

An overview of basics for developing a reopening roadmap amid COVID-19 pandemic, a suggestion for the world

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Abstract

The necessity of easing pandemic restrictions is apparent, and due to the harsh consequences of lockdowns, governments are willing to find a rational pathway to reopen their activities. To find out the basics of developing a reopening roadmap, we reviewed 16 roadmaps. The most notable findings are as following: Protecting the high-risk groups, increasing testing and contact tracing capacity, making decisions scientifically, and making the decisions to impose the lowest risks to the economy were the most principles mentioned in the roadmaps. Social distancing, using a face-covering mask, and washing hands were the necessary preventive actions that were recommended for individuals. Health key metrics pointed out in the roadmaps were categorized into four subsets; sufficient preventive capacities, appropriate diagnosis capacity, appropriate epidemiological monitoring capacity, and sufficient health system capacity to be resilient in facing the surges and next phases of the pandemic. All roadmaps describe their in-phases strategy in three major steps, with a minimum of two weeks considered for each phase. Based on the health key metrics, most of the roadmaps noted when progressing to the next phases, while some of them did not focus on the criteria of returning to the previous phase; which may alter the dynamicity of a roadmap.

Highlights

- We aimed to review reopening roadmaps implemented for activities reopening amid COVID-19.
- Protecting high-risks, increasing diagnostic capacity and making decisions scientifically were common principles.
- Metrics categorized into four subsets; sufficient preventive, diagnostic, epidemiological, health system capacity.
- Three major phases with minimum time of two weeks for each phase.
- Dynamicity was altered in some due to lack of returning back criteria.

Introduction

Late in 2019, severe acute respiratory syndrome-related novel coronavirus 2 (SARS-CoV-2), known more commonly as COVID-19, appeared. Despite extensive containment measures, this virus continued to spread rapidly throughout the world, making it a public health emergency of international concern as the World Health Organization (WHO) declared a pandemic on March 11, 2020(1).

The COVID-19 outbreak has affected everyone. Significant consequences of social distancing measures have temporarily changed the typical structures of daily life, such as work, school, sport, and entertainment. It seems that until a treatment or vaccine for COVID-19 is available, life will not return to normal. Fighting this virus is like an all-round battle that involves several stages. If we cannot move from one stage to the next, the situation will not normalize, and we will kneel in other areas, including economics. For instance, the United Kingdom (UK) and Ireland have experienced unprecedented financial problems, including raising the unemployment rate and falling of Gross Domestic Product (GDP), which is expected to be seen worldwide (2, 3). According to a report by Institute for fiscal studies (4), lockdown will disproportionately hit the community members; Employees aged under 25, females, and low earners are more likely to be affected, and lost future earnings potential is more remarkable for young people. What needs to be taken seriously is that the longer shutdown measures stay in place, the more significant scarring will face long-term economic indexes.

Apart from the financial aspects of lockdown strategies, public health care, and emergency care delivery has also been affected by the pandemic. Heart attacks and strokes, routine immunization programs, screening activities, and treatment for non-communicable diseases like cancer and diabetes face new challenges, like fear, misinformation, and limitations on movement have disrupted delivery of such services(5).

As well, isolation and restricting people to their homes has negatively affected many individuals' mental and physical health(6). A study on mental health during the COVID-19 outbreak, near half of the participants reported suffering from a new-onset depression(7). Furthermore, another study suggests that quarantine is responsible for a significant reduction in physical activity and increased emotional eating, which may increase the risk of many non-communicable diseases(8).

Due to these consequences, governments are willing to lift or at least ease the coronavirus lockdown earlier; however, this decision could refuel the pandemic and making the situation even more complicated.

To slow the COVID-19 spread, these attempts to lift or ease the isolation should be postponed until its transmission has measurably been slowed down, and the healthcare system is capable of managing the outbreak. Reopening early could cause resumption of the outbreak; reopening later could lead to socioeconomic tribulations. Unfortunately, appropriate conditions required for the timely reopening of the society have not been identified so far.

Based on a preliminary search in PubMed and Cochrane Database of Systematic Reviews, there is no overview regarding reopening roadmaps. In this review, we define the basics for developing a reopening roadmap in response to COVID-19 related lockdowns and closures. The findings will help the local and world health authorities take proper actions toward developing a reopening strategy based on existing evidence.

Methods

On July 24, 2020, three databases, including PubMed, Scopus, and Google Scholar, were searched using the following terms: reopening AND roadmap. No results were found; then, on August 3, 2020, a manual search was conducted via Google search engine to find reopening roadmaps. We limited our selection to those papers that published the reopening process as a timely roadmap and the English language. 16 roadmaps were selected and included for data extraction (Massachusetts(9), Ontario(10), United Kingdom(11), Ireland(3), Opening Up America Again(12), American Enterprise Institute(13), California(14), Shasta county(15), Connecticut(16), Indiana(17), Nashville(18), Nevada(19), Queens Land(20), Western Australia(21), Anchorage(22), and European Council(23)). The items that focused on data extraction were principles, the general recommendation for individuals, key public health metrics, and in-phases

strategy. Two independent reviewers extracted the mentioned items, and the senior author solved discrepancies. The results were summarized and tabulated to be satisfactory.

Results

The principles of roadmaps

Of 16 mentioned roadmaps, four did not mention any point about the principles of developing the roadmaps, seven roadmaps clearly mentioned their principles, and of the remaining five, the principles were not clear, so the authors implied the doctrines of the roadmaps.

In table 1, the results are summarized with details. As seen, protecting vulnerable and high-risk groups within the society is the most frequent point in the roadmaps (six roadmaps).

An increase in testing capacity and contact tracing are also noticeable in four roadmaps. Moreover, the need for science-driven and evidence-informed decision making was an important topic (four roadmaps). The proportionality of decisions to impose the lowest economic risks while protecting population health was also mentioned four times.

Transparency and being clear was also repeated three times. It is highly likely to fail if the state cannot gain public trust. In such a scenario, being honest and transparent can help to increase social cohesion.

In each phase of reopening, preventive measures such as physical distancing should be followed strictly, especially in childcare centers, schools, bazaars, and workplaces (four roadmaps). In three roadmaps, it was mentioned that the health-related resources should surge.

Moreover, only in the roadmap of the European Council, the need for international collaboration with other countries (but still with other countries of the European Union) was mentioned. In this proposed guideline, all members should observe the protocols simultaneously to increase the efficacy of actions and decrease political conflicts within the commission. They believed that lifting the restriction should be consulted a priori, and Europe should act integratively. Knowledge and resources (protective suits, masks, and ventilators) should be shared with the most vulnerable members. Without a doubt, it is believed that all countries/states, mostly those nearby, should work more cohesively to prevent the spread of disease.

People should be educated to live with COVID-19, considering new norms, which are clearly mentioned in the roadmap of Nashville. The role of public health education has not been taken seriously in other roadmaps. As a result of this, we highlight the role of education and further adaptation. The last and by no means the least is to be flexible enough to adapt to changing conditions in the case of resurgence or other unexpected issues (Ontario).

The others are provided in detail in table 1.

Table 1. The characteristics of principles found in the roadmaps

	Ontario	UK	Ireland	Shasta county	Connecticut	European Council	Nevada	Massachusetts	Open up America again	California	Indiana	Nash'
principle												
Increase testing capacity								+		+	+	+
Contact Tracing								+		+	+	+
Isolation								+		+		+
Responsibility of the state	+											
Evidence-informed decision making	+	+			+	+						
Increase health-related resources	+				+					+		
Acting quickly and effectively	+											
Monitoring the implementation	+			+								
Being clear and transparency	+	+	+									
Flexibility and adaptability	+						+					
Fairness and equity		+	+									
Proportionality and considering the social and economic burdens		+	+		+						+	
Privacy and confidentiality		+										
the public health assessment of risk is considered very important in any decision (safety)			+			+						
Enhance the solidarity and cohesion within the society			+			+						
Protecting the most				+	+		+		+	+	+	+

vulnerable					
Acting locally, countywide, statewide or countrywide			+		+
The decrease in the resurgence risk		+			+
Development of therapeutic options					+
Support the preventive measures of physical distancing, especially for crowded places such as schools, markets.		+		+	+
Support the economy and consumers and trading		+			+
Determination of criteria for a step back to an earlier stage					+
Handling the non-COVID-19 positive cases		+			
Collaboration and coordination with other sectors within the society				+	
Collaboration and coordination with other countries				+	
Education of the society to adapt and live with a new normal					+
Establishing a timeline for recovery				+	

Seven roadmaps shown in green are those with clear directions; those with orange are the group in which the writers implied the doctrines (five roadmaps). We could not find any principle in the red groups (four roadmaps)

The general recommendations for individuals

Almost all these roadmaps mentioned hand hygiene, using either water and soap or alcohol-based sanitizers. In the roadmap of California, the authors did not specifically mention practicing good hand hygiene but recommended coughing or sneezing etiquette. According to the Centers for Disease Control and Prevention (CDC), one essential part of this etiquette is performing good and suitable hand washing(24). Therefore, we implied that the authors recommended this, as well. In contrast to the others, six roadmaps such as Nashville and Nevada did not directly mention hand washing.

Except for the "Open up America again" roadmap, others emphasized maintaining proper social distancing (about two meters or six feet in public). According to the Connecticut roadmap, roommates and suitemates were considered, as family units, therefore among them; social distancing was not necessary.

COVID-19 has a wide range of clinical manifestations affecting people of all ages. Typical symptoms include cough, fever, and dyspnea; however, gastrointestinal symptoms and anosmia may occur (25-27). All individuals should be aware of clinical manifestations of COVID-19 and stay home if they feel sick and seek medical consults with qualified medical staff. Five roadmaps recommended being vigilant to signs and symptoms of the disease and nine roadmaps recommended staying at home. The roadmap from Ireland strongly suggested that individuals should keep informed about the pandemic status, support, and follow informed medical advice.

The roadmap from Indiana believed that close contact between people in a confined place is an essential route of transmission of the viruses. Therefore, this roadmap, along with the others from Ontario, UK, Shasta County, Ireland, Nevada, Connecticut, Nashville, and Queensland, firmly recommended limiting outside gatherings. Six roadmaps also mentioned the importance of travel restrictions; meanwhile, some believed that passengers should be quarantined for fourteen days.

Some people are more vulnerable to COVID-19. Individuals older than 65 or patients with diabetes mellitus, chronic lung disease, moderate to severe asthma, and severe heart conditions are some of these vulnerable populations. Immunocompromised people, through either cancer treatment, smoking, any organ transplants, genetic or acquired immune deficiencies, and/or the prolonged usage of corticosteroids, may also experience more severe and complicated disease (28). More than half of these roadmaps (nine out of 16) mentioned supporting these most vulnerable patients.

As illustrated in Table-2, general recommendations noted for individuals in reviewed roadmaps were tabulated.

Table 2. The most important preventive recommendations for individuals.

	Wearing a face-covering mask and coughing/sneezing etiquette [§]	wash hands [§]	surface cleaning	social distance*	vigilant to symptom/transmission route**	stay home (especially if feel sick or if diagnosed)	limit outside	limit travel	remote working / redesigning the workplace	most vulnerable' protection/support ^Y
Massachusetts	+	+	-	+	+	+	-	-	-	-
Ontario	+	+	+	+	-	+	+	+	+	+
UK	-	+	+	+	-	+	+	-	-	+
Ireland	+	+	-	+	+	+	+	-	-	+
Open up America again	+	+	+	-	-	+	-	-	-	-
America Enterprise Institute	-	-	-	-	-	-	-	-	-	-
California	+	-	-	+	-	-	-	+	-	+
Shasta county	+	+	+	+	-	+	+	+	+	+
Connecticut	+	+	+	+	+	+	+	+	+	+
Indiana	+	+	+	+	+	-	+	+	+	+
Nashville	+	-	+	+	-	-	+	-	+	+
Nevada	+	-	-	+	-	+	+	+	+	+
Queens land	-	+	+	+	-	+	+	-	-	-
Western Australia	-	-	-	-	-	-	-	-	-	-
Anchorage	-	-	-	-	-	-	-	-	-	-
European Council	+	+	+	+	+	-	-	-	-	-
Total	11	10	9	12	5	9	9	6	6	9

[§] The etiquette consists of providing tissues and no-touch receptacles for used tissue disposal, providing conveniently-located dispensers of alcohol-based hand rub; where sinks are available, ensure that supplies for hand washing (i.e., soap, disposable towels) are consistently available

[§] with soap and water, or using an alcohol-based sanitizer if soap and water are not available

* 2 meters (6 feet) in public.

** The typical signs and symptoms are cough, fever, dyspnea, and diarrhea. Consider atypical ones as well.

^Y high-risk individuals are 65 or older citizens or individuals with underlying health conditions.

+ The recommendations are directly mentioned in the roadmap

- The recommendations are not directly mentioned in the roadmap

Health key metrics for reopening strategy

According to data extracted from the 16 reviewed roadmaps, the key metrics used for monitoring the reopening process could be categorized into four subsets: sufficient preventive capacity, appropriate diagnosis capacity, appropriate epidemiological monitoring capacity, and sufficient health system capacity.

The preventive capacity consists of optimizing the supply of personal protective equipment (PPE), especially for those at high risk and those on the front line(29, 30). Furthermore, there should be the capacity to implement protocols ensuring appropriate safeguards for each sector reopened. The second subset relates to appropriate diagnosis capacity, which includes large-scale testing capacity combined with contact tracing(31). Each territory, based on its strategy, should continue to increase the amount of available testing and be affordable for all population group, including opportunities to obtain free tests. Ensuring adequate testing and tracing capacity is necessary to allow policymakers to oversee high-risk population and modify their planning for reopening of each sector. Besides this large-scale expansion of testing, early testing should also include amongst high-risk congregate settings, including nursing homes and assisted living facilities, prisons, and dormitories. Key metrics related to appropriate epidemiological monitoring capacity and active surveillance also play an important role in the designation of reopening strategy(32). These criteria consist of a vast range of critical metrics, including the trend of positive testing, hospitalization, and death rate. Policymakers must actively monitor the epidemiological status of the pandemic to step back in the case of resurging viral

rates. A sustained downward, or at least not being upward of the trend in these metrics is critical to allow the reopening process to keep going forward. The last set of key metrics are categorized under sufficient health system capacity, includes sufficient capacity for hospital floor and critical care beds, ventilators, and healthcare system readiness. As society moves forward in the reopening steps and the contacts between the populations are rising, there is a demand for the territory to provide sufficient health care. Furthermore, the capacity to support those in isolation/quarantine is needed(33). These health metrics mentioned in reviewed roadmaps are tabulated in Table-3.

These metrics should be assessed closely and carefully to prevent the resurgence of the infection and help authorities determine the proper pace of the reopening. Although all these metrics are important and cannot be ignored during planning for reopening, some metrics may be more considerable in the design of the reopening roadmap.

Table 3. Health key metrics categorized in four subsets

	Sufficient preventive capacity	Appropriate diagnosis capacity	Appropriate epidemiological monitoring capacity	Sufficient health system capacity
Massachusetts		<ul style="list-style-type: none"> · Testing capacity · Contact tracing capabilities 	<ul style="list-style-type: none"> · COVID-19 positive test rate · Number of individuals who died from COVID-19 · Number of patients with COVID-19 in hospitals 	<ul style="list-style-type: none"> · Healthcare system readiness (# hospitals using ICU surge capacity)
Ontario	<ul style="list-style-type: none"> · Ongoing availability of PPE based on provincial directives and guidelines 	<ul style="list-style-type: none"> · Approximately 90 percent of new COVID-19 contacts are being reached by local public health officials within one day, with guidance and direction to contain community spread · Ongoing testing of suspected COVID-19 cases, especially of vulnerable populations, to detect new outbreaks quickly · A shift to new and other ways of testing and contact tracing to promote widespread tracking of cases 	<ul style="list-style-type: none"> · A consistent two-to-four week decrease in the number of new daily COVID-19 cases · The decrease in the rate of cases that cannot be traced to a source · The decrease in the number of new COVID-19 cases in hospitals 	<ul style="list-style-type: none"> · Sufficient acute and critical care capacity, including access to ventilators, to effectively respond to potential surges
UK	<ul style="list-style-type: none"> · sufficient PPE 	<ul style="list-style-type: none"> · Sufficient testing capacity 	<ul style="list-style-type: none"> · sustained and consistent fall in the daily death rates from COVID-19 · decreasing the rate of infection to manageable levels 	<ul style="list-style-type: none"> · NHS's ability to cope sufficient critical care and specialists treatment right across the UK · Any adjustments to the current measures will not risk a second peak of infections that overwhelms the NHS
Ireland		<ul style="list-style-type: none"> · Program to consistently sample, test, and contact trace 	<ul style="list-style-type: none"> · The trajectory in the incidence of disease · The trajectory in the number of cases and clusters in residential healthcare settings · The trajectory in the number of deaths · Assessment of the risk of secondary morbidity and mortality as a consequence of the restrictions. 	<ul style="list-style-type: none"> · Hospitalization and ICU occupancy
Open up America again		<ul style="list-style-type: none"> · Robust testing program in place for at-risk healthcare workers, including emerging antibody testing. 	<ul style="list-style-type: none"> · The downward trajectory of influenza-like illnesses within 14 days · The downward trajectory of COVID-like syndromic cases reported within 14 days · The downward trajectory of documented cases within a 14-day period · The downward trajectory of positive tests as a percent of total tests within a 14-day period 	<ul style="list-style-type: none"> · Treat all patients without crisis care
America Enterprise Institute		<ul style="list-style-type: none"> · Ability to test all people with COVID-19 symptoms 	<ul style="list-style-type: none"> · A sustained reduction in cases for at least 14 days 	<ul style="list-style-type: none"> · Ability to treat all patients requiring hospitalization without resorting to crisis standards of care

		<ul style="list-style-type: none"> Ability to conduct active monitoring of confirmed cases and their contacts 		
California	<ul style="list-style-type: none"> Sufficient PPE supply to meet demand 	<ul style="list-style-type: none"> Contact tracing capacity statewide Sufficient testing capacity to meet demand 	<ul style="list-style-type: none"> Hospitalization and ICU trends. 	<ul style="list-style-type: none"> Hospital surge capacity to meet demands
Shasta county	<ul style="list-style-type: none"> Sufficient PPE Workplaces and other sectors have available their individual Reopening plans 	<ul style="list-style-type: none"> Sufficient testing capacity Contact tracing 	<ul style="list-style-type: none"> Hospitalizations and ICU trends Community disease surveillance 	<ul style="list-style-type: none"> Hospital surge capacity to meet demand capacity for Isolation and quarantine Supports available for those in isolation or quarantine
Connecticut	<ul style="list-style-type: none"> An adequate supply of PPE (30 days of PPE supplies in major healthcare systems) Safeguards to protect the workplace (Rules and regulations disseminated and adopted prior to Phase 1 reopening Detailed guidelines published for each business sector) 	<ul style="list-style-type: none"> Sufficient contact tracing capacity (Contact tracing system (ContaCT) operational) Widespread PCR testing (42K tests administered per week with <48hrs turnarounds time) Protections for the most at risk (Testing and screening of key workers and high-risk populations initiated) 	<ul style="list-style-type: none"> The sustained decline of hospitalizations (Decline over a 14 day period without evidence of a regional outbreak) 	<ul style="list-style-type: none"> Healthcare capacity to provide optimal care (<20% of beds occupied by COVID-19 amongst total bed capacity at peak)
Indiana		<ul style="list-style-type: none"> testing capacity Contact tracing capacity 	<ul style="list-style-type: none"> The number of hospitalized COVID-19 patients for 14 days 	<ul style="list-style-type: none"> The state surge capacity for critical care beds and ventilators
Nashville		<ul style="list-style-type: none"> Large-scale testing capacity (goal:4667 tests per week) contact tracing (goal: 28-105 contact investigator for Davidson country) 	<ul style="list-style-type: none"> Transmission rate 14-Day new case trend 	<ul style="list-style-type: none"> Ensure that isolation and quarantine are effective Hospital capacity: floor beds (goal: 20% capacity available) Hospital capacity: ICU beds (goal: 20% capacity available)
Nevada	<ul style="list-style-type: none"> Ability to quickly and independently supply sufficient Personal Protective Equipment 	<ul style="list-style-type: none"> The expanded ability for healthcare providers to administer tests for symptomatic patients and sufficient laboratory testing capacity to process COVID-19 testing samples Sufficient public health workforce capacity in local and state health departments to conduct case contact tracing (detect, test, trace, isolate) 	<ul style="list-style-type: none"> The consistent and sustainable downward trajectory of COVID-19 cases and a decrease in the trend of COVID19 hospitalizations over a 14-day period 	<ul style="list-style-type: none"> Ability to surge ICU capacity ability to treat patients without having to implement Crisis Standards of Care, along with no shortages of equipment, including ventilators and PPE for all healthcare workers; no shortages of healthcare workers; and patients not being directed to emergency overflow facilities
Queens land			<ul style="list-style-type: none"> Number of cases 	<ul style="list-style-type: none"> Rapid response capability
Western Australia				
Anchorage	<ul style="list-style-type: none"> Sufficient PPE for all healthcare workers and first responders 	<ul style="list-style-type: none"> Ability and capacity to screen and test widely Ability to interview all positive cases and monitor all contacts and get tested all symptomatic contacts within 24hours 	<ul style="list-style-type: none"> Downward case counts trending with stable and adequate testing. (14 days for phase1, 28 days for phase2, 42days for phase3) COVID/PUI hospitalization rate trending down (14 days for phase1, 28 days for phase2, 42days for phase3) 	<ul style="list-style-type: none"> Ability/capacity (beds, ICU beds, ventilators, staff) to meet anticipated case surge
European Council		<ul style="list-style-type: none"> Large-scale testing capacity Contact tracing 	<ul style="list-style-type: none"> Sustained reduction in the number of new infections 	<ul style="list-style-type: none"> The occupancy rate for Intensive Care Units Adequate number of hospital beds

- Antibody detection capacities

- Sustained reduction in hospitalizations and patients in intensive care

- Access to pharmaceutical products required in intensive care units
- The reconstitution of stocks of equipment
- Access to care in particular for vulnerable groups
- The availability of primary care structures as well as sufficient staff with appropriate skills to care for patients discharged from hospitals or maintained at home and to engage in measures to lift confinement

In-phases strategy

Planning a dynamic pathway to reopening necessitates breaking the roadmap into several successive stages. To better decision making, different aspects of lockdown or reopening should be addressed; otherwise, neither lockdown nor reopening would benefit. This staging should be dynamic, thorough, executable, and innovative(34, 35). Dynamic means that moving back and forth through the stages depends on the current COVID-19 situation at the time; the prevalence should continuously be monitored via the aforementioned key public health metrics(35, 36). Unfortunately, this dynamicity has been missed in some designed roadmaps. For example, Queensland's roadmap has determined the exact day and even hour of prompting to the next stage, and such approaches lack surveillance and would fail to prevent the resurging of SARS-CoV-2 infection while resuming socioeconomic activities(37, 38). In order to reach dynamicity, the health authorities should precisely determine the criteria of when progress to the next phase and when returning back and stop the reopening process. Most of the roadmaps used the health key metrics mentioned in the previous section as the criteria for moving forward. But the criteria of moving backward to the previous phase as a response to a new surge was not established well in some roadmaps. Table-4 illustrated the detail of such criteria.

In the reviewed roadmaps, the number of reopening phases differed from three to six. However, in general, the reopening stages that have been mentioned in released roadmaps can be categorized into three phases. In the first one, which is mostly referred to as the supporting phase, non-essential workplaces, recreational centers, and public places, as well as restaurants, would be closed. Furthermore, social gatherings and workplace staff were restricted. Limited working hours and frequent working shifts are of other recommendations in this phase. In the next class, restrictions will be more lift up. Social gatherings and workplace staff will be more allowed. Finally, in the last phase, the condition is, approximately, back to normal or to a new normal.

Interestingly, in some roadmaps such as American Enterprise Institute designed recovery roadmap, there is an extra phase for rebuilding readiness against the next pandemics. The minimum time considered for a phase was two weeks, which is as same as the SARS-CoV2 incubation period. More details can be found in Table-4.

Table 4. Number of phases, the time considered for each phase, when progress and when returning back

	Number of phases	Time for each phase	When progress	When returning back
Massachusetts	Phase 1= start Phase 2= cautious Phase 3= vigilant Phase 4= new normal(after vaccine or treatment)	minimum of three weeks and could last longer	Key public health metrics will determine if and when it is appropriate	1- Public health data trends indicating significant increases in viral transmission economy 2- If public health data trends are negative
Ontario	Phase1= protect and support Phase2= restart Phase3= recover	2-4 weeks	Every 2-4 weeks, based on health metrics: • Reapply or tighten certain public health measures in response to a surge in cases or outbreaks; • Maintain the status quo and continue close monitoring of impacts; or • Progress to the next two-to-four-week stage	
UK	Phase1= government response Phase2= smarter controls Phase3= reliable treatment	Step1= from May 13 Step2= no earlier than June 1 Step3= no earlier than 4 th of July	Based on the five mentioned key health metrics	Sudden and concerning rising in the infection rate
Ireland	5 phases of Reopening	Three weeks	Regarding the following on/off trigger criteria : a. The latest data regarding the progression of the disease b. The capacity and resilience of the health service; hospital and ICU c. The sampling, testing, and contact tracing capacity d. The ability to shield and care for at-risk groups e. Assessment of secondary morbidity and mortality risk due to restrictions	
Open up America again	3 phases	Didn't mention	Didn't mention	Didn't mention
America Enterprise Institute	Phase 1= slow the spread Phase 2=reopen state by state Phase 3= establish protection then lift all restrictions Phase 4= rebuild our readiness for the next pandemic	Didn't exactly mention a date	Didn't mention	1- if a substantial number of cases cannot be traced back to known cases 2- if there is a sustained rise in new cases for five days 3- or if hospitals in the state are no longer able to treat all patients requiring hospitalization safely
California	Phase 1= safety and preparedness Phase 2= Lower risk workplaces Phase 3= higher risk workplaces Phase 4= end of stay-	Didn't exactly predicted	Didn't mention	Didn't mention

	at-home order			
Shasta county	Same as California	Same as California		<p>1- Increasing new case counts of at least 30% for five consecutive days in the context of no substantial increase in testing.</p> <p>2- More than three unlinked chains of transmission in a 14-day period.</p> <p>3- Steady increase in county COVID-like illness syndromic surveillance</p> <p>4- A surge of respiratory patients at medical facilities not detected using the above methods.</p> <p>5- Increasing numbers of new health care worker infections over five days.</p> <p>6- Delayed detection (>5 days) of a case from the mass gathering.</p> <p>7- Hospitalization and ICU numbers increasing by 25% for seven consecutive days</p> <p>8- Two outbreaks of COVID-19 among residents and/or staff of congregate settings with three or more cases at each facility within a 14-day period.</p> <p>9- Substantially increased unexplained deaths within the County.</p>
Connecticut	3 phases	Four weeks	<p>1. Reopening criteria for Phase 1</p> <ul style="list-style-type: none"> · Sustained decline of hospitalizations over a 14 day period without evidence of a regional outbreak · Widespread PCR testing · Sufficient contact tracing capacity · Protections for the most at risk; testing and screening of key workers and high-risk populations initiated · Healthcare capacity to provide optimal care · An adequate supply of PPE · Safeguards to protect the <p>2. Five criteria to progress to Phase 2</p> <ul style="list-style-type: none"> · Declining transmission/ Less than 100-bed net increase in hospitalizations in last week of phase 1 · Testing and contact tracing/ 100,000 tests a week; connected with >50% of identified contacts within 48 hours · Business & social safeguards/ Rules and regulations disseminated two weeks before Phase 2 reopening · Protection for critical and at-risk individuals/ Testing plan for key workers and priority high-risk communities implemented · Healthcare capacity/ <20% of beds occupied by COVID-19 patients amongst total peak COVID-19 bed capacity <p>3. Phase 3 criteria in progress</p>	<p>1- if One week of a sustained increase in the seven day rolling average in new hospitalizations and 200-bed increase in the COVID-19 hospital census since the beginning of the previous phase</p>
Indiana	6 phases	Stage 1: March 24	Based on these four guiding principles:	

		Stage 2: May 4 Stage 3: May 22 Stage 4: June 12 Stage 4.5: July 4 Stage 5: projected to begin July 18	1. number of hospitalized patients in the last 14 days 2. surge capacity for critical care beds and ventilators 3. the ability to test who are symptomatic, as well as healthcare workers, essential workers, first responders 4. health officials have systems in place to contact all individuals who test positive for COVID-19 and complete contact tracing	
Nashville	5 phases	Phase 1: May 11 Phase 2: May 25 Phase 3: June 22 Phase 4: If, after a minimum of 28 days in phase 3, trends continue to decline or remains flat, phase 4 starts	Sustained reduction or stability in new cases for 14 days.	A significant increase in active cases
Nevada	Phase 1: Battle Born Beginning Phase 2: Silver State Stabilization Phase 3: On the Road to Home Means Nevada Phase 4: Home Means Nevada – Our New Normal	Minimum of 2-3 weeks	When meet criteria (health key metrics)	Didn't mention
Queens land	3 phases	Stage 1: May 15, 2020 Stage 2: June 1, 2020 Stage 3: July 3, 2020	Based on public health conditions for each community, including the reported number of cases, rapid response capability, community consultation	If an outbreak occurs and more restricted access arrangements are required
Western Australia	6 phases	Phase 1: April 27, 2020 Phase 2: May 18, 2020 Phase 3: June 6, 2020 Phase 4: June 27, 2020 Phase 5: August 29, 2020	Didn't mention	Didn't mention
Anchorage	5 phases	Didn't mention	Didn't mention	Didn't mention
European Council	NA	One month	NA	NA

Discussion

Of the 16 reviewed roadmaps, most of them directly or indirectly mentioned the principles of developing their roadmap. Protecting the vulnerable and high-risk groups, increasing testing capacity and contact tracing, making decisions based on scientific evidence, and making the decisions to impose the lowest risks to the economy were the most principles mentioned. Principles that can shed light on the monitoring of a roadmap have not been mentioned in four roadmaps; the fact that can raise attention in a way that a roadmap without specific principles is like a building without foundation.

Social distancing, using a mask/ facial covering to reduce the spread of respiratory droplets, and washing hands were the essential preventive actions recommended for individuals. A few roadmaps didn't mention anything about general recommendations for individuals that should be addressed in any reopening roadmaps.

Health key metrics that pointed out in the roadmaps were categorized into four subsets; sufficient preventive capacities such as personal protective equipment, appropriate diagnosis capacity including extending testing and contact tracing capacity, appropriate epidemiological monitoring capacity including the downtrend trajectory of COVID-19 positive cases and hospitalized patients, and sufficient health system capacity including hospital beds and ventilators in order to be resilient in facing the surges and next phases of the pandemic.

All roadmaps described their in-phases strategy. The phases can be categorized into three significant steps. However, the number of phases differed from three to six, with a minimum of 2 weeks considered for each phase. Dynamicity is the crucial key for developing a roadmap is missed in some roadmaps by setting a rigid timeline. Based on the health key metrics, most of the roadmaps noted when progressing to the next phase and when returning, while some of them didn't focus on the criteria of returning to the previous phase. Now when some areas are facing a new surge in the number of new cases and increasing the death tolls, it is vital to precisely describe the criteria to stop the reopening process and implement the restrictions again, as well as the criteria for progressing to the next phases.

Conclusion

In the second half of October 2020 and during the reopening of activities, when most countries are facing new surges regarding COVID-19 new cases and death tolls, it seems that providing further evidence-based information about reopening strategies is crucial. The present review aimed to provide an overview of the basics for developing and designing an in-phases reopening strategy by reviewing the current roadmaps. We believe that the results can help local and world health policymakers to take proper action plans in order to minimize the consequences of society reopening.

Abbreviations

SARS-CoV-2=Severe Acute Respiratory Syndrome-related Novel Coronavirus 2, WHO=World Health Organization, UK=United Kingdom, GDP=Gross Domestic Product, CDC=Centers for Disease Control, PPE=Personal Protective Equipment

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Declarations

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