

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

Principles and facilitation tools

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1. Introduction

Background

Countries and areas in the Western Pacific Region have implemented a series of non-pharmaceutical interventions (NPIs) against coronavirus disease 2019 (COVID-19), aiming to interrupt or reduce transmission. These interventions can be classified as: (a) personal measures, (b) physical distancing measures, (c) movement measures, and (d) special protection measures for specific populations and vulnerable groups.¹ While effective in controlling the epidemic, some measures have significant socioeconomic costs and may negatively impact the physical and emotional well-being of populations. Member States must balance epidemiological benefits, socioeconomic impact and the degree of public acceptance for each measure when designing and implementing NPIs.

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

- Asymptomatic, presymptomatic and mild cases contribute to transmission. In those that will develop symptoms, infectivity likely starts two to three days prior to symptom onset, peaking within one day before symptom onset.^{2,3} The likelihood of undetected transmission underscores

the importance of early detection, case isolation and contact tracing. Generalized and broad NPIs may be necessary in proportion to the epidemiological situation to address chains of transmission and clusters missed by surveillance systems.

- Case fatality rates are highest among older individuals and people with comorbidities, making them particularly vulnerable. These populations should receive special consideration in NPI development. Public health officials should concurrently consider younger populations in the design and implementation of NPIs, as they may contribute to transmission, require hospitalization and increase the burden on the health system.
- 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 Venues, events and activities with these environmental conditions are high-risk settings. Therefore, an NPI

¹ Overview of public health and social measures in the context of COVID-19. Geneva: World Health Organization; 2020 (<https://www.who.int/publications/i/item/overview-of-public-health-and-social-measures-in-the-context-of-covid-19>).

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. *J Infect.* 2020 Jun;80:e1-13.

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 A cluster investigation in Japan revealed that these 3Cs represent a high risk for cluster formation. See infographic at <https://www.who.int/images/default-source/wpro/countries/malaysia/infographics/three-3cs/final-avoid-the-3-cs-poster.jpg>

strategy that focuses on these environments can be effective at reducing the risk of transmission, especially in the early stages of an outbreak.

The responses to COVID-19 in China, Hong Kong SAR (China), Japan and the Republic of Korea suggest that transmission can be kept low with a focused approach on restrictions informed by epidemiology and surveillance data. Member States' experiences, along with modelling studies, suggest that communities may avoid large-scale disruptions to social and economic life through focused public health actions and strong systems for case detection and contact tracing, combined with personal hygiene measures (e.g. masking and handwashing) and physical distancing.^{5,6}

In this document, we propose four steps for Member States to implement an NPI strategy that balances epidemiological benefit and socioeconomic costs. It builds on the WHO interim guidance *Considerations for Implementing and Adjusting Public Health and Social Measures in the Context of COVID-19*⁷ and the *WHO Western Pacific Regional Action Plan for Response to Large-Scale Community Outbreaks of COVID-19*.⁸ While all Member States in the Western Pacific Region may benefit from this guidance, the principles and tools featured in the document are most appropriate for countries and areas pursuing a strategy of mitigation, as opposed to outright elimination or so-called zero-COVID approach. Governments committed to completely halting transmission may decide to implement their NPIs in a different manner, forgoing the stepwise recommendations in this guidance.

Moving forward, Member States should:

- 1) be prepared to tighten or relax NPIs depending on their epidemic trajectories;
- 2) establish the capacity to assess the risk of infection and health-care capacity at the subnational level, based on information from multiple sources, including trends in the movements of people detected with big data⁹ 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 related to the COVID-19 pandemic.

2. Goal and guiding principles

Goal

The proposed approach aims to support Member States in the Western Pacific Region in managing their policy response to COVID-19, specifically related to NPIs. The goals of strategically utilizing NPIs are to control infection, enable a sustainable response to the pandemic and avoid overburdening the health system.

⁵ Dighe A, Cattarino L, Cuomo-Dannenburg G, Skarp J, Imai N, Bhatia S et al. Response to COVID-19 in South Korea and implications for lifting stringent interventions. *BMC Med.* 2020 Oct;18:321.

⁶ SPI-M-O: Statement on population case detection. United Kingdom: Scientific Pandemic Influenza Group on Modelling, Operational sub-group; 2020 (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/926953/S0743_SPI-M-O_Statement_on_population_case_detection.pdf).

⁷ Considerations for implementing and adjusting public health and social measures in the context of COVID-19: interim guidance, 4 November 2020. Geneva: World Health Organization; 2020 (<https://apps.who.int/iris/handle/10665/336374>).

⁸ WHO Western Pacific regional action plan for the response to large-scale community outbreaks of COVID-19. Manila: WHO Regional Office for the Western Pacific; 2020 (<https://apps.who.int/iris/handle/10665/331944>).

⁹ Big data refers to the rapid collection of complex data in quantities that can require up to billion gigabytes of storage and is characterized by volume, variety, velocity and veracity.

Guiding principles

1. **Using the best available evidence and well-defined criteria to inform NPIs:** Member States should continuously collect and assess information from diverse sources to inform the design and implementation of NPIs. Member States can improve the transparency of the decision-making process by establishing criteria for evaluating NPIs. Predefined criteria on the efficacy and socioeconomic costs of NPIs will facilitate multisectoral deliberations of the measures and assist public health officials when the data and evidence on these dimensions are incomplete.
2. **A dedication to multisectoral decision-making:** The health sector should engage other key sectors (e.g. ministries responsible for finance, welfare, economy and justice, as well as 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 a health sector consideration) and negative socioeconomic impact (primarily factors outside the health sector).
3. **Establishing and supporting resilient communities:** Member States should encourage individuals and organizations to adopt resilience measures based on the principles of risk mitigation and harm reduction. These interventions should be implemented regardless of epidemiology and at least until transmission of COVID-19 has ended. Governments can support resilient communities by encouraging personal protective measures (e.g. masking, handwashing and physical distancing), staggered commuting and teleworking when possible, among other risk-reducing interventions.

Businesses and other organizations can bolster the resilience of communities by adopting risk mitigation measures, such as universal masking, improved ventilation and physical distancing. It is especially important for Member States to promote these interventions in high-risk venues and essential services and activities, such as basic infrastructure (e.g. utilities, energy and facility maintenance), religious and cultural activities, long-term care facilities, and childcare services. Essential workers are less likely to be affected by movement restrictions and more likely to be infected.^{10,11} This further elevates the need for resilience measures in essential sectors, since these workers may contribute to transmission outside their place of work or residence. If resilience measures cannot be fully implemented in high-risk settings (e.g. in migrant worker dormitories or long-term care facilities), Member States should consider prioritizing these individuals for vaccination.

A resilient private sector will reduce the risk of outbreaks in these settings and decrease the likelihood that NPIs such as reduced operating hours or closures will be necessary, thereby allowing business operations to continue. Governments can partner with industry associations to develop and implement risk mitigation guidelines to support sustainable operations.

¹⁰ Chen YH, Glymour M, Riley A, Balmes J, Duchowny K, Harrison R, et al. Excess mortality associated with the COVID-19 pandemic among Californians 18–65 years of age, by occupational sector and occupation: March through November 2020. *PLoS One* [Internet]. 2021;16(6 June):1–10. <http://dx.doi.org/10.1371/journal.pone.0252454>

¹¹ Mutambudzi M, Niedwiedz C, Macdonald EB, Leyland A, Mair F, Anderson J, et al. Occupation and risk of severe COVID-19: Prospective cohort study of 120 075 UK Biobank participants. *Occup Environ Med*. 2021;78(5):307–14.

4. **Pursuing sustainable public health responses throughout the Region:** The COVID-19 pandemic continues despite the rapid development of safe and effective vaccines due to limited global vaccine supply and inequitable distribution. Consequently, Member States must consider the sustainability of NPIs until sufficient population immunity is achieved. Stringent and sweeping restrictions are likely to become increasingly unsustainable over time, especially in countries with limited resources, social protection and health-care services. This iteration of the guidance introduces a two-track framework for NPI implementation that combines focused, prompt and stringent interventions with broad, stepwise NPIs to improve the sustainability and effectiveness of Member States’ responses to COVID-19.
5. **Protection of vulnerable populations¹²** with steps taken to minimize the risk of transmission and new outbreaks among those populations: Specific ways in which NPIs impact vulnerable populations should be considered and mitigated where possible,

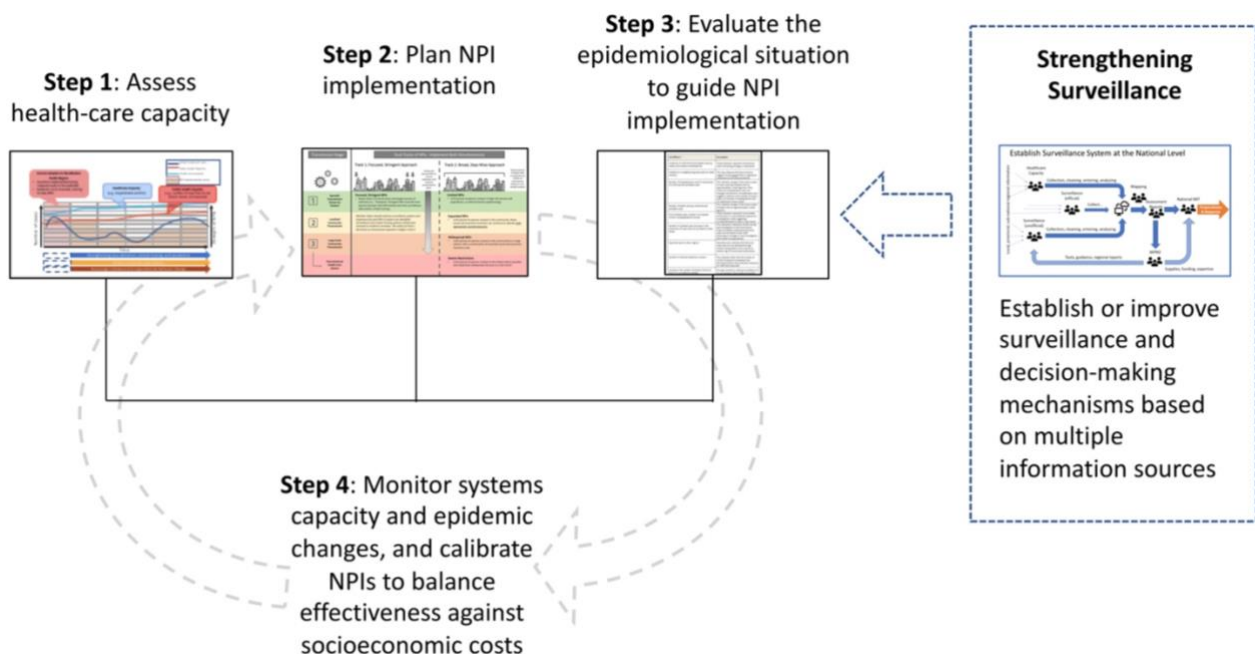
including loss of income, reduced access to health and other essential services, increased social isolation, and inability to self-isolate in crowded living conditions. Mechanisms to respond to potential increases in family violence and human rights abuses resulting from NPIs should also be developed.

This guideline proposes four steps for the implementation of NPIs at the subnational level (see Fig. 1). Member States should:

- 1) assess their current health-care capacity;
- 2) determine how NPIs will be implemented to match transmission dynamics;
- 3) evaluate the epidemiological situation to guide NPI implementation; and
- 4) monitor changes in the COVID-19 epidemic, systems capacity and NPI impact to calibrate NPIs and balance effectiveness against socioeconomic and other costs.

Additional tools and references for conducting the four-step approach are included in Annexes 1 and 2.

Fig. 1: Four steps for implementation



¹² Including older people, people with certain pre-existing conditions, people with disabilities, people experiencing homelessness, refugees, migrants and prisoners.

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

The COVID-19 pandemic must be managed so that health-care capacity is not overwhelmed (see Fig. 2). Countries should initially determine the capacity of health systems to absorb COVID-19 patients at the subnational level. 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 (e.g. hospital bed capacity), staff (e.g. health-care worker requirements) and supplies (e.g. ventilators and personal protective equipment) (**supply side**). Once key parameters are agreed upon, a process for determining and tracking the

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Based on this analysis, countries may design specific measures to increase capacity to treat COVID-19 and improve access to commodities. These proactive steps will increase a Member State’s “tolerance” for COVID-19 cases.

Countries should also ensure that there is sufficient health-care capacity set aside for non-

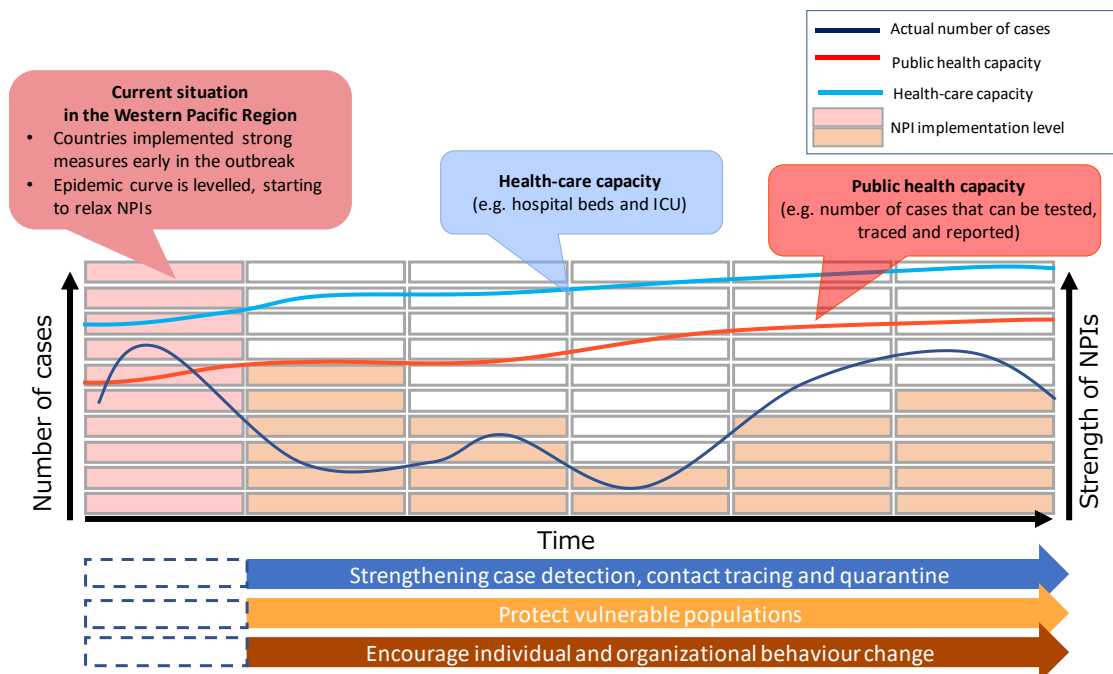
saturation rate can be designed, such as regular reporting of critical care bed occupancy rates.

Whether the current capacity is adequate can be compared against the projected need for acute and/or critical care based on the projected number of daily cases, the percentage of patients requiring acute and critical care, and the average duration of hospital stays (**demand side**). Public health officials should note that some indicators, such as hospital admissions and mortality, are lagging. There is a time lag between infection or symptom onset and hospitalization, intensive care unit (ICU) admission and death.

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.

Member States may utilize an Excel-based tool developed by WHO to support decision-making at the country level.¹⁶

Fig. 2: A proposed approach – overview



¹³ Faes C, Abrams S, Van Beckhoven D, Meyfroidt G, Vlieghe E, Hens N; Belgian Collaborative Group on COVID-19 Hospital Surveillance. Time between symptom onset, hospitalisation and recovery or death: statistical analysis of Belgian COVID-19 patients. *Int J Environ Res Public Health*. 2020 Oct 17;17(20):7560. doi: 10.3390/ijerph17207560.

¹⁶ Available at <https://www.euro.who.int/en/health-topics/Health-systems/pages/strengthening-the-health-system-response-to-covid-19/surge-planning-tools>

Step 2: Determine how NPIs will be implemented to match transmission dynamics

Member States must determine what NPIs to introduce and how to adjust them over time. These considerations will ultimately depend on the epidemic trajectory, the capacity of the health system, local culture and other considerations. To aid in decision-making, each subnational authority should establish assessment criteria for NPI implementation. Member States should also rigorously evaluate the effectiveness and impact of NPIs and measure compliance over time.

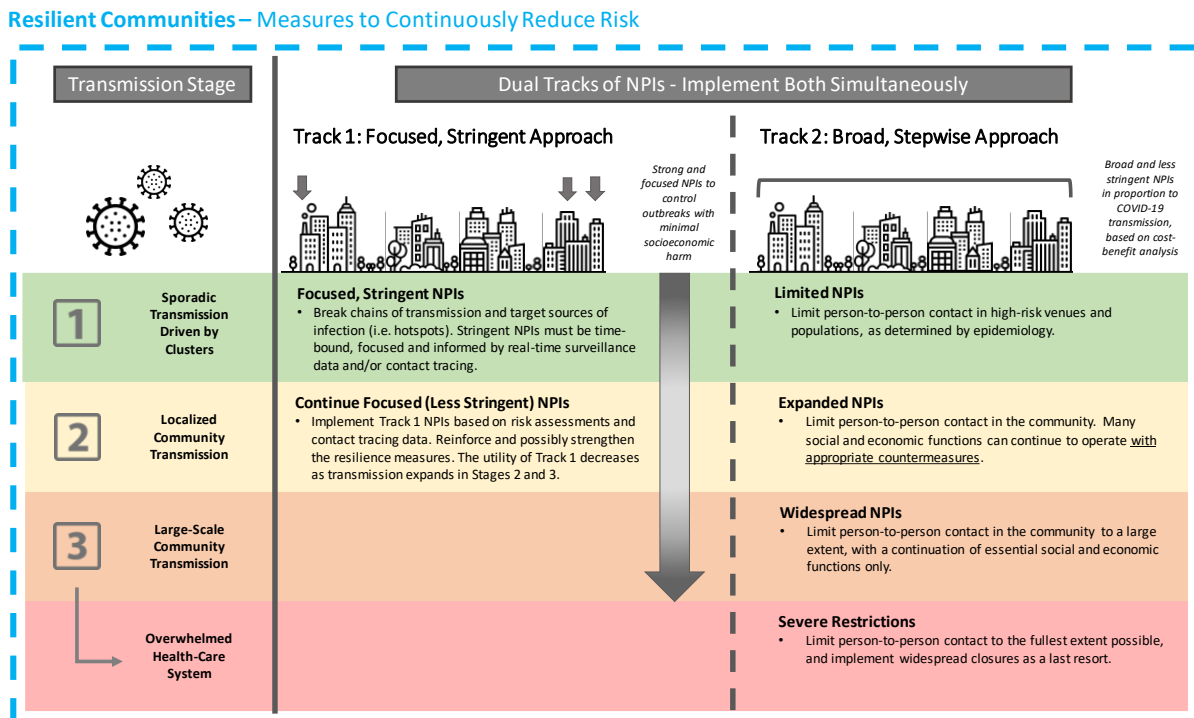
This guidance proposes a two-track approach for NPI implementation that corresponds with the stages of COVID-19 transmission (see Fig. 3). Member States should pursue both tracks simultaneously, as the two approaches complement one another. The resilience

measures should also be in place, regardless of the transmission stage, to further reduce risk.

Track 1: Focused and stringent approach to NPIs

As soon as infections are detected in a certain geographical area, Member States should introduce focused and stringent measures in the specific high-risk settings (i.e. hotspots or sources of infection) contributing to transmission (Fig. 3). These stringent NPIs, such as closures or significant limits on the operational capacity, may be warranted if their implementation is time-bound, informed by surveillance data (e.g. contact tracing, big data and population movement patterns), and focused on known clusters and/or chains of transmission. Member States may avoid large outbreaks if NPIs are implemented quickly and adequately address the locations and activities fuelling transmission.

Fig. 3: Dual tracks of NPI implementation to match the stage of transmission



*The resilience measures should be in place at all times, regardless of the level of COVID-19 transmission. To support resilient communities, individuals should adopt behaviours to reduce their risk, such as masking, handwashing, respiratory hygiene and physical distancing. High-risk venues (e.g. bars and indoor restaurants) should adopt risk mitigation measures, such as improved ventilation systems.

Focused and stringent NPIs are especially important in the early periods of an outbreak to address hotspots, prevent cluster formation and potentially reduce cases to a negligible amount in

¹⁸ Member States should continue to pursue Track 1 interventions during Stages 2 and 3 if the surveillance system detects outbreaks. Track 1 interventions during Stages 2 and 3 should: (a) reinforce the implementation of guidelines and measures consistent with resilient communities; (b) address residual risks identified through risk assessments by strengthening these risk mitigation measures based on the residual risks (e.g. reducing operational capacities from 50% to 25%); and (c) and mitigate future risks based on projections informed by past epidemiology and contact tracing data.

Track 1 interventions should be informed by real-time surveillance data. As a result, Member States should strengthen their capacity to collect, analyse and accurately respond to detailed information about COVID-19 infections at the subnational level. Contact tracing systems can inform which settings to address with focused NPIs. Retrospective or “backwards” contact tracing may be useful in identifying common sources of infection.

Member States can utilize big data, population movement patterns and links between social groups to predict future trends in areas within and beyond the initial source of infection. Governments may consider how the movement of certain groups, such as essential workers, contributes to transmission outside areas where Track 1 measures are introduced. Furthermore, Member States should anticipate how movement measures may influence behaviour outside the area of intervention. Individuals leaving and entering a community would increase population mixing and, consequently, the risk of infection.

It should be noted that Track 1 measures are not necessarily full closures or outright cancellations of all high-risk venues or activities. Member States can determine the specific NPIs that are consistent with the Track 1 strategy, although they should generally be stringent enough to

a given community or geographical area. While focused NPIs are likely to have the highest utility during periods of limited transmission (e.g. traceable clusters or imported cases),

suppress transmission and confer epidemiological benefits. A benefit of the focused, stringent approach to NPIs is that it minimizes large-scale disruptions to economic and social activities.

Track 2: Broad and stepwise approach to NPIs

In addition to focused and stringent NPIs, Member States should implement broader NPIs and adjust the measures in a stepwise manner depending on the epidemiological situation. NPIs in Track 2 should be less stringent because they are broader in scope and potentially more disruptive to a larger segment of society. Member States should conduct a rigorous cost–benefit analysis for each NPI in Track 2, given the potential for socioeconomic harms. These considerations become increasingly important once NPIs are expanded and strengthened in Stages 2 or 3 during periods of increased transmission.

In the cost–benefit analysis, Member States should evaluate: (a) the effectiveness of each NPI; (b) socioeconomic costs associated with the measure; and (c) the level of public awareness or acceptance of the policy. Consideration of the socioeconomic costs and public perception is important, especially when there is limited evidence on the efficacy of specific NPIs (e.g. school closures). Each of these criteria are elaborated in greater detail below:

1. **Effectiveness:** The health sector (e.g. the ministry of health) should review evidence (including literature and cluster investigation data) to estimate the relative effectiveness of each NPI. 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

¹⁸ As incidence increases and transmission expands into the greater community, promptly identifying outbreaks and hotspots becomes difficult. The surveillance system is likely to miss a higher proportion of cases. Furthermore, asymptomatic transmission increases the risk of ongoing unreported transmission.

from national expert groups may be sought.¹⁹ For a summary of available evidence, please see Annex 2.

2. **Socioeconomic costs:** The health sector should consider the negative impact of each NPI (see Fig. 4). Public health authorities should facilitate dialogue with other sectors (e.g. 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 **Tool #1-a: Assessment of economic costs** and **Tool #1-b: Assessment of social 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) and seek inputs from community representatives, political leaders and industry to understand public perceptions of different NPIs over time. The health sector should continuously monitor public opinion of NPIs and compliance (e.g. rates of mask usage, mobility in high-risk venues) to evaluate the extent to which communities are following countermeasures. Member States should prepare for lower compliance among the public as the pandemic stretches on and more people receive vaccinations. Higher rates of vaccinations may lead communities to believe that the risk of COVID-19 is diminished or gone before

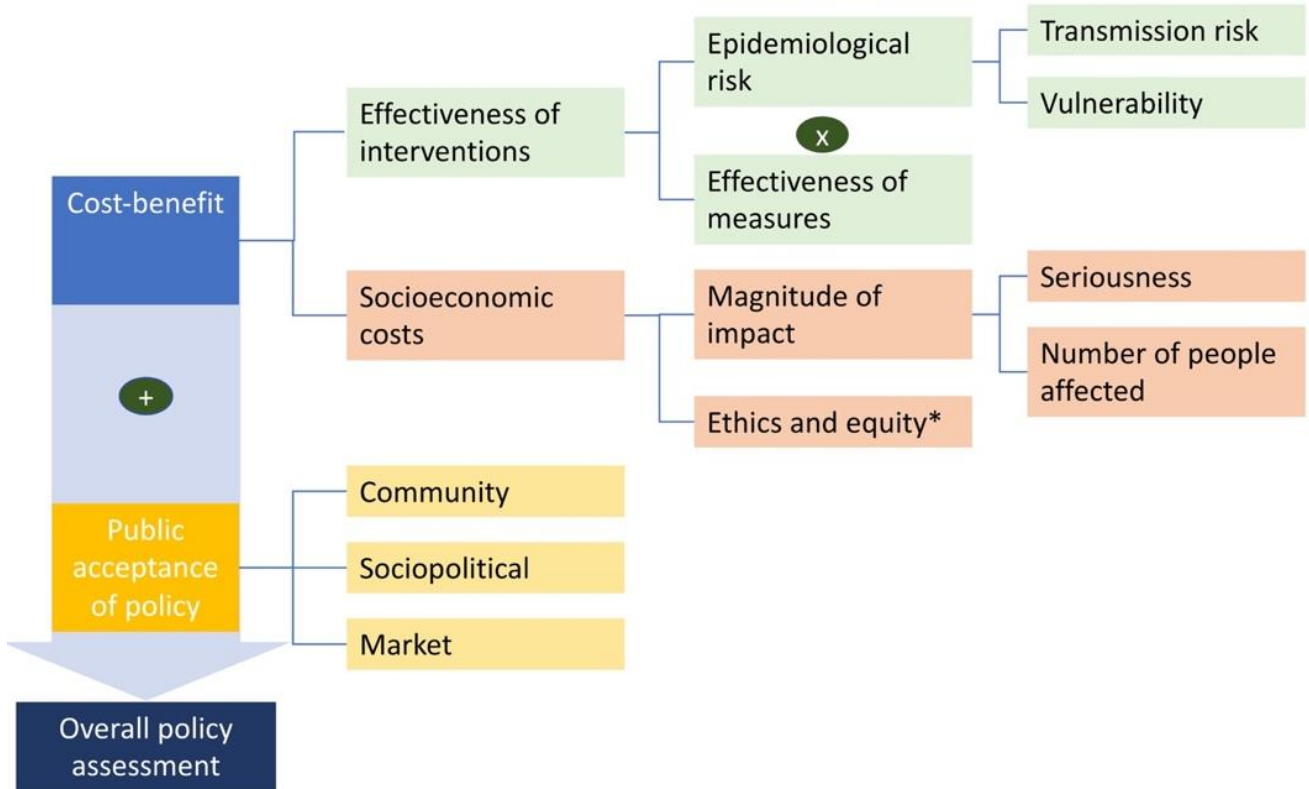
sufficient population immunity is reached and transmission is significantly diminished. A false sense of security could disincentivize compliance to NPIs. Member States should continue their close engagement with communities (especially vulnerable populations) to encourage behaviours that reduce the risk of COVID-19. Leaders should leverage strategic communications to share data on transmission dynamics and encourage cooperation with NPIs.

Officials should summarize the results of the cost–benefit assessment in a table and categorize the Track 2 interventions into four stages (see **Tool #2: Assessment and categorization of NPIs** in Table 1). These stages of NPIs align with the four stages of transmission and can be used to guide decision-making as Member States’ epidemic trajectories change over time.

Member States should periodically review their policy options, along with how they have categorized the Track 2 NPIs into the staging scheme. The way in which NPIs are designated may change over time if: (a) transmission dynamics shift due to the emergence of variants or increasing population immunity through vaccination, or (b) the criteria used to evaluate them also change (e.g. effectiveness, socioeconomic costs and/or public acceptance). Additionally, new or innovative NPIs may emerge that Member States may consider introducing to counter the spread of COVID-19. New policy options should be assessed based on the same criteria and integrated into the stages of Track 2.

¹⁹ 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.

Fig. 4: Elements of cost–benefit assessment for NPIs-



* Special attention is given to negative impacts on vulnerable populations (for example disadvantaged groups)

Table 1 – Tool #2: Assessment and categorization of NPIs for implementation of Track 2

STAGE	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p> Stage 1 – Limited NPIs</p> <p><i>Benefits substantially outweigh costs</i></p> </div> <div style="width: 45%;"> <p> Stage 2 – Expanded NPIs</p> <p> Stage 3 – Widespread NPIs</p> <p> → Severe Restrictions</p> <p><i>Beneficial, although at higher socioeconomic cost</i></p> </div> </div>					
	Category	Examples of NPIs	Effectiveness	Socioeconomic Cost	Public Acceptance	Overall Assessment*
Workplaces	Teleworking, if possible	✓✓	X	✓✓✓	Stage 1	
	Staggering work shifts to decrease contact	✓✓	XX	✓✓	Stage 2	
Schools	Classroom and activity cohorting to minimize exposure	✓	X	✓✓✓	Stage 1	
	Alterations to school days (hybrid learning arrangements, limit extracurricular activities)	✓	X	✓✓	Stage 2	
	Close schools and universities	✓✓	XXX	✓	Stage 3	
Public venues and events	Close businesses (except for essential services)	✓✓✓	XXXXX	✓	Stage 3	
	Prohibit mass gatherings and/or limit size of social gatherings	✓✓✓	XXX	✓✓	Stage 2	
	Close all venues based on the 3C principles, such as bars, sports clubs, entertainment, etc.	✓✓✓	XXXX	✓	Stage 3	
	Limit visitations to long-term care facilities	✓✓✓	X	✓✓	Stage 1	
Travel	Lockdown affected areas or communities (prohibit movement to/from and within)	✓✓✓	XXXXX	✓	Stage 3	
	Postpone travel outside the area for all nonessential travel	✓✓	XXX	✓✓	Stage 2	
	Restrict travel from and to affected countries	✓✓	XXXX	✓	Stage 3	

* Based on the simple calculation: number of ✓ minus number of X

Step 3: Evaluate the epidemiological situation to guide NPI implementation

Member States must assess the current epidemic situation (including trends) at the subnational level to inform NPI policy. Information to determine the current epidemiological situation and potential epidemic trajectories should be sourced from multiple types of surveillance systems, including:

- **Indicator-based surveillance** – Structured information on suspected and confirmed cases and death reports is collected through surveillance in the community, at the primary care level, hospitals, sentinel sites and laboratories, as well as dedicated surveillance for vulnerable or high-risk groups residing or working in closed settings. Information from surveillance for severe acute respiratory infection (SARI), influenza-like illness (ILI), respiratory syncytial virus, atypical pneumonia and unexplained fever may also be included. Daily zero reporting is crucial to verify that the surveillance is

²⁰Member States should expect cases of COVID-19 to fluctuate over time. Therefore, NPIs will need to be continuously adjusted. To decide whether to strengthen, maintain or relax NPIs, governments should note their health system capacity (Step 1) and the current epidemiological situation and projected trajectories. Decisions about what NPIs to implement (and in what order) will be guided by the previous assessment and categorization of NPIs (Step 2). Member States might also develop models to assess the impact of different NPIs on the reproductive number and inform decisions about the appropriate NPI options at any given time.

If cases are increasing or there are indications from multi-source surveillance that they are likely to increase, public health officials should first assess whether the current NPIs are functioning as intended. There are several factors that may decrease NPI effectiveness including low public acceptance, limited compliance by some or all populations groups, inadequate enforcement,

continuously functioning. Health-care-associated infections should be a priority for reporting within these systems.

- **Event-based surveillance** – Case, death and cluster/outbreak information captured through traditional 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 surveillance** – Information is collected on the risk of importation or outbreaks among vulnerable populations and on community engagement and readiness for changes in NPI implementation.

Many Member States use modelling to forecast trends in cases, hospitalizations and deaths. Further information for making decisions with multi-source information can be found in relevant WHO guidance on multiple surveillance.

poor implementation, and misdirected actions (e.g. misidentifying some areas as high risk or targeting the wrong clusters). If the policy evaluation reveals faults with the current NPIs, they should be altered and improved before additional measures are implemented. If the NPIs in place are working as intended, Member States should consider strengthening or expanding existing NPIs or introducing new measures consistent with the two-track approach outlined in Step 2 to ensure that the health system capacity is not overwhelmed.

If cases are decreasing or there are indications that the epidemiological situation is improving, public health officials should validate that the indicators are reflecting reality. Surveillance gaps (e.g. a decline in testing, reporting delays due to holidays) can occur and obscure the true epidemic trajectory. If the decline in cases is verified, Member States should begin to relax NPIs according to their staging scheme.

²⁰ Under development, available upon request.

When countries are planning to relax restrictions by gradually reopening businesses, they should start with businesses that contribute significantly to the economy, provide more employment to communities 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 #1-c: Risk of cluster formation and economic impact of NPIs by sector** in Annex 1).

Some Member States have developed detailed indicators to clarify when and how they will adjust NPIs over time. These benchmarks must be met before governments transition to a higher or lower stage of NPI implementation (consistent with Track 2 NPIs in Step 2). The indicators reflect both the saturation of the health system and whether the epidemic is on an upward or downward trajectory in order to allow for anticipatory strengthening or relaxation of measures.

Countries should communicate NPI decisions to the public using simple, clear and precise messages. For example, “Based on A, B and C, we will do X, Y and Z. We will reassess the measures after N number of weeks.” This communication strategy aims to provide accurate information while also encouraging behaviours that will 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 re-introduced, 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 4: Monitor systems capacity and epidemic changes, and calibrate NPIs to balance effectiveness against socioeconomic costs

Member States should continuously monitor changes in available and used health system

capacity, the impact of NPIs and the COVID-19 epidemic and use this information to periodically adjust NPIs by following the steps outlined above.²¹ 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.

Countries should establish and implement a monitoring and evaluation framework to assess if an expected target of coverage of NPIs has been achieved. A multi-source monitoring system should be in place to collect and analyse the status of the NPI coverage achieved.

- Engagement and compliance of people, communities and organizations/churches/businesses on NPIs. This includes systematic monitoring of mobility within communities.
- Public health and medical capacity, including emergency admission, hospital bed and ICU occupancy, and medical care worker and public health worker absenteeism.
- Specific, periodic surveys such as on people’s perceptions of, expectations for, participation in and challenges with NPIs.
- Event-based surveillance to supplement the information collected through systematic approaches for compliance with existing NPIs.
- Big data: where applicable, information on people’s mobility based on big data (e.g. mobile phone usage and location mapping).

²¹ Certain measures may no longer be needed when the situation changes (e.g. temperature screening at airports when international flights have been suspended).

3. Other considerations

- **Digital technologies** may be used for contact tracing, screening, triage and surveillance in order to: (a) monitor compliance with home quarantine; (b) conduct mass surveys and identify potential hotspots for COVID-19 transmission; (c) identify population movement patterns such as detecting mass gatherings; and (d) trace contacts (e.g. 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.
- **Ethical principles** should inform decision-making and guide the balancing of competing interests.²² 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.
- **Scaling up testing:** If a Member State has limited resources for testing, priority should be given to suspected cases with moderate to severe symptoms and those with the highest likelihood of infection (e.g. individuals with recent travel to hotspots and employees in high-risk settings, such as long-term care and medical facilities). Contact tracing and surveillance systems are dependent on testing; therefore, Member States should take steps to increase their capacity for testing and their ability to strategically utilize the results to reveal chains of transmission, identify common sources of infection, and inform NPI implementation, in particular Track 1 NPIs.
- **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. Additional measures may be taken to reduce case burden and risk of infection in health facilities by (a) setting up testing centres outside health facilities with proper physical distancing and ventilation (e.g. fever clinics in Singapore and drive-through testing locations in the Republic of Korea), and (b) providing home observation or isolation centres for asymptomatic and mild cases.
- **Legal considerations:** Member States may need to take legal steps 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.²³
- **Localized “lockdowns”:** Member States may consider localized or targeted lockdowns if the boundaries of infection can be clearly identified through contact tracing or other surveillance data. Localized lockdowns are more likely to be effective when implemented early. However, their implementation requires high operational capacity for contact tracing and effective enforcement in affected areas. Without clearly identified boundaries, a localized lockdown should be used as a last resort because, while they may be temporarily effective, they are not sustainable in the long term. Additionally, a localized lockdown may have undesirable indirect effects related to population movement

²² Guidance for managing ethical issues in infectious disease outbreaks. Geneva: World Health Organization; 2016 (<https://apps.who.int/iris/handle/10665/250580>).

²³ 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.

patterns. For example, a localized lockdown may create an outflow of people from the area instituting the restrictions. Once the lockdown is relaxed, infections may be reimported from outside the area. Member States should first consider alternative NPIs that are more sustainable.

- **High-importance events or activities:** Some events may be considered unavoidable for cultural, political, social, religious or economic reasons. If there is broad consensus that an event or activity should take place regardless of COVID-19 incidence, Member States should take a risk management approach. Government officials should ensure that the benefits of the event outweigh the risks and that appropriate countermeasures are in place to mitigate risk, such as capacity limits, physical distancing and universal masking. Furthermore, a system should be in place to promptly and effectively respond to cases originating from the high-priority events (e.g. contact tracing).
- **Vaccines:** WHO and many Member States have authorized several vaccines to prevent COVID-19. These vaccines have been shown to be safe and highly effective in rigorous clinical trials. Vaccination programmes are beginning or scaling up in most of the Western Pacific Region. Even so, the global supply of vaccines is currently limited, and NPIs will be needed to curb the spread of SARS-CoV-2, the virus that causes COVID-19, until sufficient immunity is reached in countries and areas. This guidance is still highly relevant, as Member States must remain vigilant against COVID-19 as vaccinations take place in the coming year – and likely into 2022. This document will be regularly reviewed and revised in light of emerging evidence on vaccines.

Annex 1: Tools

These tables provide examples of considerations for socioeconomic impact of each NPI. Member States 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 #1-a: Assessment of economic costs²⁴

Types of NPIs	Key interventions	Example of considerations	Possible mitigation measures (to be discussed in each country)	Economic impact
Personal protective measures	Hand hygiene	<ul style="list-style-type: none"> Generally low cost but potentially a financial burden for the poor to purchase soap, alcohol-based sanitizers, etc. 		Low
	Respiratory etiquette	<ul style="list-style-type: none"> Limited socioeconomic consequences 		Low
	Face masks	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Costs of cleaning public spaces, facilities on a regular basis 		Low
	Other environmental measures (e.g. using UV light, increasing ventilation and modifying humidity)	<ul style="list-style-type: none"> Significant cost, especially among smaller businesses, if enforced 		Low
Physical distancing measures	School measures and closures	<ul style="list-style-type: none"> 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

²⁴ 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.

	Workplace measures (e.g. encouraging teleworking, staggering shifts, and loosening policies for sick leave and paid leave) and closures	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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 service sectors such as hotels and restaurants 		High
Travel-related measures	Travel advisories	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Loss of income and missed business opportunities with some sectors more affected, such as aviation, tourism, hospitality and entertainment 		Medium–High

		<ul style="list-style-type: none"> • 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 		
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Tool #1-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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	School measures and closures	<ul style="list-style-type: none"> • Increased vulnerability of high-risk children and adolescents (abuse, malnutrition, violence); if family courts and social services 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 		<p>High if prolonged</p> <p>Medium if time-limited</p>

		<ul style="list-style-type: none"> • Possibly differential burden on women for home schooling in addition to other responsibilities at home and risks of increasing gender inequality • 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 into the labour market, particularly in hard-hit sectors 		
	<p>Workplace measures (e.g. encouraging teleworking from home, staggering shifts, and loosening policies for sick leave and paid leave) and closures</p>	<ul style="list-style-type: none"> • 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 		<p>High for poorer and vulnerable communities and women</p> <p>Medium for men and wealthier communities</p>
	<p>Avoiding crowding (including closure of businesses and cancellation of events and mass gatherings)</p>	<ul style="list-style-type: none"> • Significant impacts on poorer communities without access to television and online platforms to engage with faith-based, sports or leisure events • 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 • <i>Note:</i> No evidence exists that cancelling sports or leisure events leads to social and health impacts in the longer term 		<p>High for poorer communities impacted by the loss of work and/or unable to practise their faith online</p> <p>Medium for other communities</p>

Travel-related measures	Travel advisories	<ul style="list-style-type: none"> • Increased economic burden due to loss of work and income • Can be used as an educational tool for travellers 		Low
	Entry and exit screening	<ul style="list-style-type: none"> • Risk of stigmatization of individuals from affected countries 		Medium
	Internal travel restrictions	<ul style="list-style-type: none"> • Difficulties reaching work and gaining income due to the impact 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	<ul style="list-style-type: none"> • 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 #1-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 secondary 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 the 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 service 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.

Annex 2: Effectiveness of NPIs

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

Framework adapted from the 2020 WHO headquarters frameworks and 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	Available evidence
		Impact
Personal protective measures	Hand hygiene	<p><u>Good hand hygiene is one of the most effective measures to prevent COVID-19 transmission.</u> 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. A study in health-care settings showed that increased hand hygiene practices were associated with decreased hospital-associated infections during the COVID-19 pandemic.¹</p> <p><u>Frequent and correct hand hygiene aligning with health standards is one of the most important measures to prevent infection with SARS-CoV-2.</u>^{2,3} Diverse training modules through various channels of communication can be taken to maximize its effectiveness by increasing awareness of proper handwashing for both the public and health-care workers.² One study indicated that web-based health education for health-care workers increased the percentage of health-care workers who washed their hands more than five times a day, by 6.5% among women and 4.5% among men.⁴ <u>Furthermore, the use of face masks should be combined with good hand hygiene to prevent the spread of infection.</u>³</p> <p>WHO provides interim guidance entitled <i>Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19</i>³ and regional guidance for the Western Pacific entitled <i>Considerations for community hand hygiene practices in low-resource situations</i>.⁵</p>
	Respiratory etiquette	<p>Respiratory etiquette means covering the mouth and nose with a bent elbow or tissue when coughing or sneezing. The used tissue should be disposed of immediately in a bin with a lid.⁶ It also implies to avoid touching the eyes, nose and mouth, as hands touch many surfaces and can pick up viruses. Once contaminated, hands can transfer the virus to the eyes, nose or mouth, through which the virus can enter the body.⁷</p>

	<p>Although there is little research on the impact of respiratory etiquette on laboratory-confirmed influenza or SARS-CoV-2 infection, this feasible and acceptable intervention may reduce transmission and the impact of epidemics and pandemics.¹ Additional precautions to prevent transmission include avoiding touching the eyes, nose or mouth with unwashed hands, sneezing into one's sleeve or a disposable tissue, etc.³</p> <p>WHO continues to recommend that everyone perform hand hygiene frequently, follow respiratory etiquette recommendations, and regularly clean and disinfect surfaces.⁸ WHO recommends administrative measures to manage visitors in health-care facilities to educate caregiver visitors on hand hygiene, respiratory etiquette, physical distancing and other standard precautions,⁹ and standard precautions to post visual alerts at the entrance to health-care facilities instructing persons with respiratory symptoms to practise respiratory hygiene/cough etiquette.¹⁰</p>
Face masks	<p><u>The effectiveness of wearing masks may differ depending on the mask type, but even limited protection can contribute to preventing transmission of COVID-19 and saving lives.</u>¹¹ 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 A medical mask's initial filtration (at least 95% droplet filtration), breathability and fluid resistance are attributed to the type (e.g. spunbond or meltblown) and layers of manufactured non-woven materials (e.g. polypropylene, polyethylene or cellulose).¹² A non-medical mask has different initial filtration efficiency, initial pressure drop and filter quality depending on the material (polypropylene, cotton, cellulose, etc.), source (clothing, tissue paper, etc.) and structure (spunbond, woven, knit, etc.).¹²</p> <p><u>To maximize the effectiveness of wearing face masks, it is important to consider nationwide implementation and to promote appropriate masking behaviour.</u> A study showed that nationwide implementation with universal compliance is important to maximize the effectiveness of wearing face masks.¹³ The effectiveness may depend on appropriate wearing behaviour, such as covering both the nose and mouth instead of covering only the nose or the mouth or placing the mask on the chin.¹⁴ In addition, it is important to distinguish the front and back side of masks to maximize their functionality and effectiveness, if applicable, as each layer of medical masks consists of fine to very fine fibres.¹² A study on aerodynamics showed that even when a person wears a face mask equipped with the most effective filter and covers both the mouth and nose, if contaminated air flows through the loosened edges of the masks, there is little protective effect from droplets.¹⁵ The use of face masks by the general population should not replace other measures such as good hand hygiene.⁶</p>

		<p>WHO provides guidance entitled <i>Advice on the use of masks in the context of COVID-19</i>, which includes detailed information on filtration efficiency, pressure drop and filter quality factors of non-medical masks.¹² WHO also developed guidance entitled <i>Advice on the use of masks for children defined below of the age of 18 years</i>.¹²</p>
<p>Environmental measures</p>	<p>Cleaning and disinfection</p>	<p><u>Although the evidence base is scarce, environmental surfaces may have a significant role in transmission.</u> SARS-CoV-2 can remain viable on different surfaces at various pH levels and temperatures. One study showed that the virus remains viable on paper and tissue paper for 30 minutes, wood and cloth for 1 day, glass and banknotes for 2 days, stainless steel and plastic for 4 days, and the outer layer of a medical mask for 7 days.¹⁶ Another study showed that SARS-CoV-2 was more stable on plastic and stainless steel surfaces by remaining for 72 hours, compared to on copper surfaces for 4 hours and on cardboard for 24 hours.⁸ Also, the virus is very stable at a range of pH levels at room temperature, but is susceptible to heat and various disinfectants.¹⁶ However, it is important to note that these studies were conducted in the laboratory setting, and therefore there may be other factors in real-world settings such as the dynamics of human behaviours and mobility patterns.</p> <p><u>Disinfectants such as ethanol, chlorine-based products and hydrogen peroxide can be effective in reducing the viral titre of SARS-CoV-2 on environmental surfaces when they are used within their effective range of concentration.</u> However, there is little evidence on the appropriate frequency of disinfecting and sanitizing high-touch surfaces in relation to their effectiveness.¹⁷ A study showed that disinfectants on environmental surfaces can achieve a viral titre reduction of >3 log₁₀ with ethanol at 70–90%, chlorine-based products (e.g. hypochlorite) at 0.1% for general environmental disinfection or 0.5% for large spills of blood and body fluids, and hydrogen peroxide at >0.5% in health-care settings.^{18,19} Another study showed that 0.1% (1000 ppm) sodium hypochlorite (bleach) or alcohol at 70–90% concentration may be used to disinfect high-touch surfaces in non-health-care settings.²⁰</p> <p><u>It also may be important to prioritize high-risk areas such as gyms, restaurants, schools and public transportation in consideration of the potential risks.</u>¹⁹ The disinfection method should be carefully considered to avoid or minimize surface damages and potential toxic effects, and the preparation of disinfectant solutions should always be done in a well-ventilated area and with proper personal protective equipment.¹⁹</p> <p>WHO provides relevant guidelines entitled <i>Cleaning and disinfection of environmental surfaces in the context of COVID-19</i>,¹⁹ <i>Environmental cleaning and disinfection in non-health-care settings in the context of COVID-19</i>²¹ and <i>COVID-19 management in hotels and other entities of the accommodation sector</i>.²²</p>

	<p>Heating, ventilation and air conditioning (HVAC)</p>	<p>HVAC systems are used to maintain indoor air temperature and humidity by increasing the rate of air change and the use of outdoor air and reducing the recirculation of air.²³</p> <p>A study showed that <u>each air exchange in a hospital clears approximately 63% of viral influenza aerosols</u>, meaning that after five exchanges, less than 1% of particles remain (general hospital wards have about six exchanges per hour).²⁴ For quarantine facilities, ventilation of 60 litres per second per person is adequate for naturally ventilated areas or six air changes per hour for mechanically ventilated areas.²⁵</p> <p><u>The effectiveness of HVAC systems can be expected to be adequate with proper use of the system and regular inspection and maintenance, with awareness of asymptomatic cases and in combination with other NPIs.</u> To achieve HVAC system effectiveness, the ventilation and air conditioning system should be regularly inspected, maintained and cleaned.²³ A poorly maintained and operated air conditioning or ventilation system may contribute to virus transmission by recirculating contaminated air and/or enabling temperature and humidity conditions that allow for virus survival.²⁶</p> <p>Even in environments with ventilation, it is important to maintain other NPIs such as physical distancing, wearing masks and hand hygiene.²⁶ A modelling study measuring both physical distancing probability and ventilation effectiveness showed that physical distancing decreased the infection risk and the minimum ventilation rate.²⁷ The use of fans should be avoided when people who are not part of the immediate family are visiting the home, considering the possible presence of an asymptomatic case and the potential risk of transmission. If a table or pedestal fan must be used, opening outdoor windows and avoiding direct air blow from person to person (or group to group) are recommended.²³</p> <p>WHO provides relevant recommendations in <i>Q&A: Ventilation and air conditioning in public spaces and buildings and COVID-19</i>.²³</p>
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<p>Other environmental measures (e.g. UV light, modifying humidity)</p>	<p>Although few have been identified, some studies have presented evidence on the effectiveness of other environmental measures such as temperature, humidity and UV light.</p> <p><u>Two studies showed the effect of temperature and humidity on reducing the effective reproductive number and the number of daily new cases and deaths.</u> A modelling study suggested that higher temperature and humidity reduce the effective reproductive number (excluding other behaviour changes) of COVID-19 and have also been shown to decrease transmissibility of influenza and SARS.²⁸ Another study assessing the effect of temperature and humidity in 166 countries showed a negative relationship with daily new cases and deaths. It showed that per 1 °C increase in temperature, there were associated reductions in daily new cases of 3.08% (95% CI: 1.53%, 4.63%) and in daily new deaths of 1.19% (95% CI: 0.44%, 1.95%). Additionally, per 1% relative increase in humidity, there was a 0.85% (95% CI: 0.51%, 1.19%) reduction in daily new cases and a 0.51% (95% CI: 0.34%, 0.67%) reduction in daily new deaths.²⁹ However, this study may be limited by its observational study design and by other confounding factors.</p> <p>WHO provides so-called mythbusters and advice for the public on its website regarding transmission of COVID-19 in hot and humid climates.³⁰ As there is little evidence on the effect of climates on COVID-19 transmission, compliance with other NPIs such as hand hygiene and physical distancing would be a more feasible method of prevention.³⁰</p> <p>In terms of the effectiveness of UV light in the context of coronaviruses, <u>the use of ultraviolet germicidal irradiation (UVGI) as a supplemental air cleaning measure has limited evidence in preventing transmission of the virus in health-care facilities.</u>⁹ However, it is important to be aware of the potential adverse effects of direct UVGI exposure in humans, which include keratoconjunctivitis and dermatosis.⁹ UV lamps should not be used to disinfect hands or other areas of the human skin, as it can cause skin irritation and eye damage.³⁰</p>
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<p>Physical distancing measures</p>	<p>School measures and closures</p>	<p>Although the impacts of school closures in reducing transmission and the role of child transmission are not yet fully understood, some studies have reported that there have been few outbreaks involving children or schools.³¹</p> <p><u>Some evidence has shown that closing schools has little impact in reducing transmissibility and the number of new cases and deaths.</u> A simulation study in Ontario, Canada showed that school closures may have limited impact on reducing transmission in both the presymptomatic and symptomatic stages.³² Although limited data comparing COVID-19 to influenza are available, one study showed that school closures do not significantly reduce the transmissibility of SARS-CoV-2. At best, modelling studies have predicted that school closures alone would prevent 2–4% of deaths, substantially less than case isolation alone or a combination of other physical distancing measures.³³ Also, staff-to-staff transmission is more common compared to staff-to-student, student-to-staff and student-to-student transmission.^{34–36} Children under the age of 18 years represent around 8.5% of reported cases globally and relatively few deaths compared to other age groups.³¹ Most COVID-19 cases in children are mild, with rare cases of serious and critical illness.³¹ Although a pre-print modelling study from Australia suggested that school closures followed with 100% compliance delay increases in incidence and prevalence by approximately two weeks, they do not change the magnitude of cases, and the social costs of school closures need to be considered.³⁷</p> <p><u>However, some reports have argued that school closures were effective in curbing the epidemic by reducing incidence and mortality.</u> An observational population-wide study in the United States of America that was conducted for two months beginning in early March showed an association between school closures (primary and secondary schools) in all 50 states and reduction of COVID-19 incidence by 62% (adjusted relative change per week; 95% CI: -71%, -49%) and reduction of mortality by 58% (adjusted relative change per week; 95% CI: -68%, -46%). Further, closing schools when there is low cumulative incidence of COVID-19 was shown to be associated with the largest relative reduction in incidence and mortality.³⁸ One study in the United States of America identified that school closures and limits on gatherings were effective in reducing community mobility and thus decreased the risk of widespread transmission.³⁹</p> <p>A time series analysis using the Bayesian method in Japan showed that <u>school closures (from age 6 to 18 years) implemented from 1 March may have reduced or delayed the epidemic peak, but did not appear to be effective in reducing the incidence of COVID-19 infection.</u> However, this study highlighted the difficulties of generalizing results due to the heterogeneity of the dataset.⁴⁰</p>
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In terms of the impacts of school reopening on local transmission, there is little evidence showing the impacts on community outbreaks. A study in Jerusalem, Israel showed that a major outbreak of COVID-19 occurred around 10 days after reopening a high school after a two-month closure, with a total of 153 COVID-19 positive students (attack rate: 13.2%) and 25 staff (attack rate: 16.6%).⁴¹ However, there are limitations to drawing a definite conclusion from this study due to the potential effects of other NPIs, variations in testing and its accuracy between states, etc.

In terms of the effectiveness of school closure/opening/reopening, it is important to consider the long-term consequences of the intervention and spillover effects such as health-care worker absenteeism due to lack of childcare and outbreaks in other high-risk areas among children and adolescents. Over the long term, school closures may have educational and societal consequences not only for children but also for families and caregivers.⁴² A simulation study by the World Bank showed that students may face a reduction of US\$355, US\$872 and US\$1408 in yearly earnings for 3, 5 and 7 months of school closure, respectively.⁴³ Further, this study showed that shutting down a school for 5 months could generate a loss of approximately US\$10 trillion in life-cycle earnings.⁴³ A study in the United States of America showed that school closures appeared to reduce peak ICU and hospital demand, but there were trade-offs including increased absenteeism among health-care workers due to lack of childcare.⁴⁴ It is also important to consider any possible outbreaks in other youth-centric settings and high-risk settings while schools are closed.

WHO recommends that decisions on full or partial closure or reopening of schools should be made at the local administrative level and be based on local transmission rates of SARS-CoV-2 and local risk assessments, with consideration for potential increases in transmission among the wider community.⁴⁵ The WHO document *Q&A: Schools and COVID-19* lists prevention and control measures including age-appropriate mask use, physical distancing and hand hygiene practices.³¹

	<p>Workplace measures and closures</p>	<p>Some countries/enterprises have implemented diverse workforce policies such as allowing flexible working hours to avoid the rush hour on mass transit and reduce other commuting risks, remote working, separating the workforce into teams, stratifying workforces based on individual employees' necessity of on-site work and risk status, and delaying returns for individuals at high risk such as those who are of advanced age or have comorbidities.⁴⁶</p> <p>Few studies have identified the effectiveness of workplace closure. A transmission model based on data from Wuhan, China evaluated the effect of location-specific physical distancing on social mixing patterns. It found that <u>workplace closures changed contact patterns</u> between different age groups and geographic locations and, thus, delayed the epidemic peak and reduced the number of cases locally.⁴⁷ A staggered return to work beginning three months after closures reduced the median number of estimated mid-year infections by 92% (interquartile range [IQR] 66–97%).⁴⁷ However, there are limitations to drawing a definite conclusion about the effectiveness and risks of workplace closure due to <u>various factors</u> such as employee health status and age, workplace capacity, psychological and mental impacts on employees, and social factors for workers with children and increased family caregiving roles during the pandemic.⁴⁸</p> <p>Careful consideration of the effectiveness and risks of workplace closure must be taken. For example, mass workplace closure increases the unemployment rate. In particular, vulnerable populations such as workers in the informal economy as well as refugee and migrant workers are more likely to have less job security and more unstable sources of income.</p> <p>A combination of NPIs such as hand hygiene, physical distancing, and workstation cleaning and disinfection is important to prevent transmission of the virus. A study assessed the effectiveness of different NPIs and concluded that the combination of wearing masks and maintaining physical distancing in the workplace is critical.</p> <p>WHO provides guidelines for workplaces entitled <i>Considerations for public health and social measures in the workplace in the context of COVID-19</i>⁴⁵ and <i>Getting your workplace ready for COVID-19</i>.⁴⁹</p>
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	Mass gathering	<p><u>Bans on mass gatherings may be effective in reducing the number of new cases and controlling transmission from asymptomatic carriers.</u> A pre-print study showed that gathering bans were associated with a reduction in new cases by 34% (95% CrI 21–45%).⁵⁰ Another study showed that testing of individuals who attended mass gatherings was effective in limiting asymptomatic carrier transmission.⁵¹ Another pre-print study assessing the effectiveness of both public event cancellation and restrictions on gatherings showed that while restrictions on large groups (over 1000 people) were not effective, restrictions on small groups (less than 10 people) were effective in controlling SARS-CoV-2 transmission complicated by temporal clustering.⁵²</p> <p><u>Some studies have shown the difference in effectiveness of gathering bans by group size and the indirect impacts on other events.</u> A pre-print modelling study reported that the population attributable fraction was 2.2% (95% CI: 1.1%, 3.6%) in a large group (more than 50 people); 6.4% (95% CI: 5.0%, 8.0%) in a medium group (20–50 people); and 11.3% (95% CI: 9.9%, 13.0%) in a small group (10–19 people).⁵³ Careful considerations and tailored approaches may be required due to potential indirect impacts such as replacement of banned gatherings/activities with other activities.</p> <p>WHO guidance entitled <i>Key planning recommendations for mass gatherings in the context of COVID-19</i> provides risk assessment and evaluation recommendations in three phases (planning phase, operational phase, post-event phase).⁵⁴ In addition, WHO provides risk assessment tools for three event types (generic events, religious events, sporting events) for use by authorities and event organizers in planning mass gatherings during COVID-19.^{55–57}</p>
	Nationwide lockdown	<p><u>Some studies have shown that lockdowns may be effective in decreasing incidence and mortality.</u> One study showed that a lockdown was effective in reducing incidence and mortality rates after 7–17 days and 10 days, respectively. The required period for a lockdown to be effective was associated with the number of undiagnosed cases and transmission within households after lockdown.⁵⁸ Another study reported the effectiveness of lockdowns in restricting mobility using mobile phone data in the two Chinese provinces of Hubei and Guangdong.⁵⁸ The results showed that after the second lockdown, which was more stringent than the first, mobility restrictions were associated with a reduction in daily new SARS-CoV-2 positive cases, considering the lag time between asymptomatic infection and diagnosis of about 10 days.⁵⁹ Another study showed that countries that implemented lockdown policies saw a reduction in the number of new cases from about 10 days up to 20 days after implementation, compared to countries that did not.⁶⁰ A study using both quantitative (infected patient ratio, IPR) and qualitative (total risk assessment, TRA) historical data assessed the effectiveness of lockdowns in five countries (Italy, Spain, France, Germany and the United States of America) to forecast the number of cases until the plateau phase. When using the IPR tool, after 10 days of lockdown implementation, an immediate decrease was observed if the lockdown was effectively followed.⁶¹ However, the effectiveness of lockdowns in terms of the number of</p>

	<p>infected cases and deaths, and the period until a plateau was reached, varied depending on the level of stringency and adherence.⁶¹ A study using real-time data on cases of infection, recovery and death in India showed that the infection rate had decreased to around a third of the initial infection rate after six weeks of lockdown.⁶²</p> <p><u>Some studies present the effectiveness of lockdowns in reducing transmission and not overloading ICU capacity.</u> A modelling study in France estimated the reproductive number before and after lockdown to be 3.18 (95% CI: 3.09, 3.23) and 0.68 (95% CI: 0.66, 0.69), respectively, due in large part to the reduction of physical contacts outside households.⁶³ The study emphasized that it is important to gradually lift lockdowns to avoid overloading ICU capacity and the health-care system.⁶³</p> <p><u>In deciding whether to implement a lockdown, careful consideration must be given to the negative impacts on vulnerable populations</u> such as people experiencing homelessness, migrant workers and asylum seekers/refugees who most often live in overcrowded and low-resource settings and depend on daily labour for subsistence.⁶⁴ A lockdown may impose more mental health burdens on vulnerable populations⁶⁵ and other economic and social impacts.</p> <p>WHO does not recommend that a lockdown be the first choice of action when countries experience a resurgence of cases.⁶⁶ It is important to take a combination approach that includes surveillance, isolation of cases, testing and quarantine, and contact tracing to break the chain of transmission.⁶⁶</p>
Localized lockdown	<p>Some countries have implemented lockdowns at subnational levels, including community, provincial, municipality and state levels. A pre-print study discussed the effectiveness of three lockdown scenarios (no, partial and complete lockdown) in terms of the caseloads (positive cases and deaths) in four regions of Pakistan. The results showed that even after implementation of lockdowns, an increase in positive cases and deaths was observed, and the results at the national level showed an ineffectiveness of stringent measures.⁶¹ However, an international study showed that a one-week lockdown resulted in a decrease in the infection rate by 61% in the total cohort and 43% in Indian cohorts.⁶⁷ These results imply that careful considerations of lockdown strategies are needed based on demographic, social and economic factors.⁶¹</p> <p>A pre-print modelling study showed that localized lockdowns can control transmission while reducing the average amount of time spent under restrictions compared to a national lockdown. However, the effectiveness of a localized lockdown compared to a national lockdown is contingent on the amount of interaction between the local subpopulation under lockdown and the general population.⁶⁸ For a localized lockdown to be effective, the population movement into/from the area must be limited.</p>

		<p>A paper reviewing different long-term strategies to control COVID-19 noted several important requirements in managing a successful localized lockdown (referred to in the paper as zonal lockdown), including the ability to identify new outbreak clusters in real time. The paper concluded that, if implemented properly, localized lockdowns can reduce the spread of the virus. However, if the operational requirements cannot be met, the effectiveness of localized lockdowns will be decreased.⁶⁹</p> <p>Available observation and modelling studies show that localized lockdowns can reduce transmission in the limited geographical area during the lockdown period. However, these studies did not assess if these reductions are sustainable after relaxing the lockdown nor the “spillover” effect in reducing transmission in neighbouring municipalities.</p>
Travel-related measures	Travel advice	<p>Clinicians are urged to take detailed travel histories for suspected COVID-19 cases. Governments and organizations are also publishing regular advisories and keeping citizens updated on developments,⁸ 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.⁷ By 25 April 2020, more than 130 countries had introduced some form of travel restrictions including screening, quarantine and travel bans from high-risk areas, and around 90% of all commercial air traffic was grounded.⁷⁰</p> <p><u>Although there is little evidence measuring the effect of travel advice during influenza outbreaks, travel advice may have potential benefits in terms of informing the public when travelling and increasing awareness of travel risks in affected regions.</u> A study before the COVID-19 pandemic in Hong Kong SAR (China) assessed the perceived effectiveness of travel advisories of the Outbound Travel Alert or OTA system, which uses three symbolic colours (amber, red and black).⁷¹ The results showed that travel advisories were perceived to be more effective for tour operators and insurance companies in providing information regarding risk assessments of the travel destination and insurance compensation. Conversely, travel advisories were shown to be less effective for outbound travellers as they preferred other information sources such as the internet and social media. Therefore, this study concluded that the effectiveness of travel advisories is maximized when the information is of good quality, credible, timely and geographically specific and has wide coverage.</p> <p>Another study identified diverse forms of travel advisories in different countries such as travel warnings, travel alerts and travel advice. Regardless of the limited evidence available, it is important to maintain highly credible and transparent travel advisory information through open communication and data sharing.⁷¹</p>

		WHO provides guidance entitled <i>Public health considerations while resuming international travel</i> ⁷² and <i>Updated WHO recommendations for international traffic in relation to COVID-19 outbreak</i> . ⁷³
	Entry and exit screening	<p>Entry and exit screening measures include checking for signs and symptoms, interviewing for any respiratory infection symptoms and exposure to high-risk contacts, and completing a health declaration form.⁷²</p> <p>One simulation study estimated 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.⁷⁴ Another study also discussed the ineffectiveness of entry and exit screening measures during the H1N1 and SARS outbreaks in Australia, Canada and Singapore. However, this study highlighted the challenges in assessing the impacts and the importance of taking joint measures such as information management, case investigation, contact tracing and quarantine.⁷⁵ A 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.⁷⁶</p>
	Border control measures	<p>Border control measures involve restricting travel across and within national borders. Strict restrictions have been shown to be somewhat effective in preventing importation of cases and in delaying the onset of local transmission during the early phase of an epidemic. However, many studies have also emphasized the importance of combining such measures with detection and quarantine measures.</p> <p>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.⁷⁷ A meta-population modelling study assessed the probability of community transmission caused by imported and subsequent secondary cases. It showed that although strict border control measures and a shorter time from arrival to quarantine afforded an extra 32.5 to 44.0 days before local outbreak emergence under a low reproduction number ($R_0 = 1.4$), if the R_0 is higher (2.92), the same border control measures gained only 10 extra days of delay. This result suggests the importance of decreasing the incidence of COVID-19 in the regions of origin, coupled with other control measures in susceptible regions.⁷⁸</p> <p>Another study assessed the travel restrictions and border control measures implemented to limit the global spread of COVID-19. The results showed that travel restrictions reduced the daily rate of exportation from mainland China to other countries by 81.3% (95% CI: 80.5%, 82.1%). In other words, the reduced rate of exportation may delay the importation of cases into unaffected areas in the early stage of the epidemic. However, 64.3% (95% CI: 55.4%, 71.3%) of exported cases arrived during the asymptomatic incubation period, and such cases are especially difficult to be detected by airport screening. Therefore, researchers pointed out the importance of other measures such as</p>

contact tracing and quarantine to avoid community transmission.⁷⁹ In terms of travel restrictions within countries to control COVID-19 transmission, a pre-print study reported a high risk of large-scale outbreaks if no travel restrictions are implemented.⁸⁰

Despite the evidence that travel restrictions are important early during the epidemic and to prevent importation into countries with little to no local transmission, most countries have well-established local epidemics. In such countries, the evidence shows that travel restrictions have little impact.

In China, researchers assessed the combined effects of travel reductions to and from the mainland (40% and 90% overall traffic reduction, respectively) and a relative reduction of transmissibility ($r=0$, status quo; $r=0.75$, moderate reduction; $r=0.5$, strong reduction) in terms of epidemic incidence in mainland China and the number of exported cases to other countries. Wuhan travel bans introduced on 23 January 2020 delayed the overall epidemic progression for only around 3–5 days in mainland China and reduced imported cases by around 80% for one month. However, this modelling study also showed that even with 90% travel restrictions to and from mainland China the effect was modest, unless combined with a more than 50% reduction of transmissibility, as well as other public health interventions and behaviour changes. In other words, with 90% travel restrictions and the absence of transmissibility reduction, the maximum epidemic delay would be no more than two weeks.⁸¹

Other modelling estimates from China suggested that even a 50% reduction in inter-city mobility would have only had a negligible effect on epidemic dynamics.⁸² A Cochrane literature review stated that there is a lack of evidence based in real-life settings and that the certainty of the evidence is very low, although it also showed that some travel-related measures may have a positive impact on infectious disease outcomes.⁸³ A pre-print modelling study showed that, depending on the travel volume, imported cases accounted for <10% of total cases in 109–123 countries out of 142, and for <1% in 61–88 countries.⁸⁴ Another modelling study showed that a combination of detection and physical distancing is more likely to have a large impact than travel restrictions.⁸⁵

Border control measures additionally bring challenges in maintaining essential supplies, repatriating nationals and bringing technical support personnel in and out of countries. These measures alone may not be sufficient to prevent introduction of cases or help to prepare for response to local transmission and need to be implemented as part of a package of interventions such as quarantine and isolation, contact tracing and surveillance.

		WHO has released interim guidance to provide recommendations for managing ill persons at points of entry ⁸⁶ and measures to restrict movement within the context of local epidemiology. ⁸⁷ The Regional Office also has developed a document on considerations for relaxing border restrictions in the Western Pacific. ⁸⁸
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* 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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