Calibrating long-term non-pharmaceutical interventions for COVID-19

Principles and facilitation tools

15 May 2020

World Health Organization
Western Pacific Region

1. Introduction

Background

Countries and areas in the Western Pacific Region have implemented strict non-pharmaceutical interventions (NPIs) against novel coronavirus disease (COVID-19), aiming to interrupt or reduce transmission. They can be classified into: 1) personal protective measures, 2) environmental measures, 3) social and physical distancing measures, and 4) travel-related measures.[1]

While effective in controlling the epidemic, some of these measures have significant socioeconomic costs and may negatively impact the physical and emotional well-being of populations. Stringent measures are likely to become increasingly unsustainable over time, especially in countries with limited resources, social protection and health-care services.

Interventions should be informed by data. The evidence available thus far suggests:

- Asymptomatic and mild cases contribute to transmission, and infectivity likely starts 2–3 days prior to symptom onset, peaking within one day before symptom onset in those who do develop symptoms.[2,3] This underscores the importance of early detection and case isolation as well as contact tracing and quarantining of contacts in reducing the reproductive number.
- Older people and people with co-morbidities have the highest case fatality rates, making them particularly vulnerable and requiring special attention. However, young people still must be considered in the response, as they contribute to transmission and may also require hospitalization.
- Risk factors for cluster formation are likely similar across countries. They include closed, poorly ventilated spaces, crowded places and close-contact settings with people holding conversations (or other forms of voicing such as singing and shouting).[4]

Experience in Japan, the Republic of Korea, Hong Kong SAR (China) and other parts of China suggests that COVID-19 may be contained without substantial restrictions on social and economic activities when the reproductive number at a given time, or $R_{(t)}$, remains around 1, the number of cases is low, and there is a strong mechanism for case detection and contract tracing. This document proposes five steps for countries to implement an NPI strategy that balances epidemiological benefit and socioeconomic costs. It builds on the WHO *Considerations in Adjusting Public Health and Social Measures in the Context of COVID-19:*

[1] Non-pharmaceutical public health measures for mitigating the risk and impact of epidemic and pandemic influenza. Geneva: World Health Organization; 2019. https://apps.who.int/iris/handle/10665/329438.
[2] Huang L, Zhang X, Zhang X, Wei Z, Zhang L, Xu J et al. Rapid asymptomatic transmission of COVID-19 during the incubation period demonstrating strong infectivity in a cluster of youngsters aged 16-23 years outside Wuhan and characteristics of young patients with COVID-19: A prospective contact-tracing study. Journal of Infection. (in press)
[3] He X, Lau EH, Wu P, Deng X, Wang J, Hao X et al. Temporal dynamics in viral shedding and transmissibility of COVID-19. medRxiv. 2020 Mar 18;2020.03.15.20036707.
[4] Cluster investigation in Japan revealed these 3Cs represent a high risk for cluster formation.

Interim Guidance[5] and the *WHO Western Pacific Regional Action Plan for Response to Large-Scale Community Outbreaks of COVID-19*.[6]

In other regions, many countries with sustained community transmission are focused on how to gradually lift restrictions following a substantial peak. In the Western Pacific Region, however, many countries introduced suppression measures early on when only small numbers of cases (or no cases) had been reported. Now, many countries in the Region are considering how to relax NPIs while keeping the number of cases low.

Moving forward, countries should:

1) be prepared to tighten or relax restrictions depending on their epidemic trajectories;
2) establish the capacity to predict or detect a potential surge in cases, based on information from multiple sources, including trends in the movements of people detected with big data and future events involving significant population movement; and
3) strengthen the capacity for contact tracing to quarantine symptomatic and asymptomatic cases early and identify hotspots for further action. This enables countries to "level" (keep fluctuation to a minimum) the epidemic curve after relaxing strong NPI measures.

Target audience

This guidance is intended to assist government officials with responsibility for advising national and subnational governments on policy measures for responding to the COVID-19 pandemic.

2. Goal and guiding principles

Goal

The proposed approach aims to support countries in the Western Pacific Region to assess health system capacity to manage cases and to balance those assessments against the epidemiological and socioeconomic impacts of NPIs.

Guiding principles

1. **Decisions based on clear steps informed by the best available information.** The development of clear steps will facilitate multisectoral decision-making when data and evidence on the efficacy and cost of particular measures are incomplete. Countries should collect and assess information from different sources to inform the decisions.

2. **Joint decision-making** with other key sectors (such as ministries responsible for finance, welfare, economy and justice as well as with subnational entities and the political leadership, if appropriate) to understand the likely socioeconomic effects of interventions and determine the optimal balance between their epidemiological benefit (primarily health sector issues) and negative socioeconomic impact (primarily issues outside the health sector).

3. **Phased implementation of control measures** based on predefined assessment and criteria as well as local culture and context. Measures should be implemented in a stepwise manner, rather than implemented or removed all at once. If necessary, countries should start making changes in certain geographical areas or population groups. Each country or subnational authority should establish its own assessment and decision-making criteria for lifting and reinstalling measures, based on its local context and needs.

[5] Considerations in adjusting public health and social measures in the context of COVID-19: interim guidance, 16 April 2020. Geneva: World Health Organization; 2020. https://apps.who.int/iris/handle/10665/331773.
[6] WHO Western Pacific regional action plan for the response to large-scale community outbreaks of COVID-19. Manila: World Health Organization Regional Office for the Western Pacific; 2020. https://apps.who.int/iris/handle/10665/331944.

4. **Protection of vulnerable populations**[7] with steps taken to minimize the risk of transmission and new outbreaks among those populations. Specific ways in which NPIs impact on vulnerable populations should be considered and mitigated where possible, including loss of income, reduced access to health and other essential services, increased social isolation and inability to self-isolate in crowded living conditions. Mechanisms to respond to potential increases in family violence and human rights abuses resulting from NPIs should also be developed.

5. **A *new normal*** should be established in each country, considering many factors for risk mitigation, including personal protective behaviours, teleworking, staggered commuting, physical distancing and ventilation in offices and commercial facilities. These *new normal* interventions should be implemented regardless of the epidemiology and at least until transmission of COVID-19 has ended. It is especially important to put into effect measures to mitigate the risk of transmission in essential services and activities related to basic infrastructure (such as utilities, energy, facility maintenance), religious and cultural activities, long-term care and childcare.

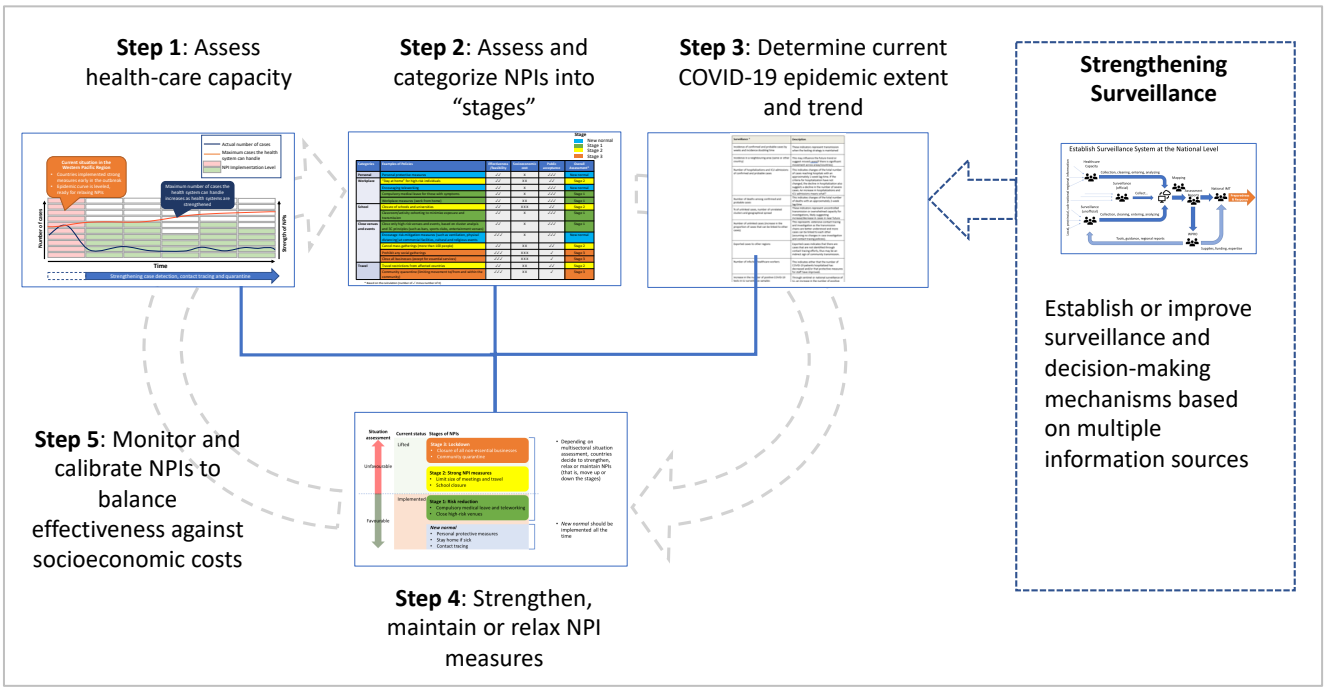
3. Recommended steps for risk-adjusted NPIs

The approach proposes five steps for countries to implement NPI strategies (Fig. 1). It recommends that countries:

1) assess their current health-care capacity;
2) categorize NPIs based on effectiveness, socioeconomic costs, and public perception;
3) determine the extent and trend of the COVID-19 epidemic;
4) decide on whether to strengthen, maintain or relax NPI implementation measures, and which NPIs to lift or reinstall first; and
5) monitor changes in the COVID-19 epidemic, systems capacity and NPI impact to calibrate NPIs and balance effectiveness against socioeconomic and other costs.

[7] Including older people, people with certain pre-existing conditions, people with disabilities, people experiencing homelessness, refugees, migrants and prisoners.

Fig. 1. Steps for implementation

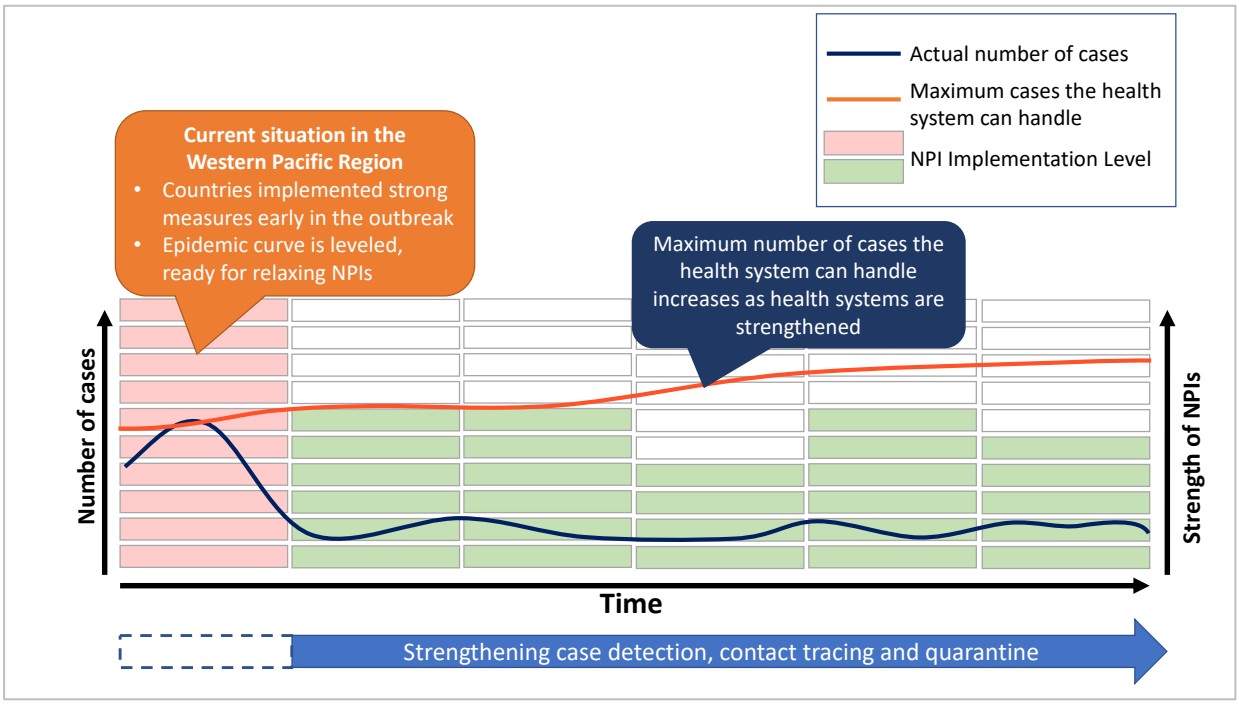


Additional tools and references for conducting this exercise are included in Annexes 1 and 2.

Step 1: Assess health-care capacity to manage COVID-19 patients

The COVID-19 epidemic must be managed so that health-care capacity is not overwhelmed (Fig. 2).

Fig. 2. A proposed approach: overview



Countries should initially determine the capacity of health systems to absorb COVID-19 patients. They should use a set of parameters that may include the number of acute and critical care beds available for COVID-19 cases, based on space (for example, hospital bed capacity), staff (for example, health-care worker requirements) and supplies (such as ventilators, personal protective equipment) (**supply side**). Once key parameters are agreed, a process for determining and tracking the saturation rate can be designed, such as regular reporting of critical care bed occupancy rates.

The adequacy of current capacity can be compared against the projected need for acute and/or critical care based on the projected epidemiological trend (number of daily cases), the percentage of patients requiring acute and critical care, and the average duration of hospital stays (**demand side**).

Based on this analysis, countries may design specific measures to increase capacity to treat COVID-19 and improve access to commodities and, hence, raise future "tolerance" for COVID-19 cases.

Countries should also ensure that there is sufficient health-care capacity set aside for non-COVID-19 services, so that increased COVID-19 care does not compromise other clinical care and public health interventions, such as immunization programmes and other essential health services.

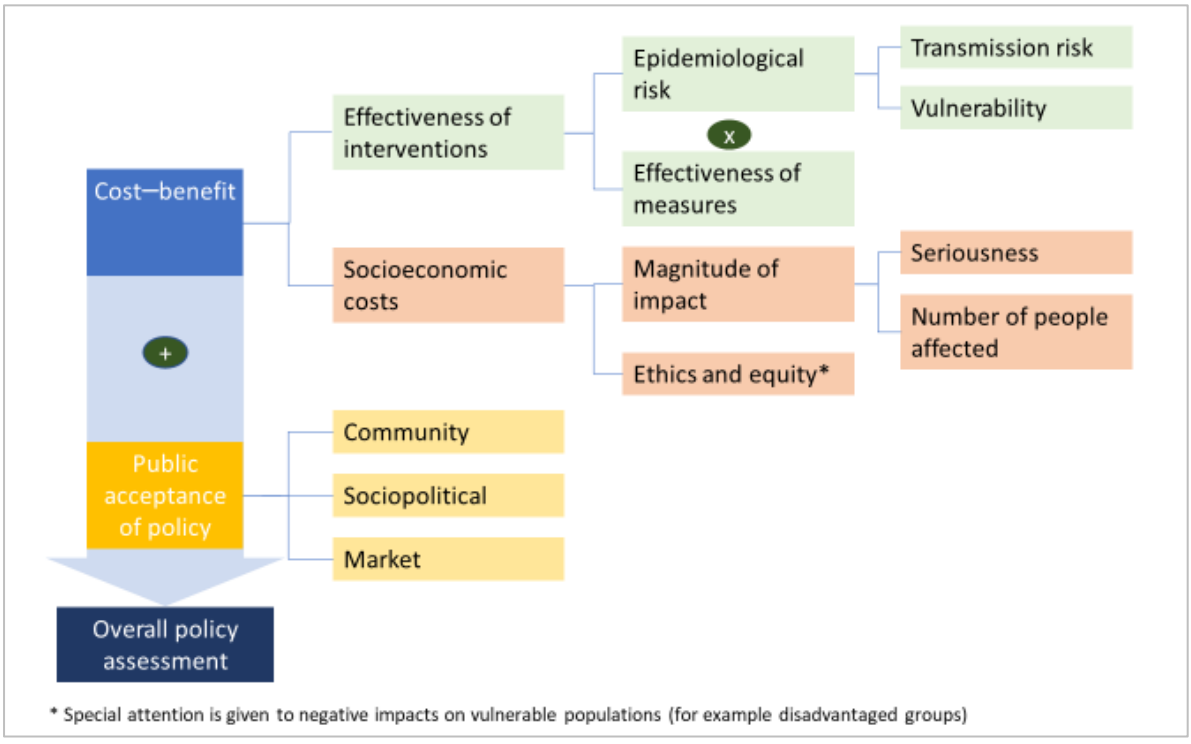
WHO has developed an Excel-based tool to support decision-making at country level (Tool #1).[8]

Step 2: Assess and categorize NPIs into "stages"

Ideally, countries should determine the effectiveness of each intervention based on local data and evidence. However, modelling and epidemiological data for assessing the effectiveness of these measures may be limited or unavailable, so consensus among experts may be sought instead.

While ensuring compliance with human rights principles, countries should estimate the following for each NPI: 1) effectiveness, 2) socioeconomic costs, and 3) public perception or acceptance. This will guide decision-making on the optimal balance of interventions (Fig. 3)

Fig. 3. Assessment of NPIs: elements to be considered



[8] Available from the WHO Regional Office for the Western Pacific upon request.

1. **Effectiveness:** The health sector (such as the ministry of health) should review evidence (including literature and cluster investigation data) to estimate the relative effectiveness of each NPI. With little direct evidence, countries may seek consensus from national expert groups.[9] For a summary of available evidence, please see Annex 2.
2. **Socioeconomic costs**: The health sector should facilitate dialogue with other sectors (such as other ministries) to understand and evaluate the relative socioeconomic costs of each NPI, including its possible impact on vulnerable populations. Countries may consider assessing the socioeconomic costs using **Tools #2-a and #2-b: Assessment of socioeconomic costs** in Annex 1. The health sector should draw attention to potential human rights issues in promoting measures that comply with human rights principles.
3. **Public perception or acceptance**: The health sector should work with other sectors (including other ministries), consider conducting a public opinion survey and/or seek inputs from representatives from the community, politics and industry (market perception) to understand public perceptions of different NPIs over time.

When countries are planning to relax restrictions by gradually reopening businesses, they should start with businesses that contribute significantly to the economy and create more employment, and represent a low risk for transmission (based on cluster analysis). These businesses should also have a high capacity to take precautionary measures, such as physical distancing and limiting the number of people at venues. See **Tool #2-c: Risk of cluster formation and economic impact of NPIs by sector** in Annex 1.

Consideration of socioeconomic costs and public perception is important, especially when there is little or no evidence on the efficacy of specific NPIs (for example, school or business closures). Countries should also consider interdependencies among NPIs (for example, if a decision is made to close schools, partial closures may be considered instead to allow children of essential workers to attend school so their parents can continue to work).

The assessment should be summarized in a single table and used to group NPIs into different categories (**Tool #3: Assessment and categorization of NPIs** in Table 1). The categorization determines the epidemic conditions under which NPIs are implemented

- ***New normal*** – continuously implemented
- **Stage 1** – in place during most of the epidemic
- **Stage 2** – implementation adjusted based on the epidemic situation
- **Stage 3** – interventions with high socioeconomic costs relaxed first.

The categories may be staged according to pertinence based on the effectiveness, socioeconomic costs and public acceptance of NPIs.

Countries should periodically review the list of NPIs and their categorization, as the appreciation of each measure may change over time with regard to its effectiveness, socioeconomic costs and/or public acceptance. Likewise, new or new variations of NPIs and new evidence may emerge.

[9] For example, a country may use the Delphi Method, which uses multiple rounds of questionnaires to seek consensus within an expert group. After each round, the experts are given an anonymized summary of the group's responses and encouraged to revise their responses. This process continues until the range of answers has converged and consensus is reached.

Table 1. Tool #3: Assessment and categorization of NPIs

Stage
New normal
Stage 1
Stage 2
Stage 3

Categories	Examples of Policies	Effectiveness /feasibility	Socioeconomic cost	Public acceptance	Overall Assessment*
Personal	Personal protective measures	✓✓	X	✓✓✓	New normal
Workplace	"Stay at home" for high-risk individuals	✓✓	X X	✓✓	Stage 2
	Encouraging teleworking	✓✓	X	✓✓✓	New normal
	Compulsory medical leave for those with symptoms	✓✓	X	✓✓✓	Stage 1
	Workplace measures (work from home)	✓✓	X X	✓✓✓	Stage 1
School	Closure of schools and universities	✓✓	X X X	✓✓	Stage 2
	Classroom/activity cohorting to minimize exposure and transmission	✓✓	X	✓✓✓	Stage 1
Close venues and events	Close only high-risk venues and events, based on cluster analysis and 3C principles (such as bars, sports clubs, entertainment venues)	✓✓	X	✓✓✓	Stage 1
	Encourage risk-mitigation measures (such as ventilation, physical distancing) at commercial facilities, cultural and religious events	✓✓✓	X	✓✓✓	New normal
	Cancel mass gatherings (more than 100 people)	✓✓	X X	✓✓	Stage 2
	Prohibit any social gatherings	✓✓✓	X X X	✓	Stage 3
	Close all businesses (except for essential services)	✓✓✓	X X X	✓	Stage 3
Travel	Travel restrictions from affected countries	✓✓	X X	✓✓	Stage 2
	Community quarantine (limiting movement to/from and within the community)	✓✓✓	X X	✓	Stage 3

* Based on the calculation (number of ✓ minus number of X)

Step 3: Determine current COVID-19 epidemic extent and trend

Countries should assess the current COVID-19 epidemic situation and trend to inform NPI policy. Since multiple factors beyond the trend in the number of cases must be considered to detect early signs of an increase in cases, countries should collect and evaluate information from multiple sources, including:

- **Indicator-based surveillance:** Structured information on case reports is collected from health-care providers, hospitals and laboratories. This information is used to determine whether the number of cases is increasing or decreasing. Information from surveillance for severe acute respiratory infection (SARI) or influenza-like illness (ILI) may also be included.
- **Event-based surveillance:** Information captured through the media, social media, blogs, hotlines, population mobility data from big data, reports to local health officials and other community-based messaging systems can be used to detect current or predict future outbreaks. As the information is unstructured and non-standardized, verification for accuracy is required.
- **Other sources:** Information on the risk of importation or outbreaks among vulnerable populations and on community engagement and readiness for changes in NPI implementation.

(See **Tool #4: Possible indicators/information for making decisions on NPIs** in Annex 1.)

Countries are encouraged to select appropriate indicators for their context and establish mechanisms to analyse data and inform decision-making. Due to the limitations and biases in all sources of information, countries should choose indicators that rely on different sources of information.

For example, a country can choose two indicators to assess a trend:

- number of newly reported SARS-CoV-2 positive[10] specimens (specific but more

[10] Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the virus that causes COVID-19.

susceptible to health-care-seeking behaviour and testing policy); and
- number of all-cause deaths against the baseline (less specific but less susceptible to health-care-seeking behaviour and testing policy).

Similar information in these two indicators would provide more confidence in the situation assessment. In addition, since these two indicators might take a day to a week to be reported, a country may include another indicator such as the number of emergency department visits with fever or respiratory symptoms. This is less specific and more susceptible to health-care-seeking behaviour but may be reported more quickly.

The indicators and datasets chosen should enable countries to assess the current *extent* of COVID-19 (the number of prevalent cases and associated treatment needs), as well as the *trend* of the epidemic (whether and how rapidly the number of prevalent cases is changing over time).

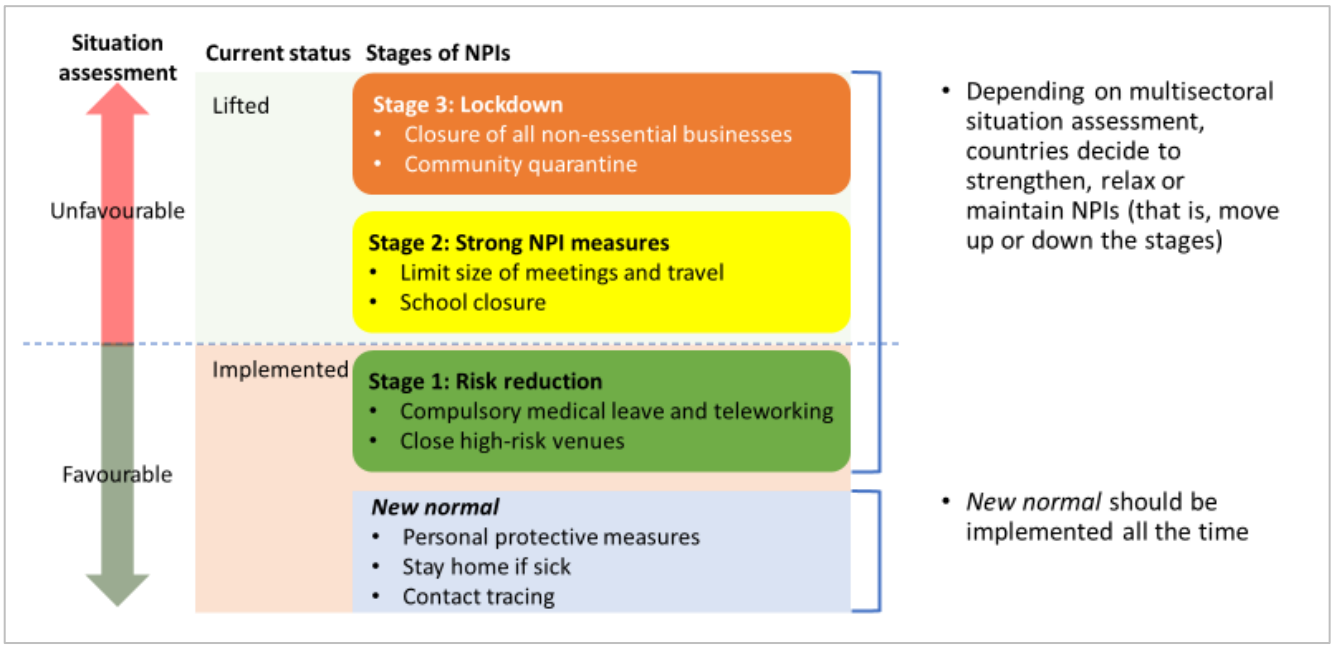
These indicators may then be supplemented by 1) event-based surveillance, such as monitoring social media for reports of non-compliance with the existing NPIs and people's mobility data based on big data (for example mobile phone usage and location mapping), and 2) other events that may influence the trend (for example increases in neighbouring countries, upcoming big events or celebrations).

While reflecting on the set of indicators and systems to generate the information, countries may consider designing specific approaches to resolve identified bottlenecks and strengthen multisource information systems.

Step 4: Strengthen, maintain or relax NPI measures

Countries should determine the specific NPIs to be strengthened, maintained or relaxed, based on: the assessment of health-care capacity (Step 1) the assessment and categorization of NPIs (Step 2); and the current epidemic extent and trend (Step 3). (See **Tool #5: An example of staging of NPI policy** in Fig. 4).

Fig. 4. Tool #5: An example of staging of NPI policy



Countries may consider different recommendations for subnational areas (such as by province or region or urban versus rural areas).

Some countries are using epidemiological modelling to forecast trends in the number of cases and assess the impact of different NPI options to inform decisions on NPIs. Others have developed a set of conditions for indicators (as defined in Step 1 and Step 3) that need to be met to move from one stage of NPI implementation to a lower or higher stage (as defined in Step 2). These conditions reflect both the current saturation of the health system as well as whether the epidemic is on an up- or downward trajectory in order to allow for anticipatory strengthening or relaxation of measures.

The categorization of indicators and the level of evidence for each NPI should be reviewed regularly.

For example, New Zealand established its COVID-19 Alert System, consisting of defined criteria and four levels of restrictions based on risk assessment (Box 1), and the United States of America introduced guidelines for reopening based on so-called "gating criteria" and phased levels of restrictions (Box 2).

Box 1. Summary of New Zealand's COVID-19 Alert System

Alert Level 4 – Lockdown
Community transmission is occurring with widespread outbreaks and new clusters.

People stay at home (essential movement allowed); gatherings cancelled; public venues, businesses (except essential services) and schools closed.

Alert Level 3 – Restrict
Community transmission might be happening. New clusters may emerge but can be controlled through testing and contact tracing.

People stay at home (essential work, school, local recreation allowed); physical distancing of 2 metres; gatherings of 10 people allowed for specific ceremonies; public venues closed; businesses can open but no physical interaction allowed with customers; limited domestic travel; vulnerable populations encouraged to stay at home.

Alert Level 2 – Reduce
Household transmission could be occurring. Single or isolated cluster outbreaks.

Physical distancing of 1 metre; gatherings of 100 people (indoors) or 500 people (outdoors) allowed; sport, recreation, public venues, businesses and schools open with appropriate safety measures in place; vulnerable populations encouraged to stay at home.

Alert Level 1 – Prepare
COVID-19 is uncontrolled overseas. Isolated household transmission could be occurring in New Zealand.

Border entry measures; schools and workplaces open – operating safely; no restrictions on gatherings or domestic transport (unless sick; stay home if sick).

These alert levels may be applied at town, city, territorial local authority, regional or national level.

Source: COVID-19 Alert System [webpage]. Wellington: New Zealand Government. https://covid19.govt.nz/alert-system/covid-19-alert-system/

Box 2. Summary of guidelines for opening up America again

State or regional "gating criteria":

Symptoms: downward trajectory of influenza-like illnesses (ILIs) *and* COVID-19-like syndromic cases reported within a 14-day period

Cases: downward trajectory of documented cases *or* positive tests as a percent of total tests within a 14-day period (flat or increasing volume of tests)

Hospitals: treat all patients without crisis care *and* robust testing programme in place for at-risk health-care workers, including emerging antibody testing

Phase One – for states and regions that satisfy gating criteria

Individuals: vulnerable individuals to continue to shelter in place; all individuals physical distancing in public; maximum group size: 10 people; minimize non-essential travel; isolation after travelling

Employers: encourage teleworking; return to work in phases; close common areas; consider special accommodations for vulnerable populations

Specific types of employers: schools and youth activities closed; bars closed; no visitors at long-term care facilities and hospitals; restaurants (dine-in), movie theatres, sporting venues and gyms, and places of worship open under *strict* physical distancing protocols; elective outpatient surgeries can resume

Phase Two – for states and regions with no evidence of a rebound and that satisfy gating criteria a second time

Individuals: vulnerable individuals to continue to shelter in place; all other individuals physical distancing in public; maximum group size: 50 people; non-essential travel can resume

Employers: encourage teleworking; return to work in phases; close common areas; consider special accommodations for vulnerable populations

Specific types of employers: resume schools and youth activities; no visitors at long-term care facilities and hospitals; restaurants (dine-in), movie theatres, sporting venues and places of worship open under *moderate* physical distancing protocols; surgeries for inpatients and outpatients; gyms open with *strict* physical distancing; bars open with physical distancing

Phase Three – for states and regions with no evidence of a rebound and that satisfy gating criteria a third time

Individuals: vulnerable individuals can resume public interactions, but practise physical distancing

Employers: resume unrestricted staffing of worksites

Specific types of employers: allow visitors at long-term care facilities and hospitals; open restaurants (dine-in), movie theatres, sporting venues and places of worship under *limited* physical distancing protocols; gyms open; bars open with limited physical distancing

Source: Guidelines for opening up America again. Washington (DC): The White House and United States Centers for Disease Control and Prevention. https://www.whitehouse.gov/wp-content/uploads/2020/04/Guidelines-for-Opening-Up-America-Again.pdf

Countries should communicate decisions about lifting or reinstalling NPIs to the public using simple, clear and precise messages: "Based on a, b, c, we will do x, y, z. We will then reassess the measures after a certain period of time (for example, 2–4 weeks)." The aim is to provide accurate information that encourages people to change their behaviour to reduce the spread of infection. Active and timely communication also helps to demonstrate transparency in the decision-making process. When measures are being relaxed, the public should be warned that they may need to be reimposed, depending on the course of the epidemic. Champions can be used to encourage adoption of protective behaviours and develop new social norms, such as frequent handwashing, physical distancing and staying home when sick.

Step 5: Monitor systems capacity, epidemic changes and calibrate NPIs to balance effectiveness against socioeconomic costs

Countries should continuously monitor changes in available and used health system capacity, NPI impact and the COVID-19 epidemic and use this information to periodically adjust NPIs by following the steps outlined above.[10] In order to do this, countries need to establish routines and mechanisms to collect, clean, enter and analyse data from different sources to inform decisions. It is particularly important to monitor early indicators to detect any sign of increasing cases. Countries may also wish to introduce targeted monitoring of specific measures, such as school-based reporting of illness following reopening of schools and continuously review available evidence on individual NPIs.

4. Other considerations

- **Contact tracing:** When countries relax NPI measures, efforts should be made to strengthen case detection, isolation, contact tracing and quarantine to minimize possible resurgences in cases. Contact tracing is especially important and has proven to be effective in preventing further spread in many countries in the Western Pacific Region. Policy-makers may consider establishing national guidelines, assigning dedicated teams for contact tracing (for example, training community volunteers) and building a cluster database of high-risk events and venues in each country or area.
- **Digital technologies** may be used for contact tracing, screening, triage and surveillance in order to: 1) monitor compliance with home quarantine; 2) conduct mass surveys and identify potential hotspots for COVID-19 transmission; 3) identify population movement patterns such as detecting mass gatherings; and 4) trace contacts (such as alerting those possibly exposed to the virus and identifying clusters). Options for implementation depend on connectivity, device ownership, government capacity, data security and public acceptance regarding privacy concerns.
- **Scale-up of testing:** Given limited resources, priority for testing should be given to suspected cases with severe symptoms and/or those with higher likelihood of infection (such as people with symptoms who visited cluster hotspots). If testing capacity increases, measures may be taken to reduce case burden and risk of infection in health facilities by 1) setting up testing centres outside health facilities with proper physical distancing and ventilation (such as fever clinics in Singapore and drive-through testing locations in the Republic of Korea), and 2) providing home observation or isolation centres for asymptomatic and mild cases.

[10] Certain measures may no longer be needed when the situation changes (such as temperature screening at airports when international flights have been suspended).

- **Health systems strengthening:** Increase capacity for care of critically ill patients including the number of beds, ventilators, oxygen supplies and trained staff. Ensure that all health-care workers have access to sufficient personal protective equipment and implement strict infection prevention and control measures.
- **Legal steps** may need to be taken to implement an NPI and adjust it over time. Measures taken should be consistent with human rights principles They should be necessary, temporary, proportionate and no more restrictive than required.[11]
- **Ethical principles** should inform decision-making and guide the balancing of competing interests.[12] NPIs have multifaceted and compounding impacts and can generate or exacerbate harm and inequity. Countries should develop plans to address the needs of the most vulnerable. They should ensure that strong measures such as restrictions on movement are applied based on public health risk without disproportionately affecting vulnerable populations and in a manner that ensures safe and healthy conditions for those affected. Above all, members of the global community need to act in solidarity, since all countries share a common vulnerability to the threat of COVID-19.
- **Effective treatment and vaccines:** The development and availability of effective treatment and vaccines in the future will change the actions needed to respond to the epidemic. Guidance will be regularly reviewed and revised in the light of emerging evidence and therapeutic options.

[11] United Nations Economic and Social Council, Commission on Human Rights. The Siracusa Principles on the Limitation and Derogation of Provisions in the International Covenant on Civil and Political Rights. United Nations document E/CN.4/1985/4 (28 September 1984): Article I.A.7–I.A.9.

[12] Guidance for managing ethical issues in infectious disease outbreaks. Geneva: World Health Organization; 2016. https://apps.who.int/iris/handle/10665/250580.

Annexes

Annex 1: Tools

These tables provide examples of considerations for socioeconomic impact for each NPI. Countries are encouraged to evaluate each NPI based on their own data and context. Countries are also encouraged to come up with possible mitigation measures for each NPI.

Tool #2-a: Assessment of economic costs[13]

Types of NPIs	Key interventions	Example of considerations	Possible mitigation measures (to be discussed in each country)	Economic impact
Personal protective measures	Hand hygiene	• Generally low cost but potentially a financial burden for the poor to purchase soap, alcohol-based sanitizers, etc.		Low
	Respiratory etiquette	• Limited socioeconomic consequences		Low
	Face masks	• Generally low cost but potentially a financial burden for the poor to buy face masks (if people are obliged to wear masks)		Low
Environmental NPIs	Surface and object cleaning	• Costs of cleaning public spaces, facilities on a regular basis		Low
	Other environmental measures (e.g. using ultraviolet or UV light, increasing ventilation and modifying humidity)	• Significant cost, especially among smaller businesses, if enforced		Low

[13] Please note the economic costs associated with an NPI are dependent on a country's particular economic make-up. Therefore, each country should customize its assessment based on its own data and information.

Physical distancing measures	Contact tracing	• Resource intensive and requiring costs of coordination, administration and logistics		Low
	Isolation of sick individuals	• Decrease in production, loss of income, employment and missed business opportunities • Risk of stigmatization of affected individuals		Low–Medium
	Quarantine of exposed individuals (e.g. 14 days)	• Not significant overall economic cost unless a significant number of people are quarantined		Low–Medium
	School measures and closures	• When children lose out on education for longer periods, they lose out on future opportunities including economic benefits, such as additional earnings • Loss of income/employment for administrative staff and contractors at school settings • More absence of workforce if there is no caregiver available at home		Low
	Workplace measures (e.g. encouraging teleworking, staggering shifts, and loosening policies for sick leave and paid leave) and closures	• Increased costs, such as administration arrangements and installation of digital technology • Potential decrease in production due to inefficiencies, especially for industries not “IT-ready”		Low
	Avoiding crowding (including closure of businesses and cancellation of events and mass gatherings)	• Decrease in production, loss of income and employment and missed business opportunities • Possible disruption to supply chain • Specific sectors hit particularly hard, such as small and medium-sized enterprises with cash flow shortages; production sites; factories and other businesses that require people at workplaces, such as manufacturing and services sectors such as hotels and restaurants		High

Travel-related measures	Travel advisories	• Indirect loss of income and missed business opportunities in several sectors, including aviation, tourism and hospitality • Long-term implication to the economy due to the reputational damage		Low–Medium
	Entry and exit screening	• Loss of income and missed business opportunities with some sectors hit particularly hard, such as aviation, tourism, hospitality and entertainment • Increase in cost and consumption of public health resources, including trained staff, screening devices and laboratory services		Low
	Internal travel restrictions	• Missed work and loss of income for individuals; increase of cost of coordination, administration and logistics, as well as public health resources • Loss of income and missed business opportunities with some sectors more affected, such as aviation, tourism, hospitality and entertainment		Medium
	Border closures	• Loss of income and missed business opportunities with some sectors more affected, such as aviation, tourism, hospitality and entertainment • Disruptions in global supply chain and cross-border economic activities • Decrease in production and loss of income, employment and business opportunities • Decrease and/or change in consumption patterns • Increase in living cost and cost of public services		Medium–High

Tool #2-b: Assessment of social costs

Types of NPIs	Key interventions	Example of considerations	Possible mitigation measures (to be discussed in each country)	Social impact
Personal protective measures	Hand hygiene	• Low-cost and well-tolerated intervention with minimal negative individual and societal consequences • Potentially extra financial burden for the poor to purchase soap, alcohol, masks, etc.		Low
	Respiratory etiquette			
	Face masks			
Environmental NPIs	Surface and object cleaning	• Potential exposure to harmful chemicals during surface cleaning or UV light during sterilization		Low
	Other environmental measures (e.g. using UV light, increasing ventilation and modifying humidity)			Low
Physical distancing measures	Contact tracing	• Risk of stigmatization of those affected • Privacy concerns regarding collection and use of personal data		Low
	Isolation of sick individuals and vulnerable groups	• Likely to lead to severe outcomes for the affected groups, particularly if measures are prolonged • Potentially affect health system capacity, if significant numbers of health-care workers are quarantined • Social isolation and quarantine could result in significant mental health issues if support structures and access to care are inadequate • May increase unemployment rates and lead to further stigmatization and inequalities, especially among vulnerable populations		Medium
	Quarantine of exposed individuals (for example, 14 days)			Medium
	School measures and closures	• Increased vulnerability for high-risk children and adolescents (abuse, malnutrition, violence); if the family courts and social		High, if prolonged

		service support are also cut, the implications for these children and adolescents are severe • Impact on educational and social development; rising inequalities as children and adolescents from poorer communities may not have access to online learning • Potentially more significant impacts on children with special needs and disabilities who require special schools and face-to-face interactions • Possibly differential burden on women for homeschooling in addition to other responsibilities at home and risks for increasing gender equality Nutritional impacts for poor and vulnerable children with loss of school meals • Possible risk to health-care capacity if many health workers take leave for childcare • Loss of income for higher education students and loss of opportunities to move to labour market, particularly in hard-hit sectors		Medium, if time-limited
	Workplace measures (e.g. encouraging teleworking from home, staggering shifts, and loosening policies for sick leave and paid leave) and closures	• Disproportionate impact on poorer communities and women • Significant impact on vulnerable people (e.g. people with disabilities, older people) if care services and facilities are closed • Many small and medium-sized enterprises will go out of business/be bankrupted due to loss of income, causing high unemployment rates and increased number of job seekers		High for poorer and vulnerable communities and women Medium for men and wealthier communities
	Avoiding crowding (including closure of businesses and	• Significant impacts on poorer communities without access to television and online platforms to engage with faith-based, sports or leisure events		High for poorer communities

	cancellation of events and mass gatherings)	• Disproportionate burden in poorer communities of people who work in the industries supporting the mass gatherings, due to loss of work and subsequent health consequences • *Note*: No evidence exists that cancelling sports or leisure events leads to social and health impacts in the longer term.		impacted by the loss of work and/or unable to practise their faith online Medium for other communities
Travel-related measures	Travel advisories	• Increased economic burden due to loss of work and income • Can be used as an educational tool for travellers		Low
	Entry and exit screening	• Risk of stigmatization of individuals from affected countries		Medium
	Internal travel restrictions	• Difficulties reaching work and gaining income impacting on transport sector and services • Potential social impacts from price increases and scarcity of essential products due to supply chain issues • Isolation and separation of families, particularly older family members • Increases in inequities if basic needs cannot be met by affected communities		Medium
	Border closures	• Risk of separation of families, especially migrants • International legal and ethical considerations (as well as reputational and political issues) • Potential social impacts from price increases and scarcity of essential products due to supply chain issues • Economic implications particularly for poor and vulnerable groups, leading to poorer health outcomes		Medium for general population High for poor and vulnerable communities and for migrant workers

Tool #2-c: Risk of cluster formation and economic impact of NPIs by sector

Sector	% of GDP	% of employment	Risk of cluster formation	Impact of different NPIs on the sector					
				Workplace: Stay at home for high-risk individuals Forced medical leave for those with symptoms	Workplace: Full closure of all businesses except essential ones	School: Closure of high schools and/or universities Closure of preschools and/or elementary schools, classroom cohorts	Public events: Closure of high-risk venues and events, based on cluster analysis, avoid any meeting with multiple people	Travel: Screening travellers for infection Mandatory quarantine for travellers (at home or in designated facilities), border closure, banning flights	Travel: Community quarantine
Agriculture			Low	Low–Medium	Low	Low	Low	Low–Medium	Medium
Manufacturing			Medium	Medium–High	Low	Low	Low	Low	High
Industry (including mining and construction)			Medium	Low	Medium–High	Low	Low	Medium	High
Services			Low	High	Low	Low	Medium–High	High	Medium–High

This assessment is an example only. Each country or region should customize it based on their situation.

Economies are traditionally categorized by sectors: agriculture, manufacturing, industry (including construction and mining) and services. It is important when determining the economic impact of NPIs that each major subcategory of economic sector activity is considered, as the effects of NPIs on each subsector may differ. Even within a subsector such as mining, the type of mining (open pit versus underground mining) has different implications for compliance with NPIs without cessation of activities.

Within agriculture, important considerations are the types of labour used in the sector. In many countries, internal and external migrant labour is used during harvest times. International travel restrictions will heavily impact this sector. Further, the ability of countries to inspect meat and other food shipments upon arrival may be hampered by any quarantine measures imposed by a country.

In terms of manufacturing, the manufacturing line configuration is important to consider in terms of adequate physical distancing and non-cluster formation. Some manufacturing is heavily automated and/or “clean” such as computer chips; others such as the garment industry may need to reconfigure manufacturing facility (and dormitory) arrangements.

The services sector is incredibly varied and includes retail, medical, financial, entertainment, conference/sporting event hosting and tourism services. Each of these subsectors will be impacted differently by NPIs. The main differences relate to whether the activity can still be undertaken by employees using telecommunications. For instance, many financial services do not require face-to-face contact, whereas tourism does require personal contact, making it much less amenable to teleworking arrangements.

Tool #4: Possible indicators/information for making decisions on NPIs

Indicator	Description	Evolution of indicator increase/decrease/stable	Assessment
Indicator-based surveillance			
Number of confirmed COVID-19 cases (trend over the past 2 weeks, using 7-day moving average)	Indicator represents the trend in detecting and reporting COVID-19 infections in an area. Caution is advised when changes in case definitions and capacity have occurred. Confirmed cases typically represent infections that occurred more than 1 week prior.		
Number of deaths (1-week cumulative number compared to previous 3-week average) COVID-19 confirmed OR Undiagnosed OR All-cause deaths	Indicator represents the level of transmission in an area, taking into account the limitations of case detection, confirmation and reporting. Current proportion of fatal cases for COVID-19 (1–2%) implies that each COVID-19 fatality represents 50–100 cases.		
Number of laboratory-positive tests (trend over the last 2 weeks) compared to the trend in the number of tests conducted over the same period (that is, the trend in positivity with consideration for the trend in the denominator)	Indicator represents the level of transmission in an area and takes into account changes in testing, clinical suspicion and health-care-seeking behaviour.		
Syndromic surveillance (trend over at least 1 week) Number of fever or respiratory visits to outpatient clinics OR Number of influenza-like (or COVID-like) illnesses	Indicator represents non-specific symptomatic infections obtained through sentinel or national surveillance. Trends may represent the state of COVID-19 transmission. This indicator is influenced by changes in health-care-seeking behaviour.		

Event-based surveillance			
Reports of NPI non-compliance (1-week trend) Media reports OR Social media reports OR Police reports	Indicator represents the effectiveness of the intervention to limit exposure. Changes in the trends of non-compliance can be an early indicator of changes in transmission and subsequent changes in cases 1–3 weeks later. Please note that changes in compliance do not necessarily mean transmission has changed. These reports should be verified and investigated before decisions on NPIs are made.		
Reports of clusters of respiratory illness Health-care facility calls and reports OR Media reports OR Social media reports	Indicator represents potential clusters or outbreaks of COVID-19, thus providing early but uncertain information. These reports should be verified and investigated before decisions on NPIs are made. A lack of reports would support surveillance data (above) indicating a decrease in transmission.		
Reports indicating stressed health-care capacity Social media messages or photos about accessing health-care services Survey of health-care facilities on emergency room waiting times Media reports about other disease outbreaks in affected areas	Indicator may represent real-time infections or capacity of the health-care system to respond to transmission. These reports should be verified and investigated before decisions on NPIs are made. A lack of reports would support surveillance data (above) indicating a decrease in transmission.		

Population movement trend based on big data (2-week trend compared to previous 2-week trend)	Indicator represents the effect of current measures on population movement and on potential transmission of COVID-19. Movement trends can be provided by mobile phone operators and are often available over time by geography, across different categories of places. Please note that changes in mobility do not necessarily represent changes in transmission. However, increases should delay easing of NPIs, while a lack of increase would support surveillance data (above), indicating a decrease in transmission.		
Reports of major events (mass gatherings, elections, holiday seasons) occurring or planned for the near future	Indicator represents potential amplification of transmission, suggesting suppression of cases might be needed.		

In addition to the indicators, it is important to consider the following aspects when relaxing or tightening NPIs:

- that risks are minimized in high-vulnerability settings both for COVID-19 and negative impact of NPIs – particularly in care homes for older people , mental health facilities and crowded residences and settings;
- that workplace preventive measures are in place – with physical distancing, handwashing facilities, respiratory etiquette, etc.;
- that importation risks can be managed; and
- that the public is regularly informed and consulted about when and how NPIs will be implemented or lifted.

Annex 2: Effectiveness of NPIs

(This is a general assessment and should be customized by countries.)

Adapted from the 2019 WHO recommendations on the use of NPIs for mitigating the risk and impact of epidemic and pandemic influenza* with data obtained from a review of COVID-19 literature on NPIs.

Types of NPIs	Examples	Pathogen	Available evidence
			Impact
Personal protective measures	Hand hygiene	Influenza	Although hand hygiene does not have proven efficacy against laboratory-confirmed influenza in randomized controlled trials, it has been shown to deactivate or remove influenza virus from the hands in experimental studies and can reduce the burden of those other infections on the health system during influenza epidemics and pandemics.[1]
		SARS-CoV-2	Using a wet towel with soapy water to wipe hands removed more than 98% of SARS-CoV-2 particles, but the importance of access to instant hand hygiene was stressed.[2] Good hand hygiene is the single most effective measure to prevent COVID-19 transmission. Universal hand hygiene using either soap and water or alcohol-based sanitizer is recommended. Furthermore, the use of face masks should be combined with good hand hygiene to prevent the spread of infection.[3]
	Respiratory etiquette	Influenza	Although there is no research on the impact of respiratory etiquette on laboratory-confirmed influenza infection, this is a simple, feasible and acceptable intervention that may reduce transmission and reduce the impact of epidemics and pandemics.[1]
	Face masks	Influenza	Ten randomized controlled trials were included in a meta-analysis of face masks, and there was no evidence that face masks are effective in reducing transmission of laboratory-confirmed influenza. Their use is conditionally recommended only in severe influenza epidemics or pandemics for the protection of the general population. Masks are recommended for symptomatic individuals at all times.[1] There is only one randomized controlled trial on the use of cloth masks by health-care workers, which found no protective effect against influenza. If used, masks should be washed and dried daily and can be cleaned during use by sanitizer spray or UV disinfection boxes.[4]

		SARS-CoV-2	A study on COVID-19 indicated that N95 masks block more than 99% of SARS-CoV-2 particles, while surgical masks block more than 97% of particles, and home-made masks using kitchen paper and polyester block more than 95% of particles. [2] In a study of four patients with COVID-19 in the Republic of Korea, neither surgical masks nor reusable cotton masks were found to be effective at preventing the spread of particles during coughing into the environment.[5] The use of face masks by the general population should not replace other measures such as good hand hygiene. And in resource-limited settings, masks should be preserved for health-care workers.[6]
Environmental measures	Surface and object cleaning	Influenza	There is evidence that surface and object cleaning could reduce detections of influenza virus in the environment, but there is no evidence of effectiveness against laboratory-confirmed influenza virus infection. Experimental studies suggest that surface and object cleaning could effectively inactivate or reduce viable influenza virus on surfaces. Theoretically, this intervention could prevent influenza transmission.[1]
		SARS-CoV-2	SARS-CoV-2 can persist on metal, glass and plastic surfaces for up to 9 days and on cardboard for 1 day. Duration decreases in temperatures above 30°C; other coronaviruses have been shown to be deactivated by stronger than 70% ethanol (i.e. hand sanitizer) or 0.1% bleach (sodium hypochlorite) solutions within 1 minute.[7,8]
	Ventilation	Influenza	In simulation studies, increasing the ventilation rate reduced influenza transmission, and there is mechanistic plausibility for increased ventilation to reduce transmission – specifically aerosol transmission and perhaps to a lesser extent large respiratory droplet transmission or indirect contact transmission.[1]
		SARS-CoV-2	A well-ventilated room is critical, particularly when undertaking aerosol-generating procedures in a health-care setting. A high rate of air exchange is probably more important than positive or negative pressure. Each air exchange in a hospital clears approximately 63% of viral influenza aerosols, meaning that after five exchanges, less than 1% of particles remain (general hospital wards have about six exchanges per hour).[9]
	Other environmental measures (such as UV light,	Influenza	Using UV light and modifying humidity are hindered by feasibility and safety concerns.[1]
		SARS-CoV-2	Modelling has suggested that higher temperatures and humidity reduce the effective reproductive number (ignoring other behaviour changes) of COVID-19 and have also been shown to decrease transmissibility of influenza and SARS.[10]

	modifying humidity)		
Physical distancing measures	Contact tracing	Influenza	Studies based on simulation models indicated that overall effectiveness of contact tracing is limited for prevention of laboratory-confirmed influenza infection, though one study found a modest effect of adding contact tracing to isolation and quarantine.[1]
		SARS-CoV-2	Contact tracing of confirmed cases in Singapore identified 53% of people diagnosed with COVID-19.[11] Pre-symptomatic or asymptomatic transmission complicates contact tracing efforts.[12] Nearly 13% of transmission events are estimated to have occurred prior to symptom onset.[13] A survey in the United Kingdom of Great Britain and Northern Ireland and predictive modelling data suggest that contact tracing can reduce the reproductive number from 3.1 to 0.2, thus enabling containment of a COVID-19 outbreak.[14]
	Isolation of sick individuals	Influenza	Epidemiological and simulation studies suggested that isolation of sick individuals could reduce influenza transmission in epidemics and pandemics, and there is mechanistic plausibility for this intervention to be effective in reducing transmission. However, the overall effectiveness of isolation is moderate.[1]
		SARS-CoV-2	A simulation modelling study concluded that contact tracing and isolation may not be effective in containing outbreaks of COVID-19 unless very high levels of contact tracing are achieved. To achieve control of 90% of an outbreak with a reproductive number of 2.5, 80% of contacts needed to be traced and isolated. Delays from symptom onset to isolation have a major role in achieving control, with a long delay (9.1 days) from onset to isolation reducing the probability of control to 31%.[15] Another modelling study using data from the Diamond Princess cruise ship estimated that isolation and quarantine of ill passengers reduced the anticipated number of infections by 79%, compared to no intervention.[16] Rapid isolation of patients in the Republic of Korea has been identified as a key factor behind the quick control of the COVID-19 outbreak, along with high rates of community testing, reducing the period between symptom onset and diagnosis, and thus reducing onwards transmission.[17]
	Quarantine	Influenza	A review of six epidemiological studies and 10 simulation studies indicates that quarantine is generally effective in reducing the burden of disease and transmissibility of influenza, and in delaying the peak of an epidemic.[1]

		SARS-CoV-2	A Cochrane review of 10 COVID-19 modelling studies found that, compared to taking no action, quarantine of people exposed to confirmed or suspected COVID-19 cases averted 44–81% of new infections and 31–63% of deaths.[18]
	School measures and closures	Influenza	A review of data suggests that the effect of reactive school closure in reducing influenza transmission varies but is generally limited. Proactive closures and planned school holidays have a moderate impact on transmission. If schools remain open during a pandemic or epidemic, school measures can be considered to reduce transmission.[1]
		SARS-CoV-2	School closures and limits on gatherings in the United States of America were found to reduce community mobility and thus decreased risk of wide transmission.[19] Although a modelling study from Australia suggests that school closures followed with 100% compliance delays incidence and prevalence by approximately 2 weeks, they do not change the magnitude of cases, and the social costs of school closures need to be considered.[20] Limited data available for COVID-19 suggest that compared to influenza, school closures do not significantly reduce the transmissibility of SARS-CoV-2. At best, modelling studies predict that school closures alone would prevent 2–4% of deaths, substantially less than case isolation alone or combination measures.[21]
	Workplace measures and closures	Influenza	A review of data indicates that workplace measures (such as teleworking, staggered shifts, weekend extension and paid-leave policy) could reduce both the overall and the peak number of influenza cases, as well as delay the epidemic peak, though the overall effectiveness and feasibility of workplace measures are modest. Large-scale workplace closures could delay the epidemic peak for more than 1 week, and small-scale closures may have a modest impact on attack rate or peak number.[1] However, a more recent systematic review of 10 simulations found limited evidence for the effectiveness of workplace closures at reducing influenza transmission, with the potential for considerable economic consequences.[22]
		SARS-CoV-2	A transmission model based on data from Wuhan, China found and evaluated the effect of location-specific physical distancing on social mixing patterns. It found that workplace closures changed contact patterns between different age groups and geographic locations and, thus, delayed the epidemic peak and reduced the number of cases locally. A staggered return to work beginning three months after closures reduced the median number of estimated midyear infections by 92% (interquartile range or IQR 66–97%).[23]

	Avoiding crowding	Influenza	The effect of measures to avoid crowding alone in reducing transmission is uncertain. Timely and sustained application of measures to avoid crowding may reduce influenza transmission, although the quality of evidence of its effectiveness is very low.[1]
		SARS-CoV-2	An Australian modelling study suggests that 80–90% compliance with physical distancing measures for 13 weeks will be required to control the spread of COVID-19.[22] One study estimates that 13% of transmission events occurred prior to symptom onset,[13] highlighting the importance of physical distancing measures. The effect of cancelling mass gatherings is yet to be determined. Although they have previously been implicated in infectious disease spread globally, the social and economic impacts of cancellation must also be considered, with context-specific risk assessments.[24]
Travel-related measures	Travel advice	Influenza	No studies on the effectiveness of travel advice were identified, but it is recommended for citizens before their travel as a public health intervention to avoid potential exposure to influenza and to reduce the spread of influenza.[1]
		SARS-CoV-2	While there are no studies on their effectiveness for controlling or preventing COVID-19, travel advisories are a simple, feasible and acceptable intervention that may reduce transmission and reduce the impact of epidemics and pandemics. Many countries have disseminated such advisories. By 25 April 2020, more than 130 countries had introduced some form of travel restrictions, and 90% of all commercial air traffic was grounded.[25] Prior to such severe restrictions, clinicians were being urged to take detailed travel histories for suspected COVID-19 cases. Governments and organizations were also publishing regular advisories and keeping citizens updated on developments,[26] with suggestions to avoid visiting affected areas, large gatherings and contact with animals or sick people, and urging people to maintain good hand and respiratory hygiene.[27]
	Entry and exit screening	Influenza	In a review of 10 studies, the effectiveness of screening travellers for influenza was thought to be very limited considering the asymptomatic period of infected patients and the sensitivity of screening devices.[1]
		SARS-CoV-2	One simulation study found that at least 46% of travellers infected with COVID-19 would not be detected by screening, that exit screening is more effective with increased travel times and that the effectiveness of entry screening is largely dependent on effectiveness of prior exit screening.[28]

			Another mathematical modelling study suggested that 50–70% of travellers infected with COVID-19 would not be identified due to unawareness of exposure and transmission from asymptomatic individuals.[29]
	Internal travel restrictions	Influenza	A review of five studies, four of which were simulation studies, indicated that the effectiveness of internal travel restrictions depends on the level of restriction – only very strict restrictions would be expected to have an impact on influenza transmission.[1]
		SARS-CoV-2	A modelling study investigating the impact of travel restrictions on preventing the spread of COVID-19 from Wuhan, China found that early, intensive restrictions may be useful if an outbreak is localized and a central source is able to be identified.[30] A global metapopulation disease model estimated that quarantine of Wuhan delayed epidemic progression by only 3–5 days in the mainland of China.[31] Other modelling estimates from China also suggested that even a 50% reduction in intercity mobility would only have a negligible effect on epidemic dynamics.[32]
	Border closure	Influenza	A review of 11 studies indicated that, in general, only strict border closures within small island nations would be expected to be effective, and that for island nations, border closures should be carefully considered because they may affect the supply of essential items to the population.[1]
		SARS-CoV-2	While many countries implemented border control measures in the COVID-19 response, to date there is limited assessment of their effectiveness. Data from Australia modelling the impact of the travel ban from China suggested that border closure had been very effective at preventing the importation of COVID-19 cases, reducing the estimated number of cases by 87%.[33] While modelling data from Japan estimated that a travel ban reduced the number of COVID-19 cases outside of China by 70.4%, this only delayed a major epidemic by approximately 2 days.[34] Similarly, another global metapopulation model estimated the travel ban on China resulted in a 77% decline in imported cases of COVID-19 globally, but this would be temporary and increase the risk of importation from other locations. It also estimated that even with sustained 90% travel restrictions to and from mainland China, the epidemic would be delayed by no more than 2 weeks, unless combined with reductions in community transmission of more than 50%.[31]

* Please see references included in the 2019 WHO publication *Non-pharmaceutical Public Health Measures for Mitigating the Risk and Impact of Epidemic and Pandemic Influenza*. Data on influenza epidemics and pandemics represent the most comprehensive assessment of data on NPIs to control and prevent viral respiratory epidemics and pandemics. Influenza and COVID-19 share some similarities, including being caused by viruses that are primarily spread by respiratory transmission, but there are important differences in viral dynamics and the epidemiology of influenza and COVID-19.

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