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Review Article

Basics of Developing a COVID-19 Reopening Roadmap: A Systematic Scoping Review

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Abstract

Background: The necessity of easing pandemic restrictions is explicit. Due to the harsh consequences of lockdowns, governments are willing to find reasonable pathways to reopen their activities.

Methods: To find out the basics of developing a reopening roadmap, on 6th-10th July 2020, we conducted a systematic search on PubMed, Scopus, and Web of Science to review the databases; and Google by manual to review the grey literature. Two independent authors extracted the data, and the senior author solved the discrepancies.

Results: Sixteen documents were included. Data categorized into four sections: principals, general recommendations for individuals, health key metrics, and in-phases strategy. The number of phases or stages differed from three to six, with a minimum of two weeks considered for each one. Health key metrics were categorized into four subsets: sufficient preventive capacities, appropriate diagnostic capacity, appropriate epidemiological monitoring, and sufficient health system capacity. These metrics were used as the criteria for progressing or returning over the roadmap, which guarantees a roadmap's dynamicity. Noticeably, few roadmaps did not mention the criteria that may alter the dynamicity of their roadmap. When some areas face new surges, the roadmap's dynamicity is essential, and it is vital to describe the criteria to stop the reopening process and implement the restrictions again.

Conclusion: Providing evidence for policymaking about lifting the COVID-19 restrictions seems to be missed in the literature should be addressed more, and further studies are recommended.

Keywords: COVID-19; Health policy; Global health; Public health

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 WHO declared a pandemic on Mar 11, 2020 (1).

The COVID-19 outbreak has affected everyone. Significant consequences of social distancing measures have temporarily changed daily life's structures. Until a treatment or vaccine for COVID-19 is available, life will not return to normal. Fighting this virus is like an all-around 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), 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 have 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 movement limitations have disrupted delivery of such services(5).

Moreover, isolation and restricting people to their homes have negatively affected many individuals' mental and physical health(6). In a study on mental health during the COVID-19 outbreak, nearly half of the participants reported suffering from a new-onset depression (7). Furthermore, 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 defined the basics for developing a reopening roadmap in response to COVID-19 related closures. The findings will help the local and world health authorities taking proper actions toward developing a reopening strategy based on existing evidence.

Research question

What is known from literature about the basics and foundation of a reopening roadmap implemented by countries or states to ease the COVID-19 restrictions?

Methods

The present review was conducted based on the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) statement (9).

Inclusion and exclusion criteria

We included the roadmaps designed by countries and states to ease the COVID-19 general lockdowns. We excluded those not published in English and those focused on reopening strategies specialized for certain activities, such as school reopening, restaurant reopening, etc.

Search strategy

As illustrated in Fig.1, we performed a multi-step search strategy. An initial and limited search was done on PubMed to find reopening roadmaps and related papers, but no paper was found. Therefore, we repeated our search via Google search engine; some roadmaps were retrieved. We analyzed the keywords in the title and text of these papers and discussed with all authors to identify the most related and comprehensive terms. During 6th -10th July 2020 and based on the previous step results, two authors separately searched PubMed, Scopus, and Web of Science systematically; Google search engine was also reviewed manually to explore the grey literature. Table 1 shows the search strategy for PubMed, Scopus and Web of Science.

Table 1: Search strategy used in the present study

Database	*Search strategy*	*Retrieved*
PubMed	(((((COVID-19[Title/Abstract]) OR (COVID19[Title/Abstract])) OR (Coronavirus[Title/Abstract])) OR (SARS-Cov2[Title/Abstract])) OR (2019-nCov[Title/Abstract])) AND ((((((((((Reopen*) OR (Re-open*)) OR (restart*)) OR (Re-start*)) OR (Resume)) OR (Resumption)) OR (Relaunch*)) OR (Re-launch*)) OR (Reentry*)) OR (Re-entry*) OR (return*) OR (recovery*))	1238
Scopus	((ALL (reopen) OR ALL (re-open) OR ALL (restart) OR ALL (re-start) OR ALL (resume) OR ALL (resumption) OR ALL (relaunch) OR ALL (re-launch) OR ALL (reentry) OR ALL (re-entry) OR ALL (recovery) OR ALL (return))) AND (TITLE-ABS-KEY (covid-19) OR TITLE-ABS-KEY (covid19) OR TITLE-ABS-KEY (coronavirus) OR TITLE-ABS-KEY (sars-cov2) OR TITLE-ABS-KEY (2019-ncov)) AND (LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019))	1900
Web of Science	(TOPIC: (COVID-19) OR TOPIC: (COVID19) OR TOPIC: (Coronavirus) OR TOPIC: (SARS-Cov2) OR TOPIC: (2019-nCov)) AND (ALL FIELDS: (reopen) OR ALL FIELDS: (re-open) OR ALL FIELDS: (restart) OR ALL FIELDS: (re-start)) Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years	18

Data items and data extraction process

The following items were extracted from included roadmaps: Country or state, time of publishing, the principals, general recommendations for individuals, health key metrics, number of phases, time considered for each phase, criteria of progressing to next phase or returning to the previous phase. A data extraction form was designed in Excel, and two independent authors extracted the data. The senior author resolved discrepancies.

Results

A total of 2709 paper were retrieved after duplication deletion. In the title and abstract screening, 2631 were removed. Of the rest, 39 documents were not roadmaps, 22 documents focused on reopening of certain activities, and 1 document's full text (roadmap from Japan) was not in English. All these 62 documents were excluded. Eventually, sixteen roadmaps included for the data extraction are as follow: (Massachusetts (10), Ontario (11), United Kingdom (12), Ireland (3), Opening Up America Again (13), American Enterprise Institute (14), California (15), Shasta county (16), Connecticut (17), Indiana (18), Nashville (19), Nevada (20), Queens Land (21), Western Australia (22), Anchorage (23), and European Council (24).

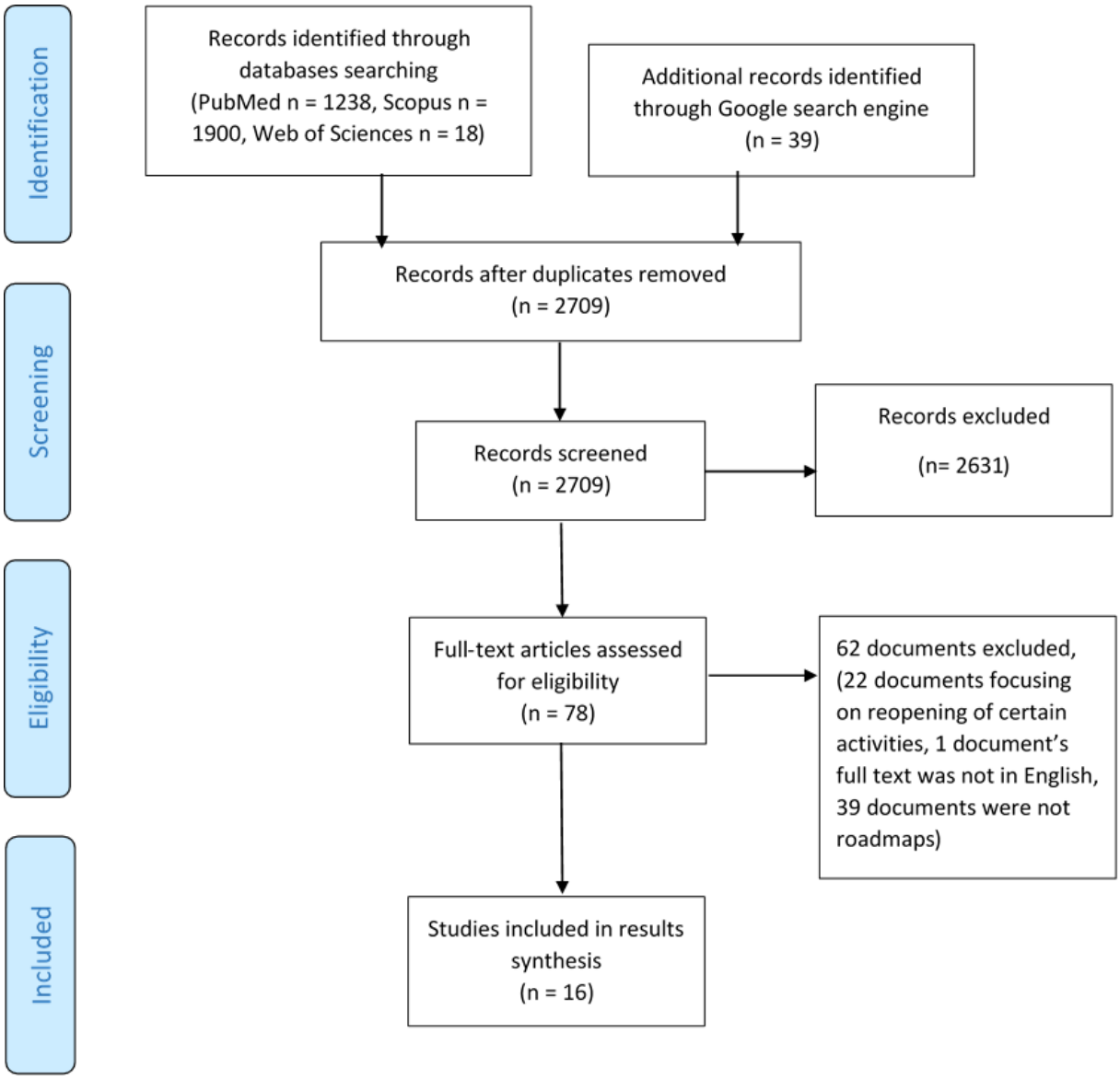

Fig. 1: Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram of the study

It is noteworthy that all the included roadmaps were retrieved from grey literature as searched via Google.

The results, as shown below, categorized into four sections.

The principles of roadmaps

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

In Table 2, the results are summarized in details. 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 deci-

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

Moreover, only in the European Council's roadmap, 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. 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. 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, clearly mentioned in Nashville's roadmap. The role of public health education has not been taken seriously in other roadmaps. Because of this, we highlight the role of education and further adaptation. The last and by no mean 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 2.

Table 2: The characteristics of principles found in the roadmaps

	*Ontario**	*UK**	*Ireland**	*Shasta county**	*Connecticut**	*European Council**	*Nevada**	*Massachusetts***	*Open up America again***	*California***	*Indiana***	*Nashville***	*America Enterprise Institute* [R]	*Queens land* [R]	*Western Australia* [R]	*Anchorage* [R]	*Total*
Increase testing capacity								+		+	+	+					4
Contact Tracing								+		+	+	+					4
Isolation								+		+		+					3
Responsibility of the state	+																1
Evidence-informed decision making	+	+			+	+											4
Increase health-related resources	+				+					+							3
Acting quickly and effectively	+																1
Monitoring the implementation	+			+													2
Being clear and transparency	+	+	+														3
Flexibility and adaptability	+						+										2
Fairness and equity		+	+														2
Proportionality and considering the social and		+	+		+						+						4

economic burdens																					
Privacy and confidentiality	+																				1
the public health assessment of risk is considered very important in any decision (safety)		+			+																2
Enhance the solidarity and cohesion within the society		+			+																2
Protecting the most vulnerable			+	+		+		+	+	+											6
Acting locally, countywide, statewide or countrywide						+		+													2
The decrease in the resurgence risk				+				+													2
Development of therapeutic options									+												1
Support the preventive measures of physical distancing, especially for crowded places such as schools, markets.			+			+			+		+										4
Support the economy and consumers and trading				+						+											2
Determination of criteria for a step back to an earlier stage									+												1
Handling the non-COVID-19 positive cases				+																	1
Collaboration and coordination with other sectors within the society						+															1
Collaboration and coordination with other countries					+																1
Education of the society to adapt and live with a new normal											+										1
Establishing a timeline for recovery						+															1

*Seven roadmaps with clear directions; **Five roadmaps in which the writers implied the doctrines. ᴿ We could not find any principle in these 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 (25). Therefore, 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 symp-

toms include cough, fever, and dyspnea; however, gastrointestinal symptoms and anosmia may occur (26-28). All individuals should be aware of clinical manifestations of COVID-19, 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 (29). More than half of these roadmaps (nine out of 16) mentioned supporting these most vulnerable patients.

As illustrated in Table 3, general recommendations noted for individuals in reviewed roadmaps were tabulated.

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 diagnostic capacity, appropriate epidemiological monitoring, 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 (30, 31). Furthermore, there should be the capacity to implement protocols ensuring appropriate safeguards for each sector reopened. The second subset relates to appropriate diagnosis capacity, including large-scale testing capacity combined with contact tracing (32). Based on its strategy, each territory should continue to increase the amount of available testing and be affordable for all population groups, including opportunities to obtain free tests. Ensuring adequate testing and tracing capacity is necessary to allow policymakers to oversee high-risk populations and modify their planning for reopening each sector. Besides this large-scale expansion of testing, early testing should also include high-risk congregate settings, including nursing homes and assisted living facilities, prisons, and dormitories. Key metrics related to appropriate epidemiological monitoring and active surveillance also play an important role in the designation of reopening strategy (33). 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 pandemic's epidemiological status 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 is categorized under sufficient health system capacity, includes sufficient capacity for hospital floor and critical care beds, ventilators, and healthcare system readiness

Table 3: The most essential preventive recommendations for individuals

Valuable	*Wearing a face-covering mask and coughing/ sneezing etiquette[ʁ]*	*Wash hands[§]*	*Surface cleaning*	*Social distance**	*Vigilant to symptom/ transmission route***	*Stay home (especially if feel sick or if diag-nosed)*	*Limit outside*	*Limit travel*	*Remote working / redesigning the work-place*	*Most vul-nerable' protection/ support[ɣ]*
Massachusetts	+	+	-	+	+	+	-	-	-	-
Ontario	+	+	+	+	-	+	+	+	+	+
UK	-	+	+	+	-	+	+	-	-	+
Ireland	+	+	-	+	+	+	+	-	-	+
Open up America again	+	+	+	-	-	+	-	-	-	-
America En-terprise Insti-tute	-	-	-	-	-	-	-	-	-	-
California	+	-	-	+	-	-	-	+	-	+
Shasta county	+	+	+	+	-	+	+	+	+	+
Connecticut	+	+	+	+	+	+	+	+	+	+
Indiana	+	+	+	+	+	-	+	+	+	+
Nashville	+	-	+	+	-	-	+	-	+	+
Nevada	+	-	-	+	-	+	+	+	+	+
Queens land	-	+	+	+	-	+	+	-	-	-
Western Aus-tralia	-	-	-	-	-	-	-	-	-	-
Anchorage	-	-	-	-	-	-	-	-	-	-
European Council	+	+	+	+	+	-	-	-	-	-
Total	11	10	9	12	5	9	9	6	6	9

[ʁ] 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.

[ɣ] 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

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 (34). These health metrics mentioned in the reviewed roadmaps are tabulated and summarized in Table 4.

These metrics should be assessed closely and carefully to prevent the infection's resurge 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 4: Health key metrics categorized in four subsets

Sufficient preventive capacity	*Appropriate diagnostic capacity*	*Appropriate epidemiological monitoring*	*Sufficient health system capacity*
• Ongoing availability of PPE to meet demands	• Sufficient testing capacity to test all symptomatic ones or at least to test most vulnerable groups • Expand other testing options like serology and antibody tests • Sufficient contact tracing and monitor all close contacts	Sustained improvement in the following metrics in a specific period: • # of positive tests • Positive test rate • # of new deaths from COVID-19 • # of new hospital and ICU admissions • # of total hospitalized patients	• Sufficient access to critical care requirements such as ventilators, medications, staff, et al. • Sufficient hospital and ICU beds to meet demands (<20% of beds occupied by COVID-19) • Sufficient capacity to treat all patients requiring hospitalization • Sufficient capacity for isolation and quarantine • Sufficient access to care for vulnerable groups • Availability of primary care structures to care for patients discharged from hospital

PPE= Personal Protective Equipment; #=number

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 (35, 36). 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 (36, 37). 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 (38, 39). To reach dynamicity, the health authorities should precisely determine the criteria of when progress to the next phase and when returning 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. However, the criteria for moving back 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, 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, the condition is approximately, back to normal or to a new normal in the last phase.

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 (Table 5).

Table 5: Number of phases, the time considered for each phase, when progress and when returning back

Variable	*Number of phases*	*Time for each phase*	*Is it mentioned when returning back?*
Massachusetts	4	Minimum of 3 wk and could last longer	✔
Ontario	3	2-4 wk	✔
UK	3	Phase 1-2: 18 d Phase 2-3: 35d	✔
Ireland	5	3 wk	✔
Open up America again	3	-	-
America Enterprise Institute	4	-	✔
California	4	-	✔
Shasta county	4	-	✔
Connecticut	3	4 wk	✔
Indiana	6	Phase 1-2: 42 d Phase 2-3: 18 d Phase 3-4: 21 d Phase 4-4.5: 23 d Phase 4.5-5: 14 d	✔
Nashville	5	Phase 1-2: 14 d Phase 2-3: 28 d Phase 3-4: minimum of 28 d	✔
Nevada	4	Minimum of 2-3 wk	-
Queens land	3	Phase 1-2: 17 d Phase 2-3: 33 d	✔
Western Australia	6	Phase 1-2: 22 d Phase 2-3: 19 d Phase 3-4: 21 d Phase 4-5: 2 months Phase 5-6: -	-
Anchorage	5	-	-
European Council	-	One month	-

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 shed light on the monitoring of a roadmap have not been mentioned in four roadmaps; the fact raises 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 did not mention anything about general recommendations for individuals that should be addressed in any reopening roadmaps.

Health key metrics 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 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 dif-

fered from three to six, with a minimum of 2 wk considered for each phase. Dynamicity is the crucial key for developing a roadmap 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 did not 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 describe precisely the criteria to stop the reopening process and implement the restrictions again, as well as the criteria for progressing to the next phases.

Limitations

Due to the scarcity of proper evidence regarding this topic in the literature, mainly in major databases, we had to search via Google search engine manually. It may alter the searching systematically as required in a scoping review. Nevertheless, these pieces of evidence can assist the global and local health authorities in taking proper action plans regarding lifting the restrictions.

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, providing further evidence-based information concerning 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. The results can help local and world health policymakers taking proper action plans to minimize the consequences of society reopening.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Conflict of interest

The authors declare that there is no conflict of interests.

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