good control, while many European countries/regions and the United States are very serious (Table 1, 2). The trend of the epidemic in different countries/regions suggests that intervention strategies are the key to the

differences in the epidemic among different countries/regions. These interventions are implemented differently in different countries, and several factors limit their development. In this article, these will be summarized from policy, economy, society, and legal system aspects, hoping to provide advice for countries that do not do well in the intervention strategies of COVID-19 by analyzing the reasons.

## 2. Current status of implementation under COVID 19 epidemic:

In 2021, the United States led the world in cumulative confirmed COVID-19 cases, death, and severe disease. Behind the "politicization of COVID-19 response" in the United States, there is a state-by-state epidemic the difference in vaccination rates depends largely on political lines, with Governors in Republican-led Florida and South Dakota, for example, refusing to impose lockdowns. Anti-epidemic measures such as the compulsory wearing of mouth gear are opposed. But as vaccination rates improved, President Joe Biden reopened the country on November 8, lifting all ties.

Restrictions on entry of foreign passengers for COVID-19 vaccines apply to all forms of entry by the ocean, and air. Europe is one of the areas where the United States has lifted travel restrictions, and its quarantine policies are controversial. When the epidemic rebounded, France, Germany, and other countries tightened quarantine policies, such as restrictions, travel restrictions, and mandatory wearing of a mouthpiece in public: When the epidemic eased, the government rushed to Britain's ambivalence is even more pronounced. In March 2020, the U.K. introduced a "universal immunization" plan, but the government abruptly tightened the quarantine on March 20. In January 2021, the UK launched its third round of COVID-19 lockdown measures. Urging people to stay home, calling for one last major nationwide effort to contain the virus before mass vaccination [5]. The omicron mutated strain has emerged in the UK, but the government has chosen to co-exist with the virus without measures to prevent it.

The Japanese government is considering easing the entry policy as the economy is in a slump. On May 10, Japan will raise the maximum number of people allowed into the country from 10,000 a day to 20,000, depending on the latest infections, starting in mid-June. To avoid confusion at airports, some measures have been made to simplify the system, such as using foreign countries' inspection when leaving the country and exempting people from vaccination. For daily personal protection, the Japanese government still advocates wearing masks, washing hands and keeping social distancing, and so on.

China has adopted a "dynamic zero clearance" model. Hu Shanlian told reporters that "dynamic zeroing" is a good tactic for China at present which is more effective. The war has been recognized worldwide. Relatively speaking, it can reduce the economic loss of a country [6].

**Table 1.** Number of COVID-19 cases reported by WHO Region, data updated to 2022.04.22

| Country  | New confirmed cases | Confirmed cases | Cumulative confirmed cases | New deaths | Cumulative deaths | The mortality rate | The cure rate |
|----------|---------------------|-----------------|----------------------------|------------|-------------------|--------------------|---------------|
| American | 71830               | 1180,060        | 82,553,058                 | 934        | 1,017,609         | 1.2%               | 97.3%         |
| Canada   | 9,896               | 229,696         | 3,684,288                  | 113        | 38,688            | 1.1%               | 92.7%         |
| Japan    | 47,120              | 528,925         | 7,585,851                  | 52         | 29,260            | 0.4%               | 92.6%         |

**Table 2.** Vaccination coverage reported by WHO Region, data updated to 2022.04.22

| Country  | The average dose for every 100 people | Average dose in 7 days (ten thousand) | Cumulative dose in 7 days (ten thousand) | Confirmed cases in 7 days |
|----------|---------------------------------------|---------------------------------------|------------------------------------------|---------------------------|
| China    | 230.05%                               | 237                                   | 332,248                                  | 4277                      |
| American | 171.83%                               | 30                                    | 57,049                                   | 42,870                    |
| Canada   | 218.28%                               | 5.9                                   | 8,309                                    | 8,643                     |
| Japan    | 211.73%                               | 54                                    | 26,689                                   | 42,391                    |

### **3. Cause of unperfect situations under COVID-19 in different countries**

#### **3.1. Policy dilemma and economic crisis in Japan**

Japan is geographically close to China, and both have taken active measures to control the COVID-19 epidemic. China responded quickly to the outbreak and made a great contribution to preventing the global spread of the epidemic. The situation is basically stable now. However, Japan responded improperly to the Diamond Princess cruise ship infection incident, then strengthened the emergency plan system and implemented a series of intervention measures, but due to the lack of policy implementation, economic crisis, and other policy difficulties, the epidemic rebounded several times in Japan.

##### **3.1.1. Decentralization and poor implementation of central policy**

Local governments in Japan are increasingly self-governing, undermining the power of the central government. Ideally, local governments should carry out prevention and control work suitable for local development based on the actual situation, but in fact, the prevention and control measures of the central government cannot be responded to by local governments, which has had a negative impact on Japan's epidemic intervention [7]. From the beginning of the epidemic to April 16 when Japan entered a state of emergency, only two prefectures responded to the central government's call for school and factory suspension. On the other hand, local governments had limited medical resources, and the central government was unable to allocate resources. For example, staff in Fukuoka were passive in fighting the epidemic and Tokyo failed to adopt a subsidy plan. At the beginning of the outbreak, China mobilized 42,600 medical workers from all over the country to support Wuhan, which brought the epidemic under control timely and made a great contribution to preventing the global spread.

##### **3.1.2. Democratic reform and reduction of policy coercive force**

Many aspects of Japan were influenced by the United States after the war. For example, Japanese citizens enjoy basic fundamental liberties such as freedom of assembly and speech. Even under special circumstances, the infringement of people's freedom should be limited to a minimum range. Therefore, in the face of the epidemic, the Japanese government's policy favors personal interests over public safety. Even in a state of emergency, the government's restrictions on people leaving the country were nothing more than "appeal" and "request". The government has no specific punishment for people who do not go out without permission or even hold rallies.

##### **3.1.3. The economic downturn led to a policy crisis**

Japan's economy has been declining for several years in a row, with GDP falling from 2.2% in the first quarter to 23.5% in the second quarter of 2020. Therefore, the core of the Novel Coronavirus Basic Policy issued by Japan is to minimize the economic impact of the prevention and control measures.

The closure of the city cannot be implemented because of the economic burden. As of April 8, the economic loss of Wuhan reached at least 200 billion yuan, but it made a great contribution to stopping the spread of the epidemic to the world [8]. On March 13, when the number of confirmed cases in Japan reached the closure of Wuhan, Japan only strengthened its "water policy" and strictly restricted entry into the city. It only appealed to people to go out, encourage telecommuting and suspend gathering activities.

To reduce the economic burden, Japan began to gradually lift the state of emergency from May 14 to 25 and focus on economic recovery by lowering entry restrictions. In August, the "GO TO" program was implemented and vigorously promoted in Tokyo and other places. The program has four parts, including tourism and catering, and a total of 170 million yuan of subsidies. In the following months, Japan relaxed entry restrictions for self-funded students, business people, medical, art, sports, and other industries, with the intention of expanding economic stimulus. Then the third wave of the epidemic hit, and the Japanese center began to focus on epidemic prevention and control. But instead

of imposing too many restrictions, the state of emergency is combining economic incentives with containment. Although previous epidemic prevention policies have been strengthened, such as the revision of the Special Measures Law, the Infection Law, and the Quarantine Law, etc., only a few requirements have been made for the catering industry, which has intensified the contradictions between government and enterprises and led to negative online opinions. In general, as the epidemic continues to rebound, the process of fighting the epidemic has been prolonged, and the Japanese government has been vacillating between "stimulating the economy" and "epidemic prevention and control", which has led to some contradictory measures and reduced public trust and attention. The prevention and control of the epidemic are still going on, but the battle lines are too long to draw enough attention from the public.

### **3.2. Loose and late restrictions in European and US**

After outbreaks in Spain and Italy spiraled out of control at the end of March, Europe began taking measures, such as reducing outings and closing schools at the end of June. Europe's campaign to lift restrictions failed to effectively control the source of the second outbreak. Since 43 weeks ago, many European countries have again adopted a range of measures, including closing public places and restricting personal travel, but the actual outbreak data suggest that increased intervention is still needed. Italy was the first European country to start a major non-drug intervention, and others soon followed, the intervention began from 2 March to 29 March 2020 [9].

During the first wave of the epidemic in the United States, states were relatively late in wearing masks and staying at home, and intervention efforts were inadequate. Although the number of new cases is the lowest on a single day, there are still more than 20,000 new cases per day. The second wave began in late April after many countries lifted restrictions on population movement ahead of schedule in violation of epidemic prevention and control guidelines. A new round of interventions failed to contain the outbreak at lower levels. The third wave of new cases reached 290,000 in one day as crowds gathered during the US election [10]. The epidemic data of various countries/regions show that early scientific and effective intervention is the key to epidemic control, and the management of infectious sources can be avoided without relaxing the management of infectious sources after prevention and control.

### **3.3. Deficiencies in emergency management laws and institutions in China**

#### **3.3.1. The legal system of emergency management is not perfect**

At the beginning of the outbreak, the Chinese compulsory measures lack law, and do not in accordance with the corresponding early warning system, information about rumors and control fails to reach the designated position. Some of the basic units of plague excessive violence law enforcement, law enforcement problems show that the emergency law in the concrete implementation process has not been able to play its role. The Law on Responding to Emergencies is a basic law for Responding to emergencies in China. It does cover all types of emergencies, but it serves only as a "backstop and summary" that provides laws to follow and general directions for solving the problem. Therefore, it is urgent to amend, enrich and perfect the Emergency Law. Laws and regulations related to China's public health emergencies by the law on the prevention and control of infectious diseases in the food safety law "law on the entry and exit animals referred to public health emergencies emergency regulations, etc., but the provision of public health emergencies emergency cases are only administrative regulations [11], and the effect is not high, in the public health emergency response, some policy decisions cannot be guided by the laws and regulations, Nor can it be "ruled by law". Therefore, the enactment of the Public Health Emergency Management Law is also an important legislative approach.

#### **3.3.2. Two problems with the authorization of emergency management**

The first is that the main leadership of the emergency law has too much power, and the junior implementation personnel often lack the corresponding enforcement authority. Without legal support

and clear accountability, it is difficult for the government to take disposal measures. Secondly, inadequate emergency response capacity and the incomplete composition of emergency staff, the influence of policy Settings on the selection of emergency managers, and training exercises conducted according to plans. In terms of authorization of major emergencies, China can learn from the experience and lessons of Canada's emergency law, and put on the agenda the legislation of emergency Law with Chinese characteristics, which stipulates authorization and temporary deprivation of power in case of emergency.

### **3.2.3. Adjust and improve the emergency management system and mechanism**

In April 2018, the Ministry of Emergency Management was officially established in accordance with the Plan for Deepening the Reform of Party and State Institutions adopted at the Third Plenary Session of the 19th CPC Central Committee. However, since the reform of the system, China's emergency management section is not completely led by the Ministry of Emergency Management. At present, the emergency administrative functions of the Ministry of Emergency Management are limited to three aspects: production safety supervision, natural disaster emergency response, and fire rescue, and there is no emergency response responsibility for major public health events and major social security events. More scholars tend to combine public health emergency management with regular emergency management, which can better solve the problem, the emergency management department can not play a role when the emergency mechanism needs to be activated [12], but there are still many details for analysis and research. China should, through relevant legislation, authorization, and professional training, do a good job of crisis monitoring and early warning, timely inform potential stakeholders of relevant risk information and take necessary measures to reduce losses caused by delayed reporting and concealment in the emergency response process.

## **4. Solutions and recommendations from different countries**

### **4.1. Emergency policy in China**

Due to the lack of initial understanding, China failed to prevent the spread of the epidemic from Wuhan, Hubei province, to the whole country during the spring festival travel of 2020. However, on January 20, COVID-19 was immediately included in the class A management and class B infectious diseases in China. There are three major groups of non-pharmaceutical interventions (NPIs) that have been implemented, making a great contribution to preventing the spread of the epidemic to the world. On March 18, no new local confirmed cases were reported, indicating that China had brought the epidemic under control in more than two months. Studies have shown that without the above NPIs measures, the predicted scale of the national epidemic could be 68 times the actual epidemic by February 29 [13].

#### **4.1.1. The inter-city travel restriction**

First of all, the first type of NPIs is the inter-city travel restriction, which was used to close the passage from Wuhan to neighboring cities in Hubei Province from January 23. Other provinces across the country have also imposed travel restrictions on non-essential movements since the Spring Festival.

#### **4.1.2. Early detection and isolation cases**

Early detection and isolation cases are type II NPI. The central government called on medical workers to help Hubei, and a total of 42, 600 medical workers rushed to Wuhan to treat patients in mobile cabin hospitals, improve screening, identification, isolation, and reporting of suspected and confirmed cases, and strictly track and isolate close contacts. Local governments in China are encouraging and supporting routine screening and quarantine of travelers from Hubei province to detect COVID-19 infection as early as possible. The average time between symptom onset and laboratory confirmation was reduced from 12 days at the beginning of the outbreak to 3 days in early February, highlighting how these efforts have improved testing and diagnosis. It is estimated that

early detection and isolation of cases prevent more infections than travel restrictions and exposure reduction, but combined NPIs achieved the strongest and most rapid effect.

#### **4.1.3. Contact restriction and social distancing measures, as well as personal precautions**

Meanwhile, measures such as extending the Spring Festival holiday, implementing community isolation, wearing masks, and banning gatherings have also effectively prevented the spread of the epidemic. The Wuhan municipal government issued a notice of Measures to Wear Masks in Public Places on January 22. The Chinese government encourages people to stay at home whenever possible and cancels or postponed large public events and mass gatherings [14]. In addition, school holidays have been extended, with the Spring Festival holiday ending on March 10 instead of January 30 in Hubei province and February 9 in many other provinces.

#### **4.2. Normal management in China**

On April 29, when the epidemic was under normal management, emphasis was placed on "external prevention of import and internal prevention of rebound", and a "dynamic zero clearance" strategy of "discovery, tracing and isolation" was implemented. According to the unified standards set by the central government, counties and cities will be divided into low-risk, medium-risk, and high-risk areas, and various measures will be taken to gradually restore daily life. Moderate and low-risk areas can be restored in an orderly or full way as soon as possible, and high-risk areas can be gradually restored in accordance with the epidemic situation [15].

There are also some non-pharmacological interventions about personal precautions which should be obeyed. People who will transfer to other countries should take testing even without any symptoms because COVID-19 has an incubation period and pathological changes can be detectable during this period. This strategy can reduce the transmission of COVID-19 and promote rehabilitation since intervention at this stage is more efficient. Sneezing, coughing, and even speaking can produce large, short-range aerosols. So wearing a mask can help reduce the risk of droplets spreading. Direct contact with COVID-19 usually refers to not washing our hands when we have pathogens on our hands, then rubbing our eyes, grabbing food, and putting it in our mouths. Washing our hands regularly can help reduce the risk of direct contact.

#### **4.3. Public health emergency rule of law in Canada**

The Canadian legal system has both common law and civil law systems. The rule of public health emergency response regulates the division of powers and responsibilities of various departments and the implementation steps of emergency measures and takes the safety of all Canadians as the primary goal. Its value pursuit and specific rules are distinctive among Western countries.

##### **4.3.1. Main content**

Both the federal and provincial governments in Canada have the power to enact public health laws. At the federal level, the three major laws are Emergency Act, Emergency Management Act, Quarantine Act, and Every province enact Public health Act. The emergency act empowers the government to restrict citizens' rights of personal liberty, privacy, and so on, in cases where the proportion is appropriate. And the federal government has the power to prohibit travel to and from specific areas, build emergency shelters and hospitals, and establish penalties for violations of measures. Quarantine Act aims to prevent and control the spread of infectious diseases through border management on entry and exit. International travelers with confirmed cases or in close contact with patients should be inspected and instructed by the quarantine officer when entering or leaving the country. They should be quarantined until instructed by the quarantine officer, and those who refuse will be arrested. Provincial governments have priority in dealing with public health events. The public health Act mainly includes the development and implementation of public health plans and the implementation of treatment and isolation orders.

#### 4.3.2. Analysis of legal guarantee of public health emergency order in Canada

In Canada, the scientificity, deterrence, and feasibility of public health emergency orders are ensured through the health officer system, the judicial guarantee mechanism of emergency executive power, and the social security system of vulnerable groups.

##### (1) Health Officer system

The health officer system is the scientific guarantee of public health emergency order. Canada set up its health officer system in 2003 after suffering a fight against SARS. Health officers consist of medical authorities, who monitor public health security, ensure that emergency measures are a key consideration with citizens' life and health, and prevent the administrative officials put forward emergency measures in non-medical specialty, Including the national chief health officer, provincial health officer, and local health officer. At the federal level, there is a national chief health officer who independently reports to the public on any public health incident, makes recommendations to the Federal Minister of Health, and communicates with provincial health officers. At the provincial level, there is a provincial health officer who monitors the health of the population of the province and makes policy recommendations independently to the health department. At the local level, there are several local health officers under the control of provincial health officers.

The emergency orders of the Health officer are not subject to intervention by other government departments. In June 2020, the first wave of Canada slowed, but provincial health officials insisted that every incoming team follow strict quarantine requirements, then Vancouver was ultimately rejected as the site for the NHL playoffs. The premier expressed disappointment but supported the provincial health officer's decision.

The order of the health officer is usually carried out with the active cooperation of various government departments and social groups. The provincial health officer of British Columbia claims to employ nurses who work for nucleic acid testing. The Ministry of Public Safety and Justice issued an order to provide detailed guidelines. Provincial health officials proposed that restrictions on social alienation in the catering industry could be gradually relaxed from mid-May 2020, while the chairman of the catering association organized the drafting of measures for the resumption of work in the catering industry.

##### (2) Judicial guarantee mechanism of emergency executive power

The judicial safeguard mechanism of emergency executive power increases the deterrent safeguard of public health emergency orders. In Canada, when there is a conflict between individual rights and emergency executive power, the emergency executive power judicial safeguard mechanism ensures the enforcement of public health emergency orders. Isolation orders and related enforcement measures enjoy judicial safeguards and have clear punishment policies. The Public Health Act of British Columbia provides that administrators and medical personnel who fail to report, record, or sample as required; public event organizers or employers who fail to prevent public health events; the general public who cause a public health incident or refuse to be isolated may be fined or imprisoned. At the federal level, the Quarantine Act provides that no one may enter or leave a quarantine place without the permission of the quarantine officer; no person shall avoid or willfully interfere with the work of a quarantine officer or health officer, or make false or misleading statements. Offenders may be fined or imprisoned.

##### (3) Social security system for vulnerable groups

The social security system for vulnerable groups increases the feasibility of the public health emergency order. The public health emergency order includes mandatory quarantine measures. In addition, after March 13, 2020, the Provincial and federal governments in Canada called on people to self-quarantine and minimize going out, and many public places are closed. Many Canadians do not have the habit of saving, cannot work properly, and live in distress, in addition to the elderly, aboriginal people who do not have access to health care in the community, and so on. Canada has enacted laws such as An Act to Amend the Financial Administration Act and COVID-19 Emergency Response Act and a series of administrative regulations, paying special attention to the social security of vulnerable groups. To subdivide the insurance gold into ordinary insurance, disease insurance,

pregnant women and parents care insurance, self-employed person insurance, fishery insurance, and can obtain 55% eligible former wages immediately after the application is approved. Emergency benefits for those not covered by unemployment insurance emergency, including response benefits, recovery benefits, and rehabilitation welfare funds. Provide additional funding of more than C \$100 billion to indigenous people, C \$50 million for shelters; C \$150 million worth of assistance to the homeless.

## 5. Conclusion

There are some analyses of the challenge in different countries under COVID-19. To be specific, the epidemic rebounded several times in Japan, because of the lack of policy implementation, economic crisis, and other policy difficulties. The outbreak was out of control in European and US, due to loose and late restrictions. And at the beginning of the outbreak, China's enforcement measures lacked a legal basis, so information about rumors and controls failed to reach their designated locations. Fortunately, there are some solutions and recommendations from different countries. Emergency policy in China includes three major groups of non-pharmaceutical interventions (NPIs). Normal management in China also obtains some non-pharmacological interventions about personal precautions which should be obeyed. Public health emergency rule of law in Canada could be used for reference which includes the health officer system, judicial guarantee mechanism of emergency executive power, and social security system for vulnerable groups.

Earlier implementation of NPIs could have significantly reduced the magnitude and geographical range of the outbreak, but equally, a delayed response would have led to a larger outbreak. Aggressive, the multifaceted response of policy, economy, society, and legal system aspects is likely to have prevented a far worse situation, which would have accelerated spread globally, which provide robust evidence and provide a preparation window and fighting chance for containing the spread and mitigating the effects of COVID-19 in other regions around the World.

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