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

Principles and facilitation tools

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Western Pacific Region

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 contract 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 data[9] 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.

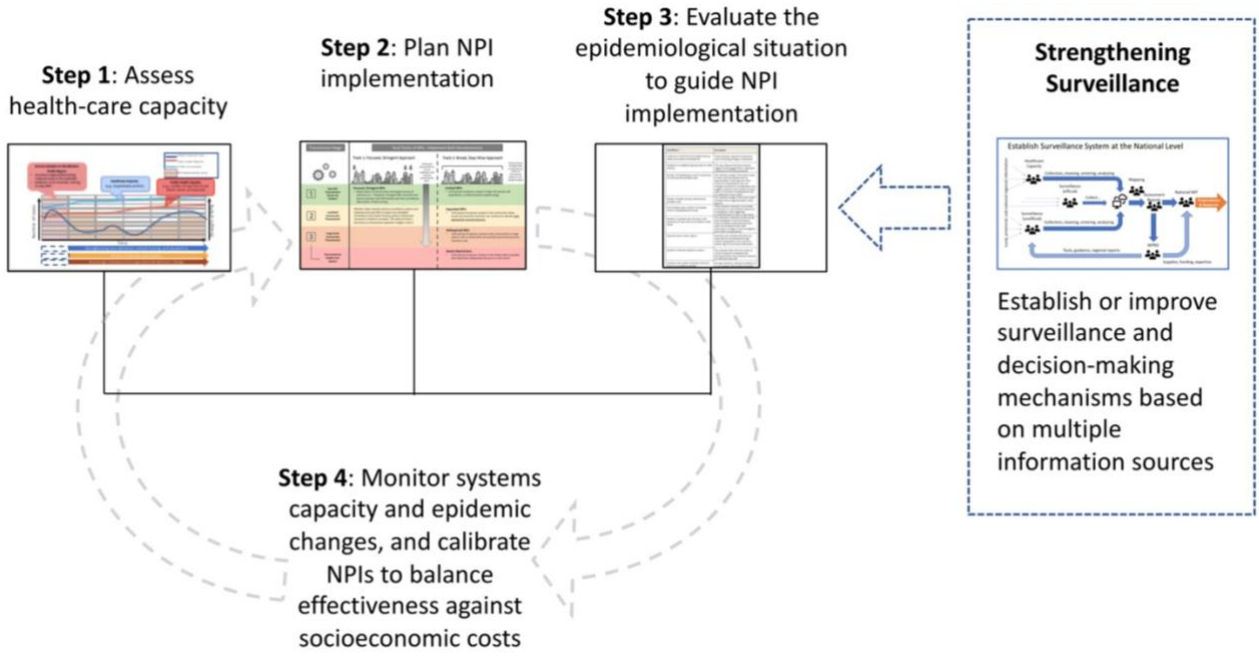
5. **Protection of vulnerable populations**[12] with steps taken to minimize the risk of transmission and new outbreaks among those populations: Specific ways in which NPIs impact vulnerable populations should be considered and mitigated where possible, including loss of income, reduced access to health 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 saturation rate can be designed, such as regular reporting of critical care bed occupancy rates.

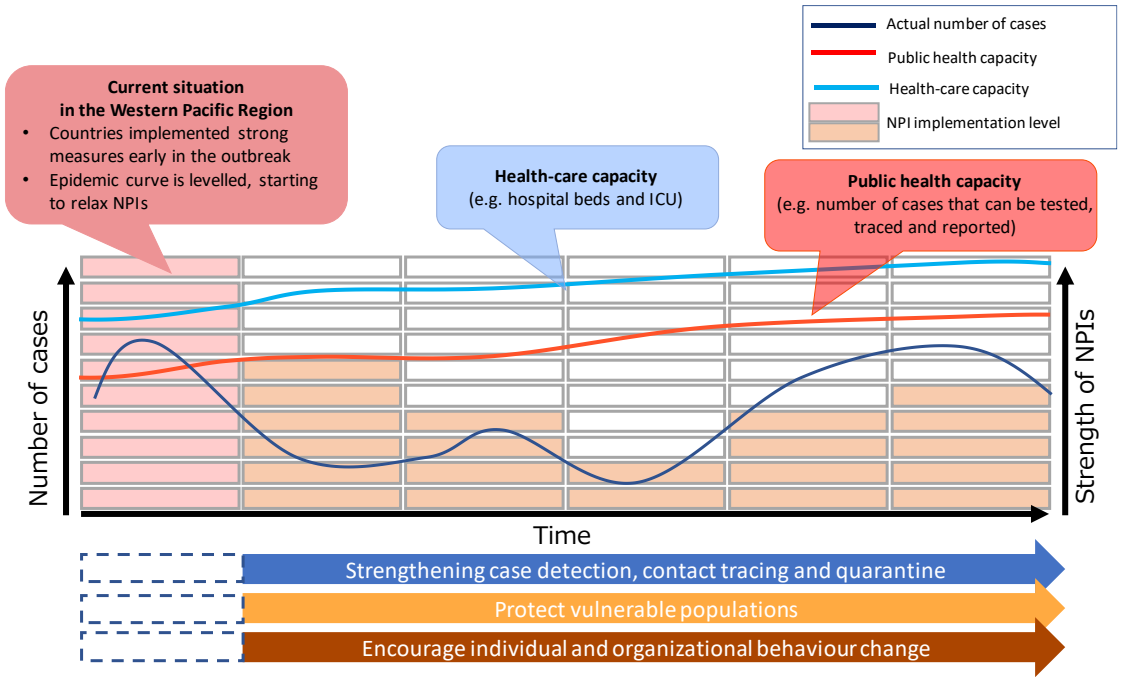
Whether the current capacity is adequate can be compared against the projected need for acute and/or critical care based on the projected number of daily cases, the percentage of patients requiring acute and critical care, and the average duration of hospital stays (**demand side**). Public health officials 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.[13]

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-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

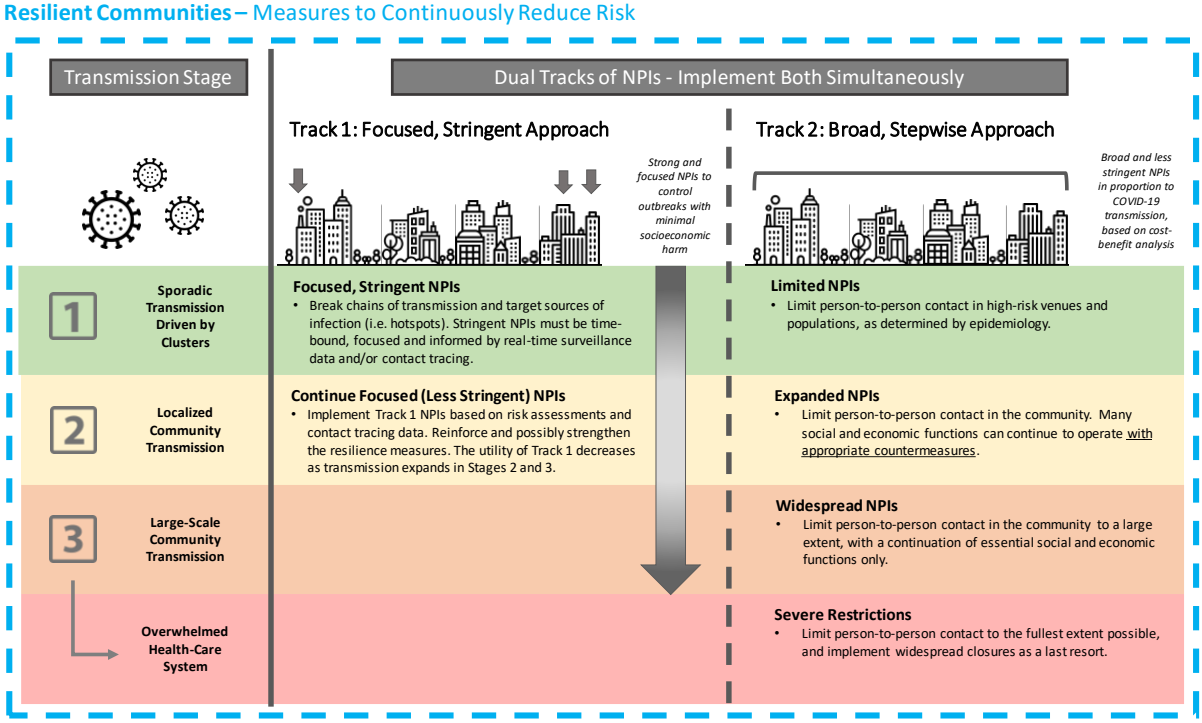
Member States must determine what NPIs to introduce and how to adjust them over time. These considerations will ultimately depend on the epidemic trajectory, the capacity of the health system, local culture and other considerations. To aid in decision-making, each subnational authority should establish 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 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] 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

[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.