

A practical guide to identifying, addressing and tracking inequities in immunization





European Region

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Abstract

Identifying and addressing immunization inequities is core to the success of immunization programmes and will require a collective effort from all parts of the immunization programme, working in partnership with governments and other areas of health. This document provides practical guidance for those working in immunization programmes to help advocate for immunization equity, embed equity as an aim in delivery of immunization programmes, and understand existing inequities by considering: who is left behind; why they were left behind; how we can intervene to resolve and avoid this; and whether our intervention has made a difference.

KEYWORDS

IMMUNIZATION
IMMUNIZATION PROGRAMS
SOCIOECONOMIC FACTORS
HEALTHCARE DISPARITIES

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Abbreviations

COM-B	Capability, opportunity and motivation for behaviour change [model]
DTP	diphtheria, tetanus and pertussis vaccine
EPI	expanded programme on immunization
FETP	field epidemiology training programme
HPV	human papillomavirus
MMR	measles, mumps and rubella vaccine
NIP	national immunization programme
SAGE	Strategic Advisory Group of Experts on Immunization
SDGs	Sustainable Development Goals
SIA	supplemental immunization activity
TIP	tailoring immunization programmes
VPD	vaccine-preventable disease

Glossary

Catch-up vaccination

Vaccinations given to unvaccinated/under-vaccinated individuals after the scheduled vaccination age.

Coverage

The proportion of a defined population which has received vaccination.

Immunization equity

Immunization inequities are the avoidable disparities in uptake which lead to population groups or individuals who shared common characteristics being at higher risk of remaining unvaccinated and vulnerable to vaccine-preventable infections. Immunization equity describes a state where these avoidable differences are eliminated as far as possible.

Immunization inequalities

Immunization inequalities are observed differences in vaccination uptake figures. Additional investigation work is required to discern the underlying reasons for these differences and whether they are avoidable immunization inequities.

Left behind

In the context of vaccine equity, “left behind” describes members of the population who remain unvaccinated, are vaccinated late or do not complete vaccine courses, due to avoidable reasons.

Life-course approach to vaccination

A concept where opportunity to access vaccination is not limited to a specific scheduled age, where appropriate vaccination programmes are available for different age-groups within the population, and the possibility to catch up on previously missed vaccinations is available over a wider age range.

Routine catch-up

Facilitated opportunities, embedded within routine delivery of immunization programmes, for individuals to access vaccination after the scheduled vaccination age.

Timely vaccination

Receipt of vaccination at the nationally recommended scheduled age.

Under-vaccinated

Individuals who have not completed a vaccination course. In this document “under-vaccinated” is used to refer to both “zero dose” individuals and those who have started, but not completed the recommended number of doses in a vaccination course.

Unvaccinated

“Zero dose” individuals; those who have not started vaccination courses.

Uptake

The proportion of a defined population which has received a vaccination by a point in time or over a period of time.

Vaccine hesitancy

A motivational state of being conflicted about, or opposed to, getting vaccinated; this includes intentions and willingness.

Why immunization equity matters

Immunization inequities are avoidable differences in accessing and accepting immunization programmes that lead to groups within the population, or individuals who share common characteristics, being left behind in immunization programmes. People can be left behind in different ways, such as remaining unvaccinated (“zero dose individuals”), not completing immunization courses, or not being immunized in a timely way.

Immunization inequities can exist even in programmes with high national immunization coverage and may not be apparent until they are looked for. Those who are subject to immunization inequities often experience other health inequities. High and equitable uptake will never be achieved by offering exactly the same service to all. Ensuring that vaccines are freely available to everyone is necessary, and is a good starting point, but in isolation is not sufficient to achieve equity within immunization programmes. Some individuals or groups will inevitably need tailoring of immunization services to achieve high levels of uptake. Resolving inequities in immunization will improve uptake and reduce the risk of future outbreaks and preventable cases in those who are often at higher risk of infections and severe outcomes.

Without addressing inequities in immunization programmes, the population will remain under-protected against the threat of vaccine-preventable diseases (VPDs). Outbreaks beginning in specific under-vaccinated groups will often spill over into the wider population. It should not be assumed that vaccine hesitancy is the reason for individuals or groups being left behind. This is often not the case. Some people face unintended barriers, affecting awareness, access and acceptance of immunization programmes. Identifying and understanding these barriers is key in reducing immunization inequities. Addressing immunization inequity requires all levels of the programme to understand and take action; from immunizers and providers on the ground, up to those developing policy at national level. Addressing immunization inequities may also involve adapting policy and procedures at national, regional or local levels and allocation of additional resources to support interventions.

Embedding equity into immunization programmes means developing processes to continuously identify **who** is left behind, understand **why** they were left behind, decide **how** to intervene to resolve or avoid this, and check **if** these interventions make a difference (and are sustainable). Addressing immunization inequity should not be seen as a one-off project. It should be a core component of policy, delivery and monitoring at the heart of immunization programmes.

Background

Immunization remains one of the most effective public health tools to prevent morbidity and mortality from communicable diseases. Inequities affect many health programmes, including immunization, often leading to lower uptake in specific groups or individuals sharing common characteristics. Equity of immunization access and coverage is a key strategic priority in the global and European immunization agendas for 2030 (1,2). Attaining high and equitable coverage in immunization will promote better population health by improving protection in often underserved groups, who may be at most risk of VPDs, and can also help address wider inequities in health. Childhood immunization efforts have contributed to progress on the Millennium Development Goals (3) and play a key role in achieving 14 of the 17 Sustainable Development Goals (SDGs) (4), particularly SDG 3 “Ensure healthy lives and promote well-being for all at all ages”. Immunization equity reflects the ethos of the SDGs in “leaving no one behind”.

Despite the success of routine childhood immunization programmes in reducing the incidence of VPD, immunization coverage varies among countries across the WHO European Region, and among different populations and districts within countries. There are also differences in coverage between the different scheduled vaccines. Consequently, many individuals and populations within the European Region are not benefitting from the full range of vaccination services available in their countries. Unvaccinated individuals are at higher risk of VPDs, and where there are higher numbers of unvaccinated individuals in populations or groups, there is a higher potential for outbreaks or the re-emergence of infections. Inequities in coverage of routine vaccines have contributed to accumulations of susceptible individuals in several countries of the Region (5,6) and hence to the continued occurrence and spread of VPDs such as measles, rubella (7), diphtheria and polio (8).

It is tempting for national programmes, policy-makers and the media to attribute decreasing or suboptimal vaccination coverage to concerns about vaccines and refusal to take up vaccination, but vaccine hesitancy is only one of numerous contributing factors. The reasons for inequitable vaccine coverage are multiple and complex. Wider health determinants, such as socioeconomic status, are often associated with vaccine coverage, while other factors can be related to the health-care system and access to it, education, family issues, and characteristics of the individual, society or environment, with many of these factors interacting in a complex causal network.

Careful consideration of a range of factors – such as place of residence, living conditions, age, economic status, ethnicity, migration status, education, disability, sexual orientation and gender – can help ensure equitable delivery of vaccine programmes. Offering the same service in the same way to all will not achieve high and equitable coverage. Preventing or reducing inequities in immunization coverage will inevitably require some specific tailoring of resources or service provision for underserved individuals or populations; some groups will require additional measures to achieve the same vaccine coverage as others. Reducing inequities will require programmes to identify and overcome or remove barriers to vaccination experienced by those for whom uptake is lowest. Groups who experience health-related inequities, may already be at higher risk of severe outcomes to infections that are preventable through immunization. Identifying, acknowledging, and understanding the barriers faced by groups with lower vaccination coverage is the first step towards improving vaccine equity and reducing the risk of disease at the individual and collective levels.

Introduction and how to use this guidance

Resources produced by WHO and Member States dealing with equity in immunization and related topics already exist (see Annex 1), providing detailed information on different aspects of immunization coverage and equity. This document builds on previous guidance, to provide pragmatic and concise operational advice on embedding equity in vaccination programmes, identifying underserved populations and understanding barriers to vaccination. It is only after identifying and understanding barriers to uptake and the related the issues that successful interventions addressing these inequalities can be adequately designed, implemented and evaluated. Across the WHO European Region, Member States and programmes will be at different stages of recognizing, considering and addressing issues of immunization equity; this guide provides inspiration and building blocks for those at various stages in the process.

This guide also makes the case for including immunization equity as a key measure of success in monitoring of immunization programmes. It is important that monitoring systems take an active approach, with provision of “information for action” as a core aim, drawing on principles of infectious disease surveillance. The issues that affect success of immunization programmes are numerous and complex and it is time to transform immunization monitoring beyond a single national or regional coverage figure.

This guidance is aimed at those with national, subnational, regional or local roles in vaccine programme planning and delivery, but will be of interest to all those involved in vaccine programmes or those advocating for immunization equity in underserved groups. The guide is accompanied by a slide set that can be used in or tailored for meetings and training.

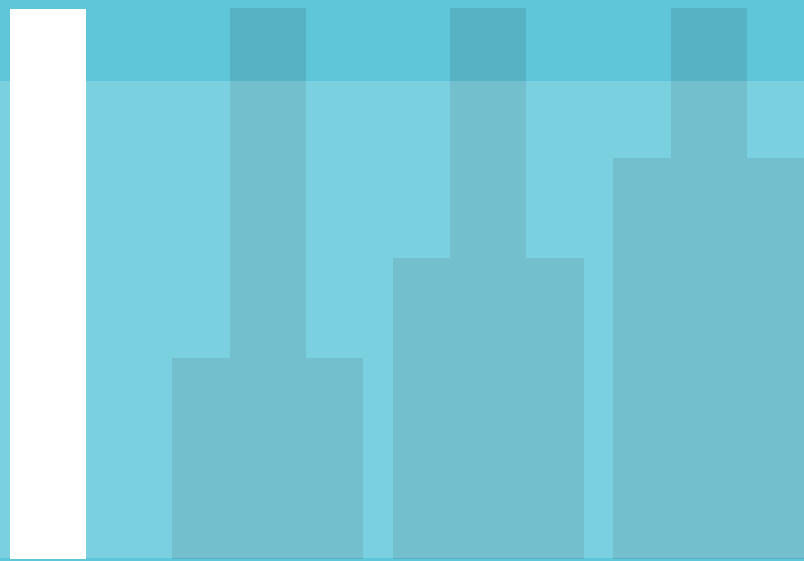
This guide comprises three main sections:

- 1. Immunization equity and its importance.** This is primarily aimed at improving understanding of immunization equity for decision-makers and policy-developers, and those managing programmes and services, who will need to advocate for equity, support it and make it a policy priority.
- 2. Embedding equity in delivery and monitoring of immunization programmes.** This is primarily for immunization programme managers at the national, subnational and local levels who are implementing an equity strategy. It contains examples of how immunization equity can be embedded into roles and responsibilities at different levels of the national programme.
- 3. Frameworks, examples and practical guidance.** This section contains a series of frameworks and concise examples of how to identify, address and monitor immunization inequities. This is the most technical section of the document and is aimed at programme managers and those on the ground who will need to or have already have taken the first steps to identify and address inequity within immunization programmes.

The guide aims to:

- improve understanding of immunization equity, and help those managing, overseeing or working within vaccination programmes to advocate for it;
- provide practical and pragmatic advice rather than theoretical recommendations;
- engage and be relevant for individuals at all levels from local health facilities up to the health ministry;
- build on existing guidance and give examples of how to operationalize it;
- offer a range of approaches considering the diversity in health systems across the Region, while acknowledging that countries are at different stages of identifying and addressing immunization inequities;
- encourage an intersectoral approach with other programmes, functions, organizations and agencies.

Section 1. Immunization equity and its importance



This section describes the importance of equity in immunization and why it needs to be addressed.

Take away messages

- Immunization equity should be a core aim at the heart of vaccination programmes across the Region.
- Immunization equity needs to be assessed and not assumed.
- Assessing and achieving immunization equity will involve collaborative working across programmes and with population groups.
- Immunization equity may be a new concept to some, but everyone involved in immunization programmes has a role to play in achieving it, which should be underpinned by awareness-raising.

What is immunization equity?

Immunization inequities are avoidable differences in immunization coverage, which disadvantage individuals and groups within the population leaving them at higher risk of preventable infection, in turn making the entire population at higher risk of outbreaks and VPDs.

The terms “vaccine/immunization inequities” and “vaccine/immunization inequalities” are often used in an interchangeable way. Immunization inequalities are differences in vaccine coverage between subgroups of a population that can be seen in coverage data. The term “immunization inequity” is more specific and refers to differences that are avoidable and unfairly affect groups or individuals with specific needs. Additional work to understand the root causes is needed to determine whether differences seen in coverage data represent avoidable and unfair inequities, and to inform strategies to reduce them (9). For the sake of simplicity, the term “immunization inequity” is used throughout this document, assuming that many of the differences in coverage between population groups are avoidable or unfair. While it is important to understand the nuance between these two terms, the distinction may not exist in all languages and it is important to clarify these concepts, regardless of the terms that are used, when introducing equity into immunization programmes.

Immunization inequities can be related to the capability of groups or individuals within a group to access vaccination services, the motivation to access vaccination, or the opportunity to access vaccination services. Immunization programmes reporting high levels of national coverage, where vaccines are widely available in health facilities may feel that equity is not an issue for them. Ensuring that vaccines are freely available to all through health services is important and necessary, but not sufficient in itself to achieve equity within immunization programmes. Immunization inequities can exist despite high vaccine coverage and may not be apparent without work specifically aimed at identifying them (Fig. 1). Failure to identify underserved groups may perpetuate and exacerbate inequity as those groups remain “invisible” to the health system.

Fig. 1. The difference between equality and equity



Consideration should be given as to whether aspects of immunization programmes inadvertently present barriers that disproportionately affect population groups or individuals with specific characteristics. Examples of issues to be considered may include: the physical distance and journey required for rural groups to attend vaccination appointments, the suitability of clinics for those with physical or mental health disabilities, the availability of resources in minority languages to combat misinformation, the impact of clinical opening times on single-parents in full-time employment, the suitability of clinics for families with multiple children, or the ability of those who are homeless or unregistered for health care to access vaccination services.

Why address immunization equity?

Immunization remains one of the most successful interventions to prevent mortality and morbidity from infections. It should be a fundamental priority that no individual or group should face unfair or avoidable barriers to benefiting from it.

Equity should be an integral consideration in the design, planning and delivery of immunization programmes. Understanding and addressing immunization equity issues within programmes provides a means to improve immunization coverage in Member States and achieve immunization goals, including those defined in WHO's *Immunization Agenda 2030 (1)* and the SDGs (e.g. goal 3.8: "achieve universal health coverage, including [...] access to safe, effective, quality and affordable [...] vaccines for all").

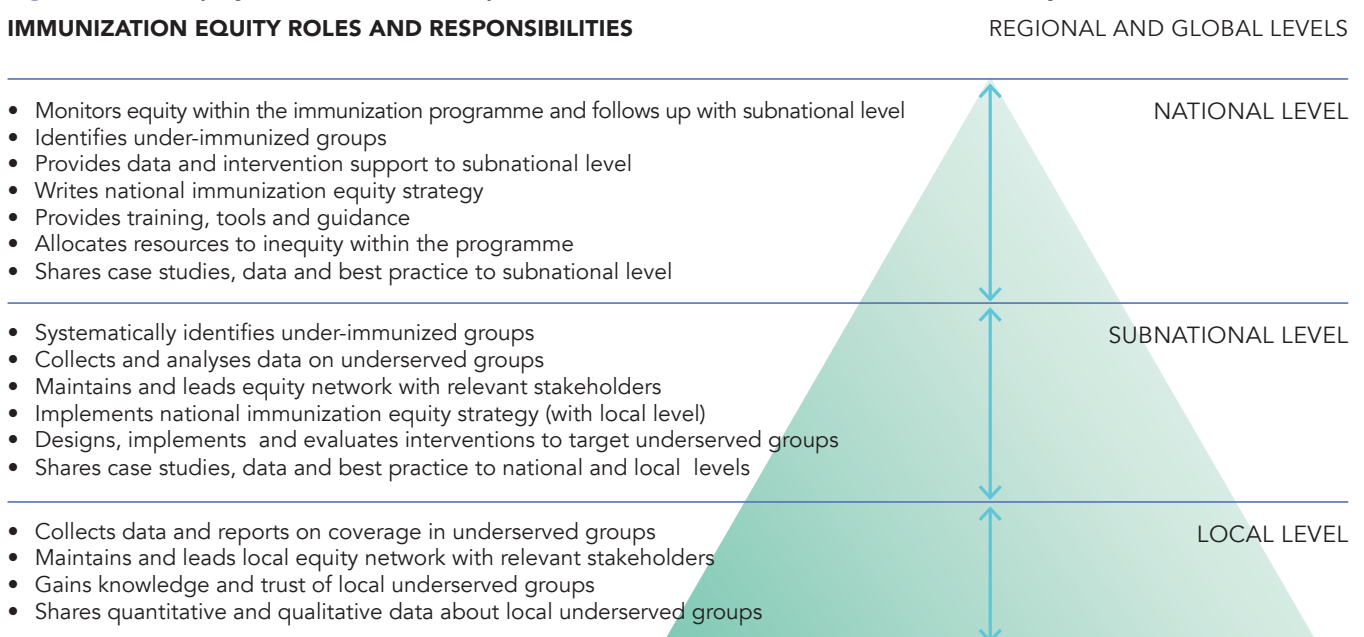
Many such goals have been endorsed by all Member States. Investigation and monitoring of immunization equity also provides a means for identifying populations or areas at higher risk of morbidity and mortality from VPDs.

Although tackling immunization inequity can involve additional resources and efforts, it will yield downstream improvements by preventing cases, complications, and outbreaks of VPDs and reducing the health-care burden at the entire population level, ultimately strengthening health-care systems. Subgroups of the population with lower vaccination coverage are at a higher risk of outbreaks or infections such as measles and polio, and may also be at higher risk of severe outcomes (10-13). Blanket approaches to improving vaccination coverage will yield diminishing incremental gains. Achieving high and equitable protection requires a robust routine vaccination programme which serves the majority well, combined with interventions and strategies specifically focusing on underserved populations. An inclusive approach, with equity as a key aim increases the chances of reaching and sustaining coverage targets, and achieving and maintaining elimination status for diseases such as polio, measles, rubella, human papillomavirus (HPV)-related cervical cancer and hepatitis B.

Who is responsible for addressing equity within immunization programmes?

Improving immunization coverage cannot always be achieved through an enforced, “top-down” approach. Avoiding or alleviating inequities should be a systematic and continuous part of planning, delivering and monitoring the immunization programme, and a core principle for everyone involved in vaccination programmes. At each stage of the immunization programme, from policy and planning to delivery and monitoring, there is the potential to unintentionally introduce or exacerbate barriers to vaccination coverage affecting specific population subgroups and individuals, or conversely to prevent, identify or address barriers and improve vaccination equity. Programme delivery and monitoring that does not embed equity will perpetuate and exacerbate immunization inequity. Fig. 2 outlines roles and responsibilities for vaccine equity at different levels of the health-care system. The exact functions at each level will be dependent on the resources and organization of the health-care system.

Fig. 2. Vaccine equity related roles and responsibilities at different levels of the health-care system.



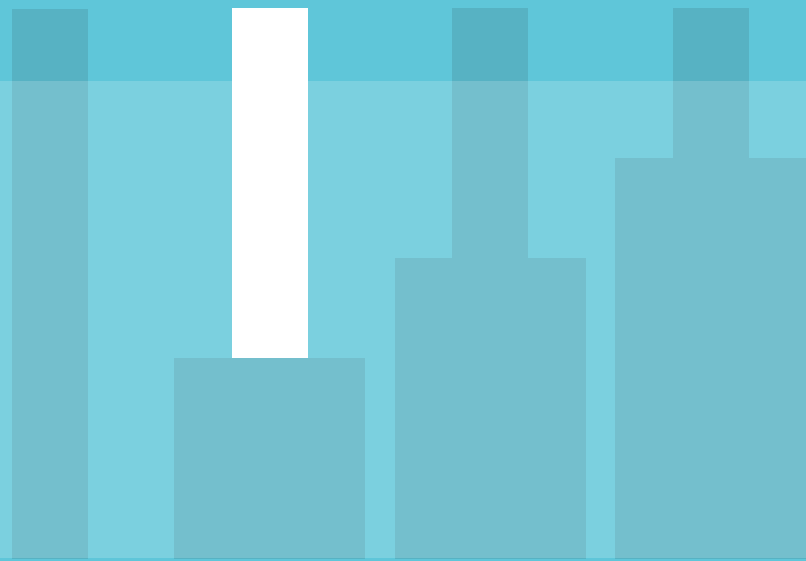
Source: Authors

Evaluation will be needed to consider whether systematic inequities exist, as will trialling of interventions to overcome or remove barriers. Where new vaccination programmes are being planned and rolled out, there is an opportunity to ensure that immunization equity is a fundamental consideration at each step. Prospective policy design presents an ideal opportunity to consider and limit the number of barriers that may otherwise prevent population groups from benefiting from immunization programmes.

Successfully addressing vaccine inequities may entail active collaboration across a range of services. For many Member States it may be appropriate to capitalize on opportunities for immunization status checks, advocacy and even immunization delivery or catch-up activities in more general health interventions, such as post-natal health visits, check-ups or registration at health-care facilities or schools. This will need a collaborative approach with other areas of health care, and social care or education (14).

For some aspects of inequities, working with underserved communities to co-produce interventions designed with them in mind can be an important and meaningful way to address inequity. As the challenges and issues faced by some under-vaccinated groups may also be applicable to other areas of health, there is an opportunity to learn from or collaborate with specialists in other fields to benefit underserved populations. In addition to those integrally involved in vaccine programme delivery, immunization programme managers may need to collaborate with those involved in other areas of health-care planning and delivery, academic partners, specialist or local public health teams, groups working with underserved populations, surveillance and outbreak managers, other stakeholders working closely with the immunization programmes and trainees in field epidemiology.

Section 2. Embedding equity in delivery and monitoring of immunization programmes



Take away messages

- It should not be assumed that immunization programmes achieve equitable uptake across the population. Inequities have been found even in highly performing programmes. → Immunization equity needs to be confirmed through effective data evaluation, monitoring and analysis.
- Vaccination managers at national and subnational level should acknowledge the potential for inequities to exist in their programmes and seek to develop appropriate methods to identify those at greatest risk of under-vaccination.
- Inequities in immunization uptake are often identified in groups also at higher risk from other aspects of health-related inequities.
- Identification of groups at higher risk of under-vaccination can highlight significant risks for future outbreaks of preventable infections, with potential to spread into wider populations. → Immunization inequity is everyone's problem and should be a core principle of immunization programmes, not an optional extra.
- Improving immunization coverage in underserved groups and reducing immunization inequity is a marker of success in immunization programmes.
- Identifying and tackling inequities in immunization uptake requires effective communication and collaboration between national and subnational levels. → Vaccine manager networks, which involve national and local teams are a good forum for discussing inequity issues and sharing good practice to reduce inequity gaps.
- Tackling inequities in immunization programmes requires effective collaboration between different health, public health, government and specialist functions. → Specialists or services already working with underserved groups may have a good understanding of barriers to health care and may provide insights on reasons for under-vaccination.

Immunization inequities are likely to occur in all immunization programmes; however, they are seldom proactively identified, not often addressed and rarely monitored in a systematic manner.

This section highlights considerations for those involved in planning and delivery of national or subnational immunization programmes, giving examples of how immunization equity can be embedded into the core of immunization programmes and how interventions may be operationalized. These examples are intended as a source of inspiration, with broad options, rather than being a prescriptive or comprehensive list. Immunization programmes across the European Region are at different stages of development in recognizing and addressing inequity; as a result, different parts of this section will be more, or less, relevant to different countries.

In order to begin to address vaccine inequity, it is vital that everyone working in vaccination programmes recognizes it as a component of their role and responsibilities (see Fig. 2). If left unchecked, the consequences of immunization inequities will continue to be problematic. Those working at national, subnational and local levels should consider whether their procedures and policies inadvertently introduce or perpetuate

barriers to vaccination that unfairly impact on individuals or population groups, especially those underserved. Additionally, they should aim to identify procedures and policies that will help individuals and populations who may be poorly served by the current programme to be vaccinated. Consideration of immunization equity is key for improving population health and resilience of health systems against preventable infections and outbreaks.

Those setting policy and managing programmes at a high level need to be familiar with the concept of immunization equity and acknowledge the potential for inequity to exist within their programmes. Although services may appear to be equally accessible to all, some individuals and groups will have additional needs, or may experience barriers that are not immediately evident to those responsible for the programme if equity, and equity-related data, are not embedded within the programmes. Some programmes may appear to be highly successful at face value, but immunization inequities will be masked by a single national or regional coverage figure. Additional analysis, using more granular data, is needed to detect such inequities, and additional investigation is necessary to understand the root causes. Inclusion of immunization equity at policy level, as a marker of success in a programme, will help focus attention on the issue. In recent years, there have been good examples of ministries and public health institutes publishing their expectations that vaccine programmes leave nobody behind, the core principle of vaccine equity. In its Phase 3 COVID-19 Vaccination Strategy for Autumn/Winter 2021, for example, the Welsh government prospectively included vaccine equity as a core component by specifying a “nobody left behind” approach. This strategy document made the commitment that all people in Wales should have fair access and opportunity to take up their offer of the vaccine, including under-served groups such as those from minority ethnic backgrounds, people with disabilities and people who live in economically disadvantaged households or are experiencing deprivation in other ways (15).

To help everyone involved in immunization programmes reflect on how their actions could help in identifying and addressing vaccine inequities, the concept of immunization inequity and awareness of key issues should be a core component of training provided to immunization programme workers. Effective communication between immunization programme workers and managers is also key in identifying inequities, proposing and evaluating interventions, and sharing good practices.

Aspects of national, regional and local roles which have an impact on vaccine equity

Equity, the fairness of society and social determinants of health are fundamental concepts in public health and should be key considerations of vaccine programmes. Even if it is not currently acknowledged as a priority, many aspects of national, regional and local roles in immunization programmes implicitly contribute to equity, or the ability to detect and monitor vaccination inequities.

Outside of immunization programmes, national functions dispensed by health ministries, public health institutes, national health services and government in general may all have roles in addressing equity more broadly, that can strengthen immunization programmes. The 2021 WHO guidance document *Why gender equity matters* (16), explains how societal gender inequity may impact on the effectiveness of immunization programmes beyond differential vaccine coverage according to gender. Taking an “intersectional” approach will be important in identifying and addressing some key equity issues, involving those from other areas of health and social care who have specialist

knowledge and regularly engage with underserved population groups or those in vulnerable situations. Immunization inequity may not be the only health inequity common to population groups with lower coverage, and failure to identify other needs could represent a missed opportunity to improve health and related outcomes. Immunization equity is a component of broader health and social equity within society. It is essential for leaders of immunization programmes to be aware of, and if possible, influence the equity agenda within their health ministry or government. There may be opportunities to translate broader equity policies to immunization and attract government funding and buy-in this way. In England (United Kingdom) for example, health equity was put firmly on the national policy agenda through a broad public health equity strategy (17), which could subsequently be applied to vaccination.

Practical steps for embedding equity into immunization policy and practice

The following list contains practical steps that can be taken at the national level to embed equity into immunization policy and practice. This guidance acknowledges that it may represent a large shift in practice and that not all recommendations may be implementable at once. The potential pace and scope for considering these recommendations will depend on the situation in each country, including available resources and the policy and political context.

Policy – routine vaccination programmes

- Acknowledge at the highest level that immunization inequity may exist in immunization programmes at national and subnational/regional level and that some groups may be unintentionally underserved by vaccination programmes. Review existing vaccination programme data to identify aspects of inequity which may be improved through policy change. However, recognize that many inequity issues will not be detectable through aggregated, high-level uptake statistics.
- Where new immunization programmes are being designed, prospectively develop national policy with a core objective of achieving high and equitable levels of uptake. Conduct risk assessments (or equality impact assessments) of new policies for the potential to create unintended inequities in immunization uptake (e.g. by recommending a service delivery model which is unfavourable for some groups) and routinely monitor equity, defining key equity indicators across core dimensions. Guidance on making equity a core commitment in general policies is available in the WHO document *How to equity proof your policies and interventions* (18). Policy-makers should also be aware of the potential role for immunization-specific policy in alleviating wider health and societal inequities.
- Ensure, where appropriate, that policy recommendations include in-built, evidence-based procedures to improve immunization coverage and equity, for example the use of universal call and recall for vaccination appointments.
- Recognize that good practices may already be in place at local or regional level, or with specialist services, to prevent or reduce inequity in service delivery and immunization uptake. Identify and share good practices, and work with specialist services and/or regional teams to ensure that relevant issues can be identified and included in policy development, with appropriate recommendations for delivery models (e.g. consideration of home/remote vaccinations where rurality or mobility may have an impact on coverage). This may involve developing intersectoral collaborations with other parts of health systems or other government functions to integrate services.
- Ensure, as far as possible, that vaccination programmes do not directly or indirectly discriminate against anyone and are inclusive of the needs of society's most vulnerable people. In some countries, legal frameworks protecting people from discrimination on the basis of, for example, ethnicity or gender, may provide a useful foundation for guiding

immunization equity policies. In the United Kingdom, for example, specific groups are protected by law (19). In other countries, it may be challenging, legally and politically to single out specific groups. Understanding and navigating the country's legal context can be key to sustainable equity within immunization programmes.

- Identify services and pathways that ensure that routine vaccination programmes are available to asylum seekers, displaced people and migrants. Where possible, include in this proactive checking of vaccination status and facilitate catch-up.

Policy – catch-up and national supplemental immunization activities (SIAs)

- Where possible, adopt a “leave no one behind” approach. Facilitate, through national policy, a continuing offer of catch-up vaccinations for those who have missed out on routine vaccinations. Approaches to leaving no one behind should aim to catch individuals up in a timely way. For children, vaccination status checks and offer of catch-up vaccines at regular child-health check-ups, health visitor appointments or at school entry are important. Inequity exists not only in initiating vaccine courses but also in completing them in a timely manner, or at all (12). Although there may be priority infections to prevent against, to achieve immunization equity “leaving no one behind” should extend to the complete vaccination schedule.
- Ensure that financial and operational processes are amenable to identifying the need for and delivering opportunistic catch-up beyond the scheduled vaccination age, in a setting appropriate for the population group.
- Where routine delivery and routine/opportunistic catch-up is insufficient to achieve high and equitable coverage, consider mass catch-up and supplemental immunization activities, as required. These additional activities present a good opportunity to consider which models of catch-up have the highest chance of improving coverage in under-vaccinated groups, for example taking vaccination sessions to community settings and co-delivery (20) when appropriate.

Resources

- Ensure the allocation of vaccines and associated resources are sufficient to achieve the objective of high and equitable coverage.
- Acknowledge that the same delivery model is not always suitable for everyone and that areas and population groups with particular coverage or equity issues may require additional help or resources, with support through national health policy as appropriate.
- Consider how best to bring people and functions together to discuss immunization equity and evaluate equity of immunization uptake. This may involve encouraging collaboration between public health institutes, academic institutions, health service providers and representatives of underserved communities, or may require additional investment in epidemiological functions. The WHO guidance document *How to equity proof your policies and interventions* (18) provides advice on engaging communities and participatory policy-making.

Monitoring, surveillance and research

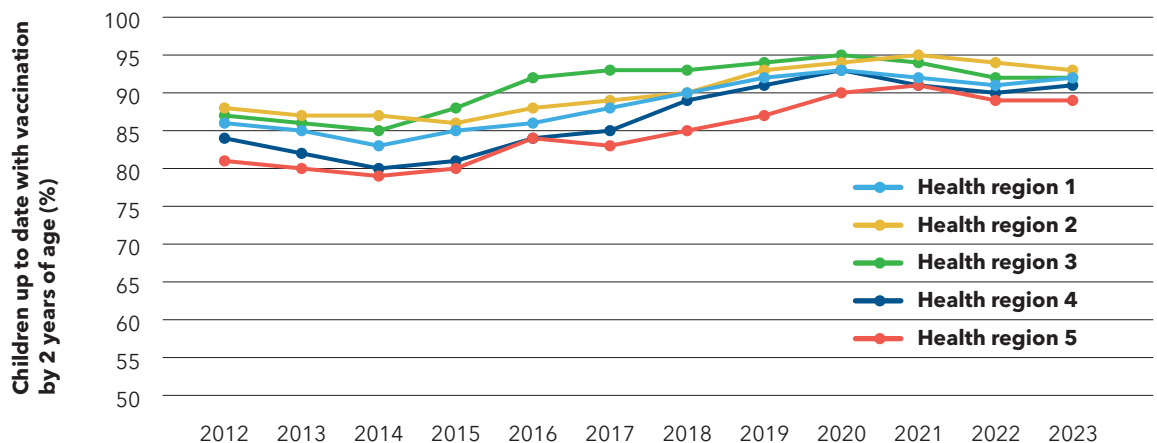
- Set in place robust immunization programme monitoring systems that include the ongoing and systematic monitoring of equity alongside coverage or build on existing monitoring systems to be able to describe vaccine coverage by key aspects of equity (e.g. variation by geographical region, health provider or clinic, demographic factors or characteristics of the individual).
- Recognize that passive “monitoring” of immunization programmes is unlikely to be enough in the context of identifying and tracking immunization inequities. There is a growing need to move beyond viewing vaccine statistics as a high-level “performance

metric” and develop an approach more in line with surveillance, where the aim is to provide key information for action. Be aware also that there are limitations to what high-level coverage data can tell you, taking into account the following issues: (i) inequities affecting individuals or groups may not be visible in population uptake statistics, (ii) coverage data alone cannot differentiate between inequality and inequity, and (iii) some groups may not be included in coverage data at all (e.g. those not registered with health services or recent migrants).

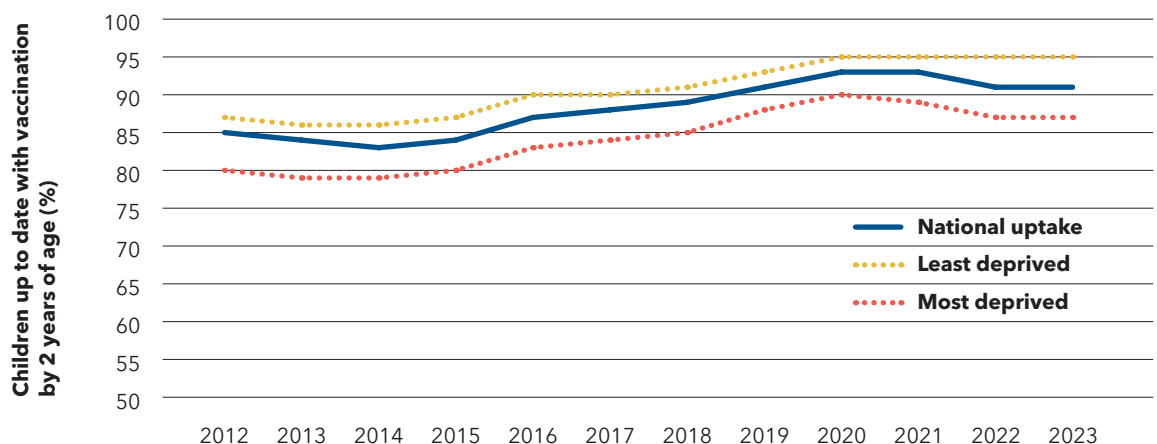
- Track trends in vaccination coverage at regional level and the gap between areas of highest and lowest coverage. This is a good way to start, but additional analysis will be required to monitor trends in more diffuse population groups (e.g. those with a physical disability) or to monitor aspects of inequity that are not defined by geography (e.g. socioeconomic status – Fig. 3)
- Utilize data from vaccine registers. These are a good source for coverage figures and are also capable of providing key information about immunization inequity and unvaccinated populations. Where population vaccine registers are in use, a regular process of data quality assurance is required to guard against denominator inflation (i.e. records remaining in the database for those who are no longer resident in the area/region/country), especially where frequent migration is likely. Vaccine registers also

Fig. 3. Examples of routine monitoring of coverage trends according to health region of residence (a) and level of socioeconomic deprivation (b), country X 2012–2023

3a: Proportions of children up to date with routine vaccinations by 2 years of age, comparison of those living in different health regions



3b: Proportions of children up-to-date with routine vaccinations by 2 years of age, comparison of those living in the most deprived and least deprived fifths of areas



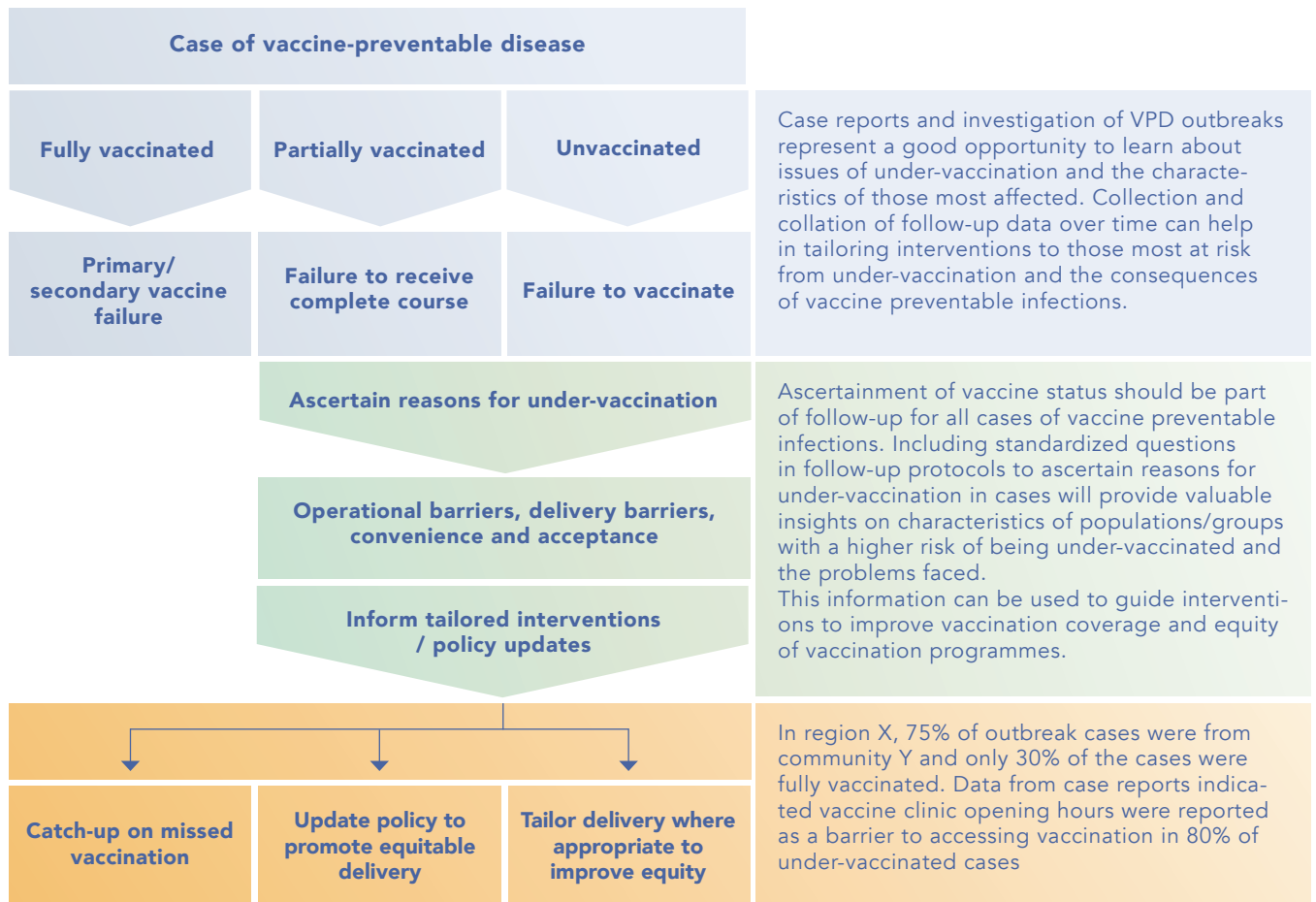
provide an opportunity to link to other datasets, at individual or aggregated level (e.g. at neighbourhood, health centre or municipality level), in order to add information relating to inequities (e.g. the deprivation status of a neighbourhood, or a measure of comparative rurality, or individual-level characteristics such as gender, ethnicity or belonging to specific marginalized or underserved groups). Where it is acceptable and appropriate to do so, recording of additional personal characteristics within vaccine registers will help with identifying and monitoring inequities; for some vaccine programmes having this information available to vaccine teams will help in vaccine delivery.

- Ensure that immunization uptake monitoring or surveillance is aligned to the aims of the immunization programme, and risk assess vaccine programme monitoring or surveillance systems for potential to exclude under-vaccinated, marginalized or underserved populations, who may be less likely to engage with health services or who are less likely to register for health care. Without this, groups may be “hidden” to vaccine statistics and reported coverage may provide false reassurance; this may be especially true for those seldom engaging with routine health care and families who migrate frequently. Tools such as equity impact assessments can help with this. A 2021 health equity audit of immunization programmes in England (21) provides examples of some of the issues faced, but inclusivity of routine vaccination data will vary from country to country and even from situation to situation.
- Use disease surveillance data from cases, and incident and outbreak reports to assess which groups are being affected by VPD (see Fig. 4).
- Where possible, collect and collate granular data (including by small area, gender and other demographics) on vaccine status and reasons for under-vaccination as routine in follow-up of cases and/or outbreaks of VPD. This information is a very useful point of triangulation and can guide urgent interventions to improve coverage in under-vaccinated groups (see Fig. 4).
- Encourage and facilitate collaboration of specialists in government ministries, health services, social care and academia to identify and utilize relevant data on vaccine equity. Specialists working in different areas may already have in-depth knowledge of challenges faced by underserved population groups in accessing health care that would be directly relevant to immunization programmes. Specialists working in other areas may also have knowledge of datasets that could be linked to routine immunization data to help identify and monitor inequity in coverage. Inequalities in vaccination by age and different population groups can be sought through routine monitoring of differences in age-specific vaccination between population groups as illustrated by Gorelik et al (22). Ensure that there are mechanisms for findings – from vaccination monitoring, surveillance and research – to inform policy discussions; invite input from specialists to aid interpretation.
- Ensure that initiatives to reduce inequity within the programme are documented and shared between subnational areas and with the national level; failing to do so means missing opportunities to use the best available evidence and risks wasting resources by “reinventing the wheel”.
- At the local and regional level, monitor coverage at provider level to gain insights into systematic inequities by area or operational delivery model (e.g. identifying outliers in distributions of coverage data at health centre level, general practitioner level or school level).
- Remember that although monitoring and surveillance data can provide a means for highlighting/tracking inequity in coverage, it will not identify all the issues and cannot give all the answers:
 - There will be parts of the population who may be hidden to monitoring data, for example families who move residence more frequently and individuals who

are less likely to be registered with health services (including people who are homeless, or populations groups who have been stigmatized).

- There will be aspects of equity which routine monitoring might not report on, for example not all monitoring systems will capture robust information on ethnicity or physical vulnerability.
- In these situations, triangulation of data sources, including soft intelligence from local teams and specialists, may yield meaningful information (see Section 3, step 1).

Fig. 4. Schema for utilization of case data to inform risks for being under-vaccinated and potential for future preventable outbreaks



Source: Authors

Data and systems

- Encourage and support the collection, management, analysis and use of robust and inclusive vaccine data (e.g. data disaggregated by gender, race/ethnicity and other important variables), including electronic vaccine registers at local, regional or national level where possible.
- Encourage and facilitate the development and use of digital systems for collection and management of immunization records. This will help facilitate more efficient, robust and timely monitoring and may also enable use of invitations and reminders for immunization appointments.
- Encourage the use of universal call and recall systems to invite individuals to receive vaccination. Where appropriate ensure that invitations are accessible to those with minority language needs or sensory impairment.

Training and resources

- Ensure that national vaccination training standards include guidance on vaccine equity issues and key concerns or challenges faced by different groups.
- Ensure that vaccinators are trained to consider underlying issues of under-vaccination and are confident to respond to questions from hesitant individuals. Consider providing additional training in the use of motivational interviewing or behavioural change theory to help vaccinators address concerns (23).
- Ensure that resources to improve awareness of vaccination eligibility and importance are accessible, including provision of additional materials for those with specific language, literacy or sensory needs, as appropriate.
- Ensure that subnational teams receive adequate training to identify and address inequity, and to think about how their roles may contribute to it. This guidance and the documents referred to in Annex 1 provide a good starting point.
- Ensure that training is provided for those working within the immunization programme to identify and address immunization inequity. This can capitalize on existing training materials from WHO, such as the training resources accompanying this document and resources available on tailoring immunization programmes (TIP) (24).

Research

- Where information is not already available, consider commissioning research (or developing research collaborations) to identify immunization inequity and explore underlying root causes.
- Set up working groups with appropriate partners (e.g. epidemiology programmes, subnational regions, academia and advocacy groups) to identify and discuss factors influencing equity of coverage; discuss strategies for co-production of interventions and what kinds of targeted resources may help.

Communication and support networks

- At the national level, identify existing health equity networks and stakeholders; if there are any in place, it may be more efficient to embed immunization equity into existing broader equity policies.
- Develop immunization networks at national or regional level, with regular touchpoints, such as meetings or teleconferences, between national and subnational immunization managers. These networks can provide a useful forum to discuss developments and issues for immunization programmes, including “top-down” strategic priorities and “bottom-up” support needed. Immunization network meetings also provide a key opportunity for managers and programme workers to discuss common issues faced by underserved groups, share good or innovative practices between regions, and encourage peer-to-peer advice and support between immunization managers.
- Develop effective communications between local, regional and national levels, to facilitate discussion of vaccine equity issues.
- Establish robust mechanisms for the provision of monitoring/surveillance data from local to national levels and provision of feedback. Consider mandating data provision where appropriate to do so. Ensure that feedback and interpretations from immunization monitoring and surveillance, including vaccine inequities, are available to and discussed by those setting strategic directions and policy.
- Consider setting up multidisciplinary expert meetings, including specialist services for underserved populations/advocacy groups, to discuss findings/intelligence from monitoring and surveillance or feedback from vaccine manager networks.

Section 3. Frameworks, examples and practical guidance



This section describes a range of conceptual frameworks and “how-to” guides for embedding consideration of vaccine equity into national vaccination programmes.

Where to begin?

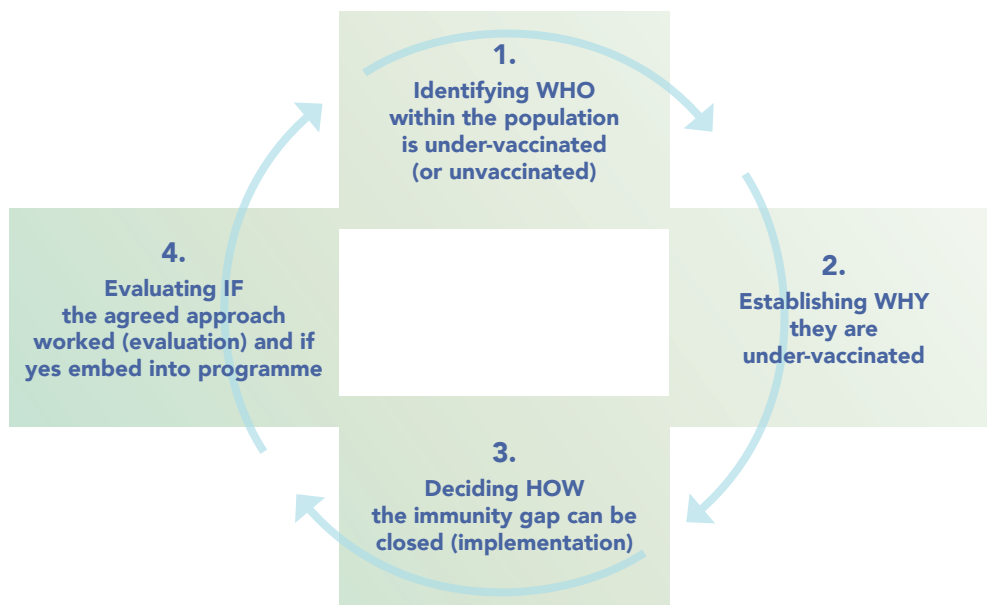
There is no single way to “start” to address inequities in immunization programmes and steps will vary according to place and context. In different Member States it may be necessary to develop policies, to adapt services, or to create systems to analyse and identify disaggregated data or to maintain and improve such data (25). Addressing inequities can start from a high-level policy decision (see Section 2), or it can start from a local data analysis. Either way, addressing inequity within immunization programmes is not a one-off action, it is a shift in conceptualizing how services are delivered and how the goals and targets are set, and therefore requires ongoing review.

Improving equity requires the completion of four fundamental steps (Fig. 5) centred around four key questions:

- 1 Identifying **who** within the population is under-vaccinated (or unvaccinated).
- 2 Establishing **why** they are under-vaccinated.
- 3 Deciding **how** the immunity gap can be closed.
- 4 Evaluating **if** the agreed approach worked.

These steps should not be considered as a project with a beginning and an end, but rather as a process to continuously monitor equity within the national immunization programme (NIP). It is also important to share evidence on inequities and evaluation of interventions to address immunization inequity, so that others may learn from the issues identified, approaches developed and the findings. Evidence sharing can occur through a range of modalities including publishing in the peer-reviewed literature, distributing through peer networks and organizing training sessions.

Fig. 5. The ongoing cycle identifying and addressing equity within national immunization programmes



Source: Authors

Implementing each of these steps requires financial and human resources as well as a willingness at the policy or operational level to make changes, and ideally both. In other words, addressing equity can be top down (a national strategy locally implemented) or bottom up (a subnational initiative that gains national traction). In practice, a combination of both in partnership is likely to yield the best results. In addition, for each of these steps a balance should be achieved between cost, speed and rigor. For example, in some situations an adequate understanding of barriers to vaccination in a particular population group may be provided through conversations with community leaders/stakeholders and health-care providers, rather than an extensive epidemiological study. Alternatively, this can be achieved through a formal, more in-depth, qualitative study led by an academic group including professional qualitative researchers and a theoretical model. Striking the right balance to achieve the maximum possible results will depend on urgency, available resources, time, expertise and needs.

Vaccine monitoring data is often a starting point for identifying and addressing vaccine inequity. However, to detect and track vaccine inequities, there is a need to take collection and use of data beyond a passive “tick-box” performance monitoring exercise. To tackle vaccine inequity, vaccine programme monitoring needs to provide information for action, and be considered more as vaccine programme surveillance (i.e. providing information for action). This may involve active collection of data, including identification of underserved groups within the data; analysis of data at regional or subregional levels using different techniques; tailoring of outputs and interpretations; and making recommendations for action. In addition to providing overall, high-level measures of success, immunization programme monitoring also needs to ensure that those working at local levels have the tools to be able to monitor their own performance and identify issues of under-vaccination or variation in uptake that may stem from inequity (e.g. uptake data at neighbourhood level, clinic level or municipality level).

High-level vaccine monitoring data (at the national or even larger subnational levels) are unlikely to be sufficient to monitor equity in vaccination coverage. Tracking differences in vaccine coverage between subnational regions can be a useful starting point, however aspects of inequity that are diffuse across populations may be invisible in these figures. Similarly, the choice of denominator data may mask inequities and inflate calculated coverage figures; population estimates may be outdated or may exclude migrant and displaced groups; and even immunization registries can suffer from denominator inflation or missing data – this is especially the case where populations move frequently or are less likely to be registered for health care or other services. Identifying and tackling immunization inequity will involve a paradigm shift in the way we use data, away from passive monitoring to an approach where the aim is to provide information that will alert stakeholders to issues, help guide actions, and monitor the success of existing interventions.

National or local immunization registers provide a wealth of information to inform on equity, especially when they contain sociodemographic data and/or population denominator information alongside vaccination status. Where bespoke immunization registers do not exist, lists of health-care facilities and databases may provide a functional alternative. Further detail is provided below under “What dimensions of inequity should be considered?”.

Poor quality or incomplete data may present a misleadingly positive picture, making identification of inequities difficult. Everyone involved in vaccination programmes should keep in mind their role in ensuring data quality, as the consequence of inaccuracies

or incompleteness in data they collect and record may be a failure to detect under-vaccination in the population or in specific population groups, which may exacerbate systematic vaccine programme inequalities. Everyone involved in immunization uptake monitoring should keep in mind who their datasets exclude and consider how to produce more inclusive summary figures.

What if low-level or disaggregated vaccine coverage data are not readily available?

Where national vaccination data systems do not routinely provide the level of definition needed to detect and monitor immunization inequities, it will be necessary to triangulate with other data sources or carry out primary data collection. Primary information gathering does not always have to be through extensive surveys, and other sources of intelligence can be considered, including field research or qualitative information from communities or those working with population groups.

Ultimately, the impact of immunization inequities may be seen in data relating to incidence, morbidity and mortality of VPDs. Working alongside colleagues in incident and outbreak response to monitor the characteristics of those affected and reasons for under-vaccination will yield important information. Analysis of primary case, hospital admission datasets and utilization of methods to link datasets (e.g. to account for missing data within one system) may also provide intelligence on inequitable distribution of VPD morbidity. Ultimately, improving the quality and use of immunization and disease surveillance data should be an ongoing goal that will improve the performance of immunization programmes and enable the reduction in inequity within the vaccine programme. The 2019 WHO SAGE report on improving immunization and surveillance quality and use provides recommendations and resources for achieving this (26).

What happens once data is collected and analysed?

Identifying inequity within the immunization programme is an important but insufficient step in itself. The information should be used to spur action. Actions need to follow this to understand the root causes of the inequity, and design, implement and evaluate interventions to address them. These steps can be complex and require collaboration outside of the immunization programme, and often outside of the public health institute or health ministry. Engagement with partners is required to develop, implement and evaluate successful, evidence-driven interventions, and the lack of it is a common cause for failure to address inequity. Immunization programmes must go beyond collecting and analysing data.

Step 1. Identifying vaccine inequities and under-vaccinated populations

Take away messages

- Identifying inequities within the immunization programme is an ongoing surveillance process, not a one-off data exercise. → Just like coverage, equity should be monitored over time and action taken if it decreases.
- There are many dimensions of inequity within vaccination programmes. → Consider what is relevant to your context.
- Inequities in vaccination should be considered across the life course. → Think beyond the first year.
- Immunization data is the right place to start to identify inequities, but it is not enough. → Think beyond the programme.
- Informal, lower grade evidence on inequalities should not be dismissed → Be pragmatic.
- Analysing data for inequalities need not be complex. → Don't be put off by statistics.
- Data triangulation helps in identifying inequalities not immediately visible in a single data source. → Consider your evidence as a whole rather than as a series of datasets.

National immunization coverage statistics do not usually provide sufficient detail to identify which local populations are not fully vaccinated or which individual characteristics place them at higher risk of being under-vaccinated. There is a clear need to expand the focus of immunization programme monitoring beyond measuring the difference between worst and best-performing broad geographical areas and to accurately identify who or which populations are not being immunized, and provide information to guide action.

What dimensions of inequity should be considered?

Identifying and characterizing under-vaccinated populations is the first step to improving coverage in these populations and as a result addressing inequities in immunization. Most countries that have undertaken identification of inequities in immunization have found them. Inequities are not always obvious from coverage statistics, as they can relate to different domains, and while data may be routinely captured and readily available for some, it may not be for other particular attributes. Dimensions of inequity may also be specific to certain contexts and may be dynamic. For example, ethnic differences may be highly relevant in multicultural societies with clearly identified ethnic groups, whereas in other societies, there may be no such distinction.

Circumstances may also change within countries. For example, conflict or pandemics may have created under-vaccinated birth cohorts as a result of temporary disruption to immunization programmes. In addition, in accordance with the WHO Immunization Agenda 2030 (1), many countries are transitioning to a life-course approach to vaccination, in which vaccines are offered not just in early childhood but in later life. Although monitoring and addressing inequalities in vaccination remains largely focused on early life, emphasizing the ongoing need for catch-up of missed vaccinations over the longer-term is vitally important in

reducing immunization inequities. Similar issues also exist within adult programmes and will also require attention.

Member States will need to identify through which lens, relevant to the context and time, immunization inequities should be examined. The WHO guidance on conducting a situational analysis of immunization programme performance (27) also suggests equity dimensions that may be considered and how to monitor them – these include gender, geography, socioeconomic status and rurality. Other examples of relevant dimensions include (list not exhaustive):

- geography (coverage by subnational administrative unit);
- ethnicity;
- religion;
- gender;
- disability;
- socioeconomic status;
- age – if specific age cohorts are not vaccinated (e.g. disruption of the programme because of conflict, pandemic etc. that affected the routine programme);
- rural/urban;
- immigration status (migrant vs resident);
- years in the country;
- frequent migration within the country;
- access to health and social care.

The United Kingdom's National Institute for Health and Care Excellence (NICE) identifies the following populations as being at risk of low vaccine coverage (there will be additional factors to consider in other countries and contexts) (28):

- people from some minority ethnic family backgrounds
- people from Roma and traveller communities
- people with physical or learning disabilities
- people from some religious communities (e.g. Orthodox Jews)
- new migrants and asylum seekers and other displaced populations
- looked-after children and young people (e.g. in the care of local authorities)
- children of young or lone parents
- children from large families
- people who live in an area of high deprivation
- babies or children who are hospitalized or have a chronic illness, and their siblings
- people not registered with a general practitioner
- people from non-English-speaking families
- people who are homeless.

It is important to consider how these dimensions interact when choosing variables of interest and how to analyse them. For example, the impact of parental immigration status on childhood immunization may differ according to the parent's gender and number of years in the country.

Where to find relevant data or information?

Data may be available in an aggregate form (either from the immunization programme or outside), or at the individual level (if a vaccine register exists in the country). Where data are available at the individual level, it is possible to calculate exactly vaccine coverage in groups of interest, according to the inequity dimension of interest – either directly or by linking to other datasets. A key advantage of population immunization register data at individual level is that it can provide useful information about the unvaccinated population, in addition to a means to calculate group-specific coverage. In some instances, information about ethnicity,

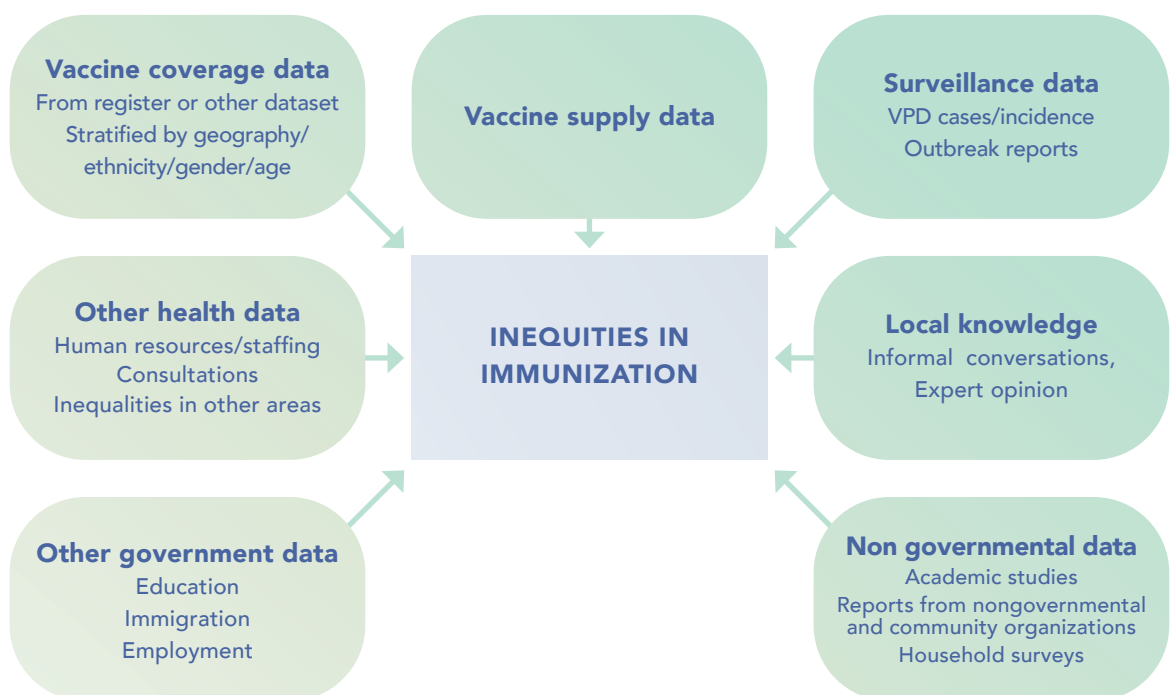
religion or socioeconomic status can be inferred indirectly even though it is not directly available to the immunization programme. For example, if certain ethnic or religious groups live in certain districts or municipalities, or if socioeconomic status by locality is available, then it is possible to infer differences about these characteristics by comparing coverage in these localities. Although there is a risk of ecological fallacy in this approach, where characteristics of some individuals living in an area are different from the aggregated whole area, it is nonetheless a useful starting point.

In assessing vaccine equity, it is greatly beneficial to consider data beyond vaccination statistics and to collaborate across sectors and functions. Information about the characteristics of a population within a specific locality may be available formally (e.g. from the central bureau of statistics), or informally from local knowledge, (e.g. a local public health officer may be aware that a particular group of people lives in a particular area).

Some populations may be harder to define through existing data and be more geographically diffuse (e.g. people with learning disabilities) or not necessarily share a common personal characteristic but rather an ideology or a belief (e.g. vaccine hesitancy). These populations may not be easy to enumerate and may be more challenging to target with interventions. However, there may be indirect ways to characterize such populations, for example, around a particular educational facility or support group. Quantitative evaluation of interventions targeted to groups not easily identified through data may also be challenging, without additional survey work. In these situations, stakeholder engagement and qualitative evaluation is important to consider.

Relevant data may be available from many sources and should be considered (Fig. 6). It is recommended to perform the steps outlined below and to collate all the relevant data/information identified in a single document for future reference. WHO's *Inequality monitoring in immunization: a step-by-step manual (29)* (Chapter 2A) offers templates to build such a document. Before you collect, analyse and report on the data, you must ensure compliance with local ethical and legal requirements. Some data relating to inequities may be particularly sensitive, and avoiding stigmatization of already marginalized groups should be a key priority at all times.

Fig. 6. Potential sources of data relevant to identifying inequities within the immunization programme



Identifying relevant data

1. Check available coverage data from the immunization programme

- Coverage data may be available at the individual level (register) or already aggregated.
- Coverage data may be stratified by region, district, municipality or neighbourhood. This enables you to easily measure geographical inequities and other aspects of immunization inequity if used in conjunction with other data available at these levels, for example, the level of socioeconomic deprivation.
- Additional person-level variables may exist within the immunization programme data, such as ethnicity and gender. Each variable available in the immunization database should be considered as a potential dimension of inequity.
- Sometimes variables overlap, for example, if a particular population group lives within a known locality it may be possible to use geographical data to infer coverage in the group living in that geography.
- Calculating coverage by birth cohort (year of birth) may identify under-vaccinated cohorts. This is particularly important in settings where the programme has been disrupted, for example, by a vaccine scare, conflict or the COVID-19 pandemic. The results of such analyses have previously prompted measles, mumps and rubella (MMR) catch-up campaigns (30).
- Always keep in mind that coverage data may mask inequalities: you can only see what you measure. Not seeing inequalities within the coverage data does not mean that inequities do not exist, only that the data are not detailed or inclusive enough to identify them. Equally, outdated demographic data may not reflect key changes in population migration, and use of it with vaccine coverage data can mask issues or provide false reassurance. In addition, specific groups may purposefully not be included in formal data sources (both numerator and/or denominator). This may occur in specific situations such as in countries or regions that have a sensitive balance between different population groups, or countries that have seen large and rapid influxes of migrants. While it is essential for those responsible for the NIP to understand the country's social and political sensitivities, programmes should be monitoring using numerators and denominators that reflect the population as closely as possible. It may be necessary to specify that the data collected as part of addressing equity within the NIP is intended for programmatic use only.

2. Check other surveillance data, VPD case data and outbreak reports

- Surveillance data: differences in VPD incidence by area may highlight differences in underlying immunization coverage, regardless of official coverage data. If available, age-specific incidence may give an indication of what age groups are under-vaccinated. Where notification of VPDs to authorities is mandatory, additional relevant information may be recorded in notification records, such as vaccination status and/or characteristics that enable the assignment of the case to a particular group. Fig. 4 outlines in more detail how such information can be used.
- Outbreak data: outbreaks predominantly affecting certain areas/population groups are a strong indication of inequalities in immunization. As much information as possible should be obtained on the age, sex/gender and characteristics of cases to help define under-vaccinated groups. This information may be available in the form of reports from public health agencies, or peer-reviewed publications. Defining characteristics of under-vaccinated groups, such as specific religious groups, are often not available in routine coverage figures. In Belgium, issues

of under-vaccination have been reported in Orthodox Jewish communities (31), such population groups are not necessarily identifiable through the use of vaccine coverage, as religion is seldom recorded in vaccination datasets. Outbreak reports may also help inform on the underlying reasons for under-vaccination in affected areas, groups or individuals.

3. Check other health data

- Vaccine supply data can be very informative. Comparing, for example, the number of doses used or ordered to the estimated number of doses required – considering the size of the eligible population in a health facility known to serve a particular population group – can help identify discrepancies that can be further investigated.
- Health inequalities in a population group or geographical area often occur across health issues. Therefore, if inequalities are documented with other health issues, they may well also occur with regards to VPD and immunization. Obtaining the number of consultations with a doctor or a nurse per 1000 people in a particular area and comparing consultation rates across areas can give an indication of accessibility of and engagement with health-care systems and identify areas where the population is less likely to engage with health services in general. Likewise, documented inequalities in other health areas can highlight areas or population groups likely to be under-vaccinated. Although, it should be kept in mind that this may be confounded by the availability of health care and variation in the level of health-care provision between areas.

4. Check other official, non-health data sources

- Evidence across the Region and beyond has identified factors associated with low vaccine coverage, including educational attainment, belonging to certain ethnic and religious minorities, recent arrival in the country, membership of large households and single parenthood. Such data may be available from official sources outside of health, for example, ministries of education or immigration. Exactly what data may be relevant is context specific and data that may seem far removed from the immunization programme may be highly relevant. For example, the number of applications for asylum status or for social security numbers in a particular area may be an indication of recent migration.
- Such data can be triangulated with coverage data to identify under-vaccinated populations (see data triangulation below). A 2016 study from Vancouver, Canada, demonstrates how ministry of education data was triangulated with vaccination data to identify underserved communities with regards to vaccination (32), whereas another study from the United Kingdom shows how the comparison of vaccination data with data on religious belief and ethnicity from the Office for National Statistics could highlight inequalities within the influenza vaccine programme in the United Kingdom (33).

5. Check other informal data sources (e.g. nongovernmental organizations, surveys, studies)

- Other organizations active in the country, but acting outside of the health-care system, may provide useful data sources. These can range from local, grassroots community organizations working in a particular neighbourhood or region, to global multilateral organizations such as the United Nations Children’s Fund (UNICEF) or the World Bank.
- Organizations may have conducted studies or projects that contain information about immunization, population make-up, or other health issues which may

highlight inequalities. Information may previously have been gathered through household surveys or other studies. It is worth contacting such organizations working in the area of interest to enquire about the existence of such data. Published reports may also be available on organizations' websites. Some organizations may have published their findings in peer-reviewed literature and searching relevant publication databases for evidence around immunization in particular population groups may help identify relevant data or evidence.

6. Speak to people

- Local knowledge about the population may prove useful where no, or insufficient, data exists. Speaking to local health workers, community leaders, voluntary organizations and advocacy groups may provide some insight about who is and is not vaccinated. Such information should be considered as hypothesis generating (i.e. needing confirmation), as it may be subject to bias and misinformation. Nevertheless, it should not be dismissed outright, especially for populations that are hard to define and enumerate using formal data. This includes religious groups and specific communities linked by an ideology that may include scepticism, misconceptions and myths about vaccination. Stakeholder engagement and qualitative research, directly with communities or specialists working on marginalized groups can also yield important information on groups that may not appear in official data. Information consistently provided by independent information sources is more reliable than data from a single source.

How can data be analysed?

Identifying inequalities within the immunization programme need not rely on complex analysis. The approach, and degree of complexity, depends on the context and the needs. Broadly speaking, analysing data to identify inequalities can entail:

- **Descriptive analysis/epidemiology:** this is the simplest approach and relies on presenting the data in a particular way without statistical analysis. Descriptive epidemiology is sufficient for most needs and can be extremely powerful.
- **Statistical analysis:** this entails the use of statistical tools of varying complexity and should only be used where descriptive epidemiology is not sufficient to identify under-vaccinated populations.
- **Data triangulation:** where single sources of data or statistics do not exist or are of questionable reliability, data triangulation can be very helpful. This entails utilizing multiple existing sources to address a specific question, for example, to estimate coverage in an under-vaccinated population or to help elucidate reasons for under-vaccination.

Before analysis, the obtained data may need to be cleaned and prepared. Managing immunization data is beyond the scope of this guidance, but the 2019 SAGE report on immunization data quality (26) gives an in-depth analysis of the dimensions of quality that need to be considered. The *WHO handbook on the use, collection, and improvement of immunization data* (34) also provides useful guidance. It is important to recognize that data do not need to be perfect, but should be good enough for intended purposes. Knowing and understanding the datasets and their limitations is also important, especially in situations where there is a risk of differences between groups being caused by data artefacts.

Descriptive analysis/epidemiology

Descriptive epidemiology focuses on presenting data in a way that will highlight inequalities without the need for advanced statistical analyses. For maximum impact,

three standard approaches could be considered to highlight different aspects of inequity: maps, tables and graphs. To make the information conveniently accessible to target audiences, all three can be integrated into interactive dashboards that enable users to focus on areas of interest and to follow trends in inequalities over time if the dashboard includes several years of data. Examples of dashboards that help visualize geographical inequalities within countries include an MMR and rotavirus dashboard for Germany (35) and a routine vaccination dashboard for England (36).

Maps

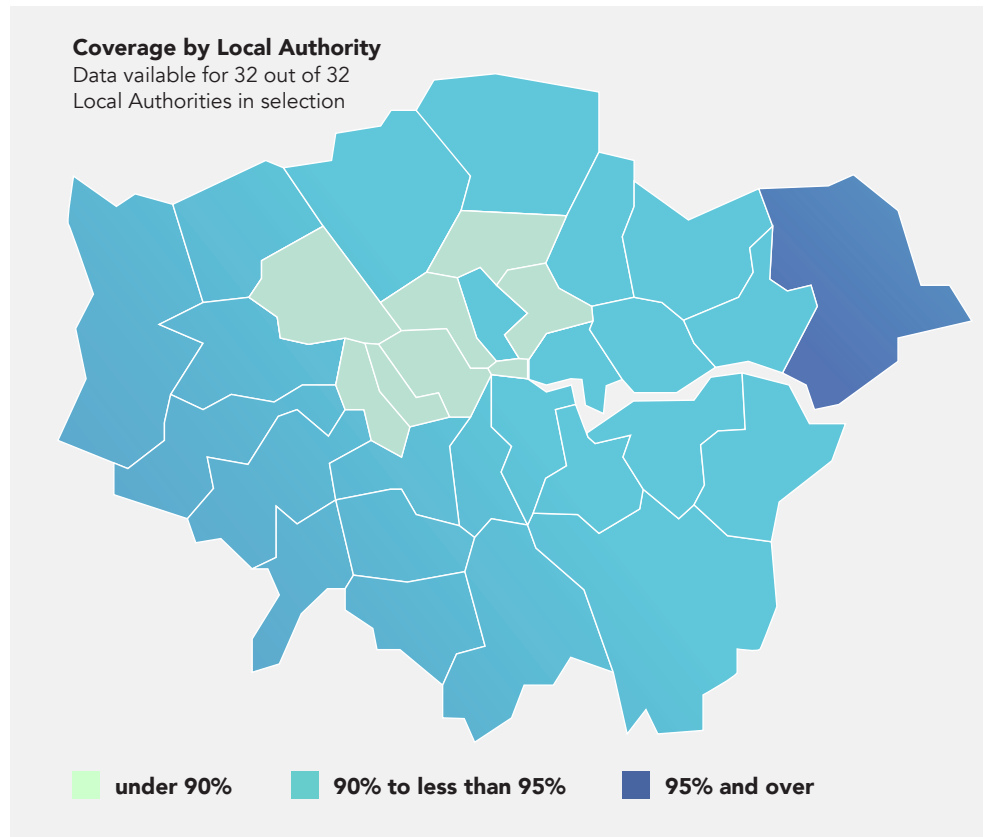
Maps can help the reader quickly identify geographical areas that are under-immunized. A map can show which areas are under-vaccinated, but not who lives in those areas, or even which individuals within the area are not vaccinated. Inequities that are more diffuse across geographies may not be apparent in coverage maps, but they can still add useful context. If additional information exists about each area, a narrative can be attached to the data. For example, if a particular population group is known to live in a district, this can be mentioned in the text accompanying the maps. In order to highlight inequalities in vaccine coverage between geographic areas, data can be presented at the smallest meaningful administrative level, provided coverage data exist at that level. Colours can be used to reflect meaningful coverage intervals, for example, using three colours to visualize which areas or regions that have MMR coverage that is above 95%, 90–95% or below 90% (Fig. 7). Detailed maps are most relevant to stakeholders who are familiar with the geography and understand the underlying characteristics of the areas displayed.

Fig. 7 provides an example of a map highlighting inequalities. Maps should be appropriate to the audience they are designed for, and the risks of accidental disclosure or stigmatization of neighbourhoods should always be considered when they are intended for the public domain. There are many Geographic Information System (GIS) tools available online to generate maps relevant to immunization programmes. Providing detailed guidance on producing maps is beyond the scope of this guide, but the United States Centers for Disease Control and Prevention (CDC) has produced useful cartographic guidelines (37) that explain the fundamentals of using maps for public health.

Fig. 7. Coverage with three doses of combined diphtheria, tetanus and pertussis vaccine in the 32 local authorities (districts) of London, United Kingdom^a

^a The map highlights districts in central London with coverage under 90%. These areas include the most affluent and the most deprived parts of the city – suggesting the reasons for low coverage in each of these districts, and the populations they include, are different. Contains information from NHS England, licenced under the current version of the Open Government Licence.

Source:
UK Health Security Agency (36)



Tables

Tables can present coverage according to any variable of interest. They can be organized from the highest to the lowest value, which enables the viewer to immediately identify outliers, both positive and negative. This can be important when analysing the causes of inequities, because understanding the characteristics of the positive and negative outliers may help generate hypotheses. Inequities can be expressed in tables as relative (ratios) or absolute differences in numbers vaccinated or percentage of coverage. Both are important and convey a different message. Relative differences help highlight the magnitude of the inequity between groups, whereas absolute differences convey information about the number of individuals who are under-vaccinated. A smaller relative difference can still mean a larger number of unvaccinated individuals in a larger group, as illustrated by the fictitious example in Table 1. Both absolute and relative differences are valuable, and the choice depends on the type of message conveyed.

Table 1. Vaccine coverage by area for vaccine X in a fictitious country^a

	Number of eligible individuals (n)	Vaccine coverage (%)	Coverage ratio, compared to Area 1	Difference in % coverage, compared to Area 1	Number of unvaccinated individuals
Area 1	12 000	98	Baseline	0	240
Area 2	3 000	89	0.91	-9	330
Area 3	15 000	93	0.95	-5	1 050

^a Even though Area 3 has a higher coverage ratio and a smaller relative difference than Area 2 (compared to Area 1), Area 3 has more than three times more under-vaccinated individuals than Area 2. Hence the importance of considering both relative and absolute comparisons.

Tables can also be colour-coded to highlight high, intermediate and low coverage. In addition, while most tables generally present coverage in the group of interest (an area, an ethnic group, a socioeconomic group), it is also possible to present other figures relevant to inequalities. This is particularly true if several years are presented in the same table and change or difference compared to the mean is included. Such data determines whether inequalities are increasing or decreasing. Table 2 provides a fictitious example.

Table 2. MMR1 coverage at 24 months by ethnicity in a fictitious country, over time (fictitious example)^a

	2017		2018			2019		
	Number of individuals eligible	Coverage (%)	Number of individuals eligible	Coverage (%)	Change compared with previous year (%)	Number of individuals eligible	Coverage (%)	Change compared with previous year (%)
National average	820 012	91	980 809	91	-0.05	980 809	91	-0.32
Ethnic group 1	123 546	87	123 436	84	-3.45	123 436	83	-1.19
Ethnic group 2	5 476	96	6 476	96	0.00	6 476	96	0.00
Ethnic group 3	347 655	91	345 655	92	1.10	345 655	91	-1.09
Ethnic group 4	17 567	89	179 567	89	0.00	179 567	90	1.12
Ethnic group 5	325 768	93	325 675	94	1.08	325 675	94	0.00

^a Where coverage is 95% or higher, the value is coloured in green.

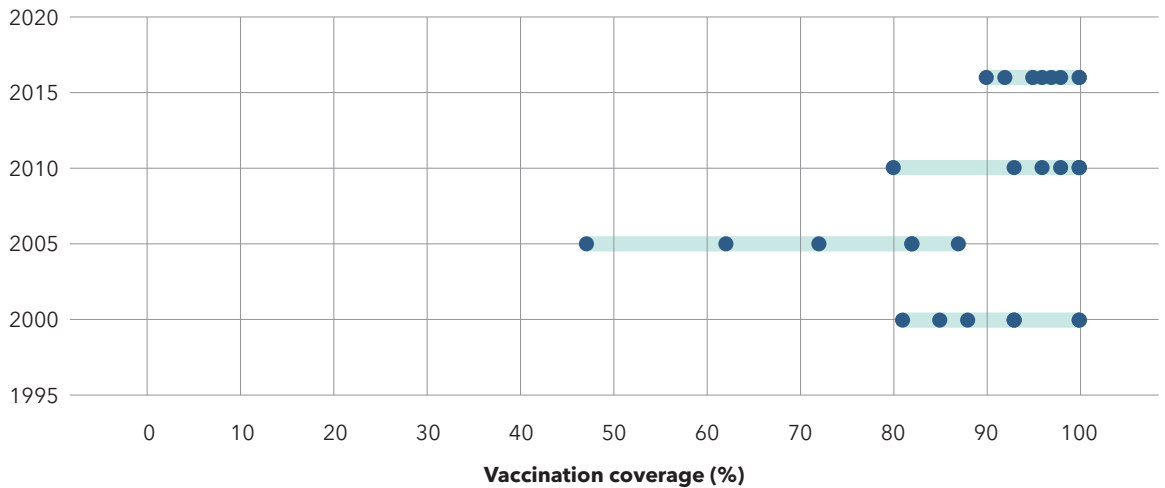
Coverage in the least vaccinated group (Ethnic group 1) decreases faster than any other group, with the largest decreases between 2017 and 2018 and 2018 and 2019 respectively. Coverage in the most vaccinated group (Ethnic group 2) remains stable over time, suggesting inequalities by ethnicity are increasing in this country and Ethnic group 1 warrants urgent attention. Note that national level coverage remains constant, masking the under-vaccination issue and the risk of a measles outbreak in Ethnic group 1.

Graphs

Graphs are a flexible tool that enable clear display of inequalities within different groups. A simple bar chart, ordered from highest to lowest coverage, can highlight inequities, differences between groups and unmet need when it comes to vaccination. Tiley et al graphically illustrate differences in diphtheria, tetanus and pertussis (DTP) vaccination by ethnic groups among 5 year-olds in London (12). Dot plots of coverage at subnational levels within a country, as shown in Fig. 8 demonstrate not only changes of coverage levels over time, but also changes in equity over time. This represents a good example of a simple and powerful way to highlight inequalities without using advanced statistics and highlighting trends over time.

Inequality monitoring in immunization: a step-by-step manual (29) has several detailed examples of how different graph designs can help visualize inequities and whether they increase or decrease over time (see Chapter 4).

Fig. 8. Dot plot showing DTP3 immunization coverage for 1-year-olds disaggregated by subnational region in Armenia, 2000, 2005, 2010 and 2016



Source: WHO Health Equity Assessment Toolkit, built in database edition, Version 5.0, Geneva (38)

Statistical analysis

Using statistical tools to analyse data in order to identify inequalities within or between populations can be important but is by no means the first step. Robust, comprehensive, descriptive epidemiology will be sufficient in many instances. When underlying data include an entire country or an entire population, calculating confidence intervals or statistical significance in the difference between groups is less essential than when interpreting the result of a study based on a sample (but may still be useful to help interpret significance of differences). Nevertheless, there are instances when more advanced analysis is warranted. For example, when identified differences are based on a subset of a population (e.g. a household survey), it is important to exclude chance as a reason for observed differences. Likewise, when differences between groups are complex and multifactorial, regression analyses can help determine whether a particular dimension of inequality is associated with vaccine coverage, after taking other factors into account.

Table 3 shows the difference in MMR vaccine coverage among children in Bosnia and Herzegovina in 2018, according to geographical, sociodemographic and ethnic characteristics of parents, before and after taking other factors into account (39).

Table 3. Association between child and caregiver characteristics in relation to MMR1 (full vaccination) coverage, among children born in 2015 and aged 24–35 months, Bosnia and Herzegovina, January 2018

Characteristic	Fully MMR1 vaccinated	Crude odds ratio (95% confidence interval)	Adjusted odds ratio (95% confidence interval)
Total	65 (60–71)%	n/a	n/a
Gender of child			
Male	64 (58–71)%	Baseline	Baseline
Female	67 (60–74)%	1.12 (0.89–1.40)	1.03 (0.78–1.36)
Residence			
Urban	51 (44–57)%	Baseline	Baseline
Rural	74 (66–82)%	2.81 (1.76–4.49)	4.65 (2.63–8.24)
Father's education			
None	36 (0–86)%	0.26 (0.03–1.92)	0.11 (0.01–1.51)
Low	66 (47–85)%	0.87 (0.42–1.84)	0.71 (0.28–1.77)
Medium	69 (64–74)%	Baseline	Baseline
High	61 (53–69)%	0.72 (0.57–0.91)	0.89 (0.65–1.22)
Mother's age (years)			
<24	64 (55–74)%	1.02 (0.67–1.54)	0.70 (0.37–1.32)
24–29	70 (62–78)%	1.30 (0.95–1.77)	0.95 (0.60–1.51)
30–35	64 (58–70)%	Baseline	Baseline
>35	68 (62–74)%	1.19 (0.96–1.47)	1.44 (1.13–1.83)
Community affiliation			
Other	66 (60–72)%	Baseline	Baseline
Roma	22 (0–45)%	0.14 (0.04–0.50)	0.25 (0.03–2.33)

n/a: not applicable. Source: Musa et al. (39)

Other advanced methods to calculate inequalities across subgroups exist (Table 4). The exact statistical approach required depends on the nature and format of the data available, whether the groups are ordered or categorical, and whether absolute or relative differences are measured. The use of these methods is described in more detail in the WHO handbook on health inequality monitoring (40) (the examples are not vaccine focused but the concept is similar). It is advisable to seek the help of a statistician if the use of these approaches is warranted.

Table 4. Advanced approaches to vaccination data analysis

Type of variable of interest	Type of measure	Type of test
Ordered (e.g. socioeconomic decile, child order in a family)	Absolute	Slope index
	Relative	Concentration index
Not ordered (e.g. ethnic group, district)	Difference from mean	Absolute mean difference
	Relative difference between subgroups	Weighted mean difference
	Relative difference between subgroups	Theil index

Data triangulation

Data triangulation entails the synthesis of evidence from two or more existing data sources to yield information not immediately inferable from either source. Triangulation can be purely descriptive, or analytical. Data sources included in triangulation can include vaccination and non-vaccination or even non-health data. Overlaying the distribution of certain population groups, or recent immigration data (e.g. from the department of housing or immigration) onto vaccine coverage data (e.g. from the health

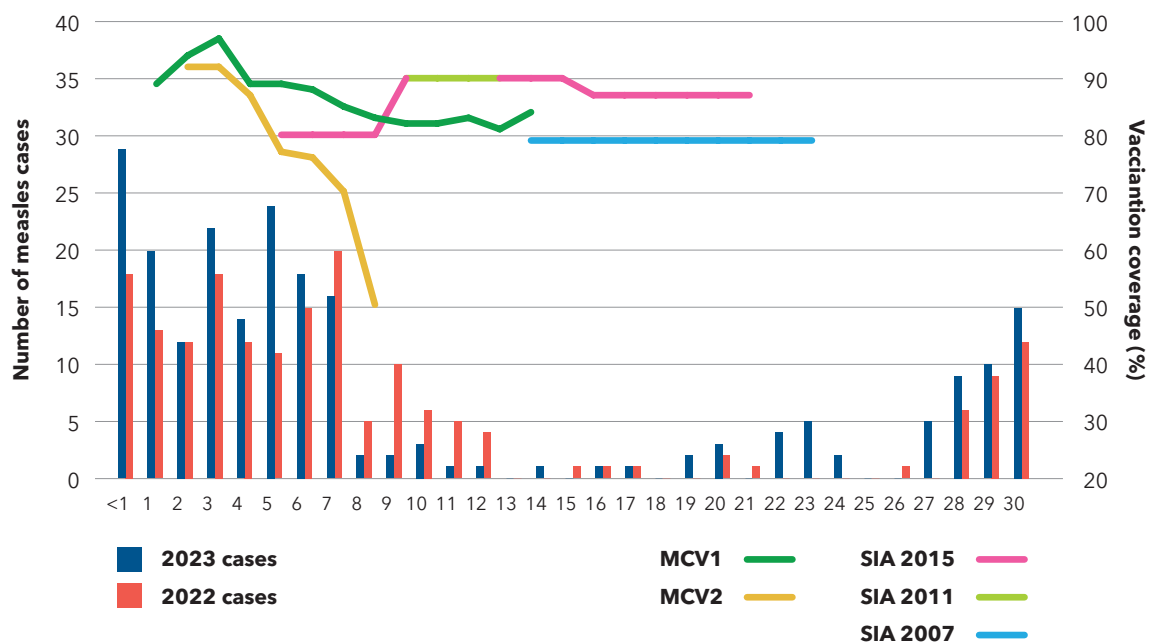
ministry) is an example of descriptive triangulation that helps infer vaccine coverage among certain population groups when such information does not exist in the vaccine register or coverage database.

It is envisaged that using the concept of “measles as a tracer” not only supports the elimination of measles in the Region but also helps to address inequities in immunization for all VPDs (Box 1) and advance progress to reach the strategic priorities of the EIA 2030. For example, analysing cases and outbreaks of measles can help yield additional information about the age groups in which immunity gaps lie (Fig. 9). Guidance compiled by TechNet-21, on triangulation for improved decision-making in immunization programmes (41), provides step-by-step details on how to conduct triangulation at the national and subnational levels. Caution should be used in interpreting results from triangulation of routine statistics; it is a very useful exercise in hypothesis generation, but may at times generate spurious associations and cannot identify causation.

Box 1. Measles as a tracer

- Using measles cases and outbreaks to better tailor and implement activities towards measles and rubella elimination
- Using measles cases and outbreaks as a diagnostic tool for identifying gaps in equity, strategy, and implementation of the immunization for VPDs and primary health services
- Using measles and rubella elimination as a target to focus investment in broader public health system strengthening.

Fig. 9. Example of triangulation between measles incidence and coverage from various campaigns, highlighting the under-vaccinated birth cohorts, thus highlighting age-based inequalities^a



Source: Adapted from TechNet-21 (41).

MCV1 and MCV2: 1st and 2nd vaccine dose of a measles-containing vaccine, respectively.

Bars refer to cases. Lines refer to vaccination coverage through routine vaccination of MCV1 and MCV2 and SIAs in 2007, 2011 and 2015. Note the higher case numbers in 24-30-year-olds, who were too old to have benefitted from the SIAs and for whom no coverage data are available.

^a Further information about cases (from outbreak reports, for example) and identification of common characteristics (around ethnicity, religion, belonging to a particular educational community, immigration from a particular country or region etc.) may yield further information about inequalities.

Step 2. Characterizing root causes of immunization inequities and under-vaccination

Take away messages

- Understanding why individuals and populations are under-vaccinated requires the use of qualitative methodologies.
- Harnessing expertise from academic and other technical partners is likely to be most efficient for this step.
- Qualitative approaches include the use of interviews and should follow a rigorous, methodological approach – described in this section and in further detail in referenced guidance documents.
- Approval from an ethics committee will be required in most instances.

To characterize the root causes of under-vaccination requires investing time and resources. This step can range in duration, cost and complexity depending on resources available, needs and the context. In some contexts, inequities created by service delivery can be identified through service-evaluation work. In other contexts, the root causes of immunization inequities may only be identified through primary research or evidence gathering in the field. It is also important to consider the impact of wider societal inequities, outside of service delivery, on immunization uptake (e.g. gender inequities).

Where primary research or qualitative evidence gathering is needed, ideally it would be conducted to a standard publishable in a quality peer-reviewed journal – to ensure robust methods and also to aid sharing of findings. The steps needed to achieve this are described below. In practice this may not always be possible. At the other end of the spectrum, informal conversations with relevant stakeholders can yield useful insights into the causes of under-vaccination but cannot be considered a substitute for formal qualitative research.

To understand barriers to vaccination in specific groups (e.g. ethnic groups) it may be necessary to derive information from multiple sources, such as evidence reviews, rapid coverage monitoring, interviews with health-care providers and community leaders, and case and outbreak investigations. This step can be a challenge for public health institutes because it relies on qualitative research expertise not always available internally in expanded programmes on immunization (EPI), and may require additional personnel to reach out and interview individuals from the populations of interest, health-care workers, community leaders and other relevant stakeholders. In addition, immunization programmes may not have links with, or a “way in” to, specific population groups who may not be fully engaged with health services. While it is possible for well-resourced immunization programmes to conduct this step within existing resources, it is a step where national programmes commonly collaborate with external partners, such as academic departments or field epidemiology training programmes (FETP).

A collaborative approach has several advantages, in particular making use of skills not necessarily available internally within immunization programmes and sourcing additional human resources to answer programmatic questions at limited financial cost to the programme.

Finally, there can also be an advantage for politically sensitive health issues (e.g. refugee health, or marginalized communities) to be tackled by an independent institution. Civil society organizations with links with specific populations may also act as a bridge between population groups underserved by immunization programmes and the EPI.

Identifying these potential partners and contacting them may be a useful early step. In particular, collaborative partnerships may include the following:

- Fellows from FETP (or field epidemiology and laboratory training programmes), which exist in most countries. A list of programmes by country can be found on the TEPHINET website (42).
- Local universities may have public health or social sciences departments that are willing and able to conduct such studies in partnership with public health institutes and/or ministries of health. It is also possible that some academic institutes already conduct work that is relevant to the programme without the knowledge or collaboration of the EPI.
- In some instances, an academic unit can become the official partner in answering research questions pertinent to an immunization programme, for example the National Institute for Health Research (NIHR) Health Protection Research Unit in Immunization in the United Kingdom (43). Even in instances where local universities cannot lead, they may have students looking for projects, who can conduct interviews under guidance.

Regardless of who conducts the investigation into the root causes of inequalities, the steps are similar. The WHO tool *Rapid qualitative research to increase COVID-19 vaccination coverage* (44) provides a useful step-by-step guide to conducting such an analysis. While this guide is specific to COVID-19, the steps would be similar for the investigations of the root causes of inequality for any vaccine programme. In the WHO TIP guide (24) this step is called the “Research” (phase 2) step.

The steps for conducting a qualitative analysis of the root causes of inequalities within a specific group are summarized below.

1. Establish a core research team

As described above, a collaborative approach is preferable and may be necessary for success. Three components are essential in the team: knowledge and understanding of the immunization programme; access to the underserved populations (identified in Section 3, Step 1); and qualitative research skills. The team may comprise EPI representatives, health ministry representatives, WHO country office staff, researchers from relevant institutions such as FETP or universities, members of civil society organizations with knowledge or connections to the group of interest, and possibly community representatives where appropriate.

2. Develop a research protocol

The protocol is an internal document that is essential to ensure the right question will be answered, using a rigorous and systematic approach. Protocols usually should contain the following sections:

- a) Background:** a brief description of what the current status of knowledge is regarding vaccine coverage and epidemiology for the VPD(s) of interest, in the country or subnational area on interest, and in the population identified. If no information exists regarding the specific population of interest, this should be mentioned.
- b) Aims of the study:** this determines what you want to get out of the study, what knowledge will be generated and how it will help inform future interventions.

The aim should be specific in terms of the target (a particular population), the vaccine (it can be a specific vaccine or vaccination in general) and the type of information you seek to obtain (knowledge, attitudes, barriers, enablers). Since under-vaccination can be the result of insufficient demand from the population, or system barriers, understanding the root causes can focus on the population itself, individuals who work within the health-care system (e.g. doctors, nurses, public health managers and school managers) or a combination of both.

The following are examples of aims from qualitative studies seeking to improve vaccination equity:

- to explore facilitators and barriers to MMR vaccination among parents living in anthroposopic communities in Sweden (45);
- to explore attitudes to HPV vaccination among black and Asian mothers living in the United Kingdom (46);
- to investigate the views of health workers on barriers and drivers related to positive childhood vaccination practices in Bosnia and Herzegovina (47); and
- to explore the process of vaccinating migrant populations in Norway and elucidate any challenges as perceived by health-care providers (48).

c) Research method: generally, methods include either focus group discussions, individual in-depth interviews, or a combination of both. The WHO TIP guide (24) provides a summary of these two approaches and their pros and cons. For more detail on these approaches, two articles from the British Medical Journal on focus groups (49) and interviews (50) provide a good start. Researchers within the core team will advise on the most appropriate approach.

d) Sample choice: sampling in qualitative research is very different from in quantitative studies such as surveys. There is no sample size calculation, statistical power or representativeness. In qualitative research, the sampling is purposive, meaning that you specifically aim to recruit individuals that represent a mix of characteristics you are interested in. If you are interviewing parents from a minority immigrant group for example, you may want to include a range of ages, geographies and year of arrival into the country. If the norm in your population of interest is for mothers to be responsible for vaccination, this needs to be reflected in your choice of interviewees, although you may decide to include fathers too if one of your objectives is to further understand why they are not engaged in vaccination. If you are interviewing health-care workers, you may want to include a range of professions within the health system, for example, nurses, doctors, administrators and public health managers. The numbers of individuals recruited cannot be defined by a calculation, but rather it is an estimation of the number of interviews needed to reach theoretical saturation (i.e. the point where analysing additional data does not teach you more about your topic). This number generally ranges from less than 10 to several dozens. Each interview or focus group has a cost that includes transport, recording, translation (if relevant) and transcription, which together with time and logistics may also dictate the sample size.

e) Topic guide: unlike quantitative research, qualitative research uses an open, semi-structured approach to gathering information. This means that while conversations are guided, the questions are not closed. The document needed to guide conversation is called a topic guide. The WHO tools and guidance *Rapid qualitative research to increase COVID-19 vaccination uptake* (45) and *Behavioural and social drivers of vaccination* (51) contain examples of topic guides. In order to structure and systematize the information collection and ensure completeness, topic guides are generally underpinned by a theoretical

framework. One commonly used framework for understanding health behaviours, including vaccination behaviours, is the Capability, opportunity and motivation for behaviour change (COM-B) model (52, 53), which is the model the WHO TIP guidance recommends. Its application is described in *Rapid qualitative research to increase COVID-19 vaccination uptake* (45) and the TIP guide (25). Researchers within the core team will be able to advise on topic guide development.

3. Consider the need for ethics approval

While some aspects of service evaluation work may not require ethical committee approval, for primary qualitative research involving underserved groups it is often essential and always advisable. Before starting the research project, ethical approval should be obtained to conduct the research from the appropriate independent local ethics committee. Ethics committees generally require the submission of the protocol and the topic guide together with the application form. Requirements will vary locally and depending on the setting of the committee (e.g. university, hospital, primary care). If in doubt, it is always better to seek the opinion of your local ethics committee, who can advise as to whether formal approval is required or not.

4. Collect the data

Interviews and focus group discussions are generally recorded and transcribed. Depending on the population of interest, interpretation and or translation may also be required. Transcription, translation and interpretation can be expensive, and it is important to ensure the budget includes these. An understanding of the sociocultural norms of the population of interest is also important for data collection. For example, in some instances, a female interviewee may feel uncomfortable being alone in a room with a male interviewer. It is important to understand what these norms may be to ensure a smooth data collection process. It is also essential to ensure that data is anonymized and collected and stored according to the requirements of the ethics committee and in compliance with legal requirements.

5. Analyse the data

Taking a rigorous approach, interviews and focus groups should be transcribed verbatim (word for word) and analysed for emerging themes interpreted in the context of the chosen theoretical framework. Such an approach requires the use of established methodological approaches and possibly dedicated software; the leadership of a researcher with experience in qualitative research as part of the core team is therefore required. Where this is not available, feasible or required, the WHO guides *Rapid qualitative research to increase COVID-19 vaccination uptake* (44) and the TIP guide (25) offer simplified alternatives such as the use of rapid assessment procedure (RAP) sheets. These documents provide detailed information on how to design and use these tools.

6. Disseminate the findings

Once the data has been analysed, the findings should be written up and shared with stakeholders, in particular decision-makers and those responsible for the delivery of the immunization programme. There should be a clear mechanism to transfer the knowledge generated from the research team to those responsible for the development and implementation of the intervention targeting the population of interest. While some qualitative studies focusing on under-vaccinated groups have the potential for publication, this should never delay information sharing for programmatic purposes. It should also not be assumed that stakeholders involved in the programme delivery will look for or find these data, and provision should be made for the findings and their implications to be actively shared. Failure to communicate findings in a timely and meaningful way with stakeholders in the community may have a downstream impact on the success of future work to roll out interventions within the community.

Step 3. Developing interventions

Take away messages

- The most effective interventions to reduce inequity are likely to be multi-component and can be context specific.
- There are no "off the shelf", ready-made interventions likely to be entirely suited to specific contexts and even evidence-based interventions successful elsewhere may require tailoring.
- National and subnational teams should consider whether it is possible to adapt existing evidence-based interventions to their context and situations, or whether the situation demands a completely new approach.
- Interventions should address barriers identified through research, not assumptions.
- Forward planning and identification of relevant stakeholders, potential risks and performance indicators before implementing are key to success.

Improving vaccine coverage at the national or subnational level should focus on a two-pronged strategy:

- (i) continuously strengthening the routine immunization programme; and
- (ii) focusing specifically on under-vaccinated groups using tailored approaches.

A sole focus on the former may lead to increasing health inequalities with regards to immunization; whereas, a sole focus on the latter may lead to stagnant or decreasing vaccine coverage and an eventual decreased herd immunity, in particular if underserved groups represent a small proportion of the total population. While this document focuses on under-vaccinated groups, the two approaches should not be mutually exclusive or competing, but rather complementary.

An intervention can take many shapes or forms. The WHO TIP guide (24) lists a range of intervention types, which include:

- information (increasing knowledge or understanding);
- persuasion (using communication to induce positive or negative feelings or stimulate action);
- incentivization (creating an expectation of reward);
- coercion (creating an expectation of a cost or other negative outcome);
- training (imparting skills);
- restriction (using rules to reduce the opportunity to engage in the target behaviour);
- environmental restructuring (changing the physical or social context); and
- modelling (providing an example for people to aspire to or imitate).

Each of these intervention types can be operationalized through one or several activities, such as:

- information campaigns (posters, leaflets etc.)
- communication campaigns (using influencers on social media, religious leaders etc.)
- reminder/recall (letter, SMS text, email etc.)
- health-care worker reminders (flagging unvaccinated patients to health-care workers)
- outreach (making vaccination available in community settings)
- digital tools (educational videos).

Evidence suggest that the most successful interventions are those that are multicomponent and tailored to particular contexts and populations (5).

Interventions that are more likely to succeed are:

- interventions based on a clear understanding of the barriers specific to the population of interest, identified in Section 3, Step 2;
- interventions based on activities that will directly address these barriers;
- interventions that are affordable, realistically implementable, acceptable by the target population and measurable (can be evaluated);
- interventions that are sustainable (they can be embedded into the routine programme rather than run and funded as a project);
- interventions that are rooted and designed according to a theoretical framework (ideally the same framework used in Section 3, Step 2);
- interventions that are designed or adapted specifically for the target population;
- interventions that are supported by policy (see Section 2) – including legislation, guidelines and service provision;
- interventions that address barriers identified through evidence rather than assumptions;
- interventions that involve the population of interest in their development;
- interventions that have evaluations planned at the design stage (where it is decided in advance how success will be measured, and what is considered successful).

Interventions based on barriers that are assumed rather than evidence based may be ineffective, or worse, have a negative impact. Box 2 contains examples of interventions that are unlikely to succeed in improving immunization equity, because they are not evidence based.

Box 2. Examples of immunization interventions that are unlikely to succeed in improving immunization equity

- An MMR information campaign (for instance, leaflets and posters) targeting a community where lack of knowledge has not been identified as a barrier.
- An HPV vaccination campaign encouraging men who have sex with men to come forward in a country where individuals from the lesbian, gay, bisexual, transgender, queer, plus (LGBTQ+) community are discriminated against.
- A vaccination campaign targeting a religious community using theological arguments for vaccination where barriers are actually logistical or related to access, rather than vaccine hesitancy.

Searching for evidence – fidelity versus adaptation

It is possible that examples of interventions seeking to address either similar barriers in vaccination in different population groups, or targeting a similar population group, exist and are described either in the peer-reviewed literature (manuscripts in scientific journals), or in the grey literature (reports from public health or other agencies and other sources not published in the scientific literature). Evidence around barriers or effective interventions in a particular context or a particular population may have already been summarized or synthesized in the form of a report, systematic review, or meta-analysis, such as for example in a systematic review by McCosker et al reviewing effective interventions to improve vaccination

in homeless people (54). It is essential to identify such evidence relevant to one's own context prior to designing or implementing an intervention, in order to better understand factors that have contributed to successes and failures; to emulate successful approaches and to avoid approaches shown to be ineffective. It may be advisable to contact individuals/authors who were involved in the design and implementation of relevant interventions, as they may hold valuable information not described in any publication. Accessing this information may increase the efficiency of the intervention you are planning and decrease its costs by avoiding expensive mistakes.

When identifying the evidence, it is important to consider that no two circumstances are exactly the same, and successfully addressing inequities in immunization in one population group, in one context, does not necessarily mean the same approach can be replicated in a similar group in a different context. For example, an intervention that improved vaccine coverage among a Roma community in Bulgaria may not be effectively applied to another Roma community in the United Kingdom. However, there may be lessons learned and elements from an intervention in Bulgaria that could help design an intervention for the United Kingdom. Using previous evidence to design a new, context-specific intervention requires being aware of the balance between fidelity (not compromising the theoretical basis of an intervention) and adaptation (bringing changes to the original design of an intervention to fit a new context). More details on how to strike the right balance can be found in a study by Pérez et al. (55).

Using a theoretical framework

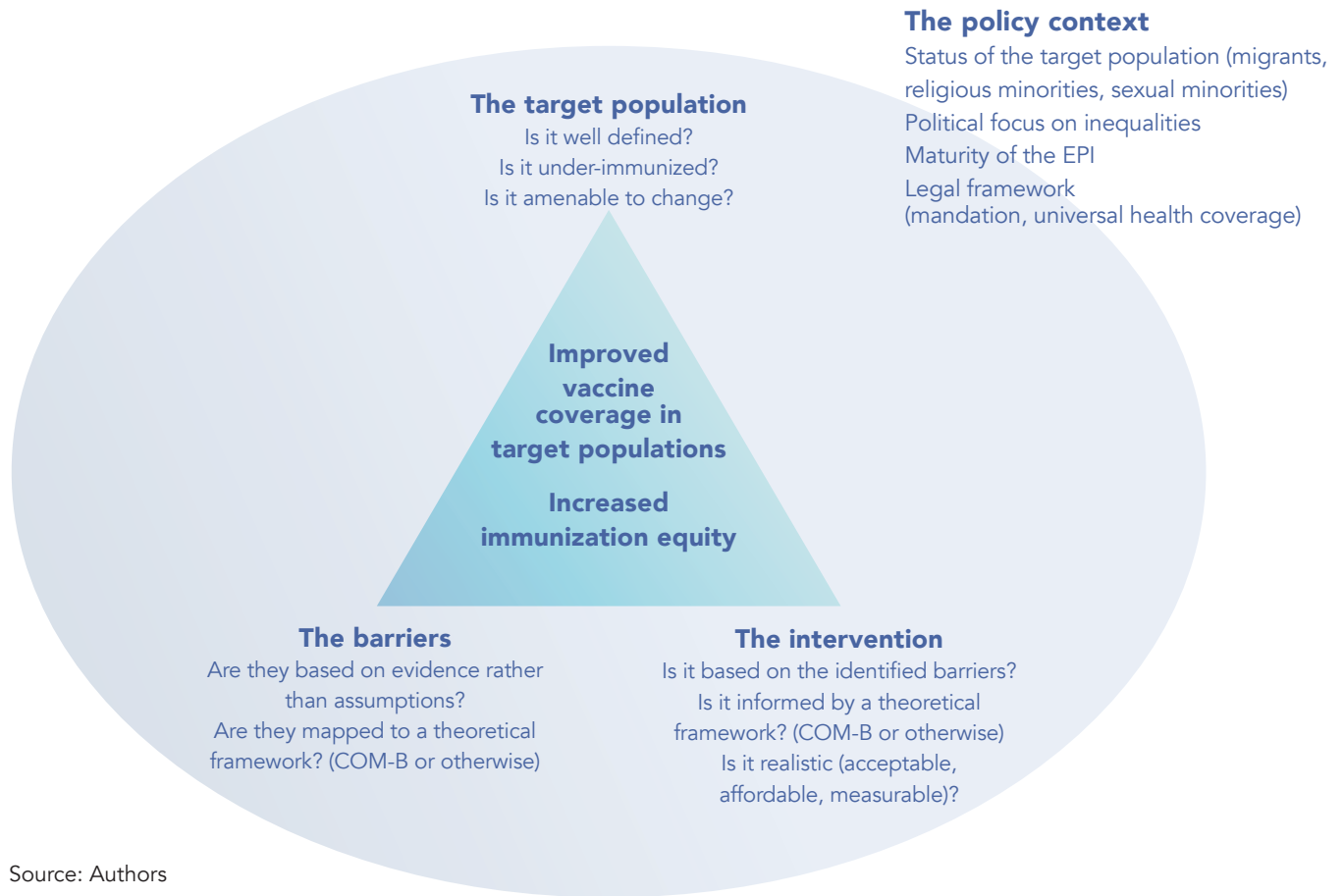
There are many frameworks commonly used for the design and implementation of public health interventions, including immunization (56). These include:

- RE-AIM (Reach, effectiveness, adoption, implementation, maintenance)
- EPIS (Exploration, preparation, implementation, sustainment)
- COM-B (Capability, opportunity and motivation for behaviour change).

Using a theoretical framework to underpin an intervention ensures a systematic and comprehensive approach; considers a range of factors, internal and external, that influence the outcome of the intervention; and overall increases the chance of the intervention being a success. The choice of one model over another depends on the particular context, and it is advisable to seek guidance and input from a team member with implementation science experience, where possible. There are also online tools such as the Dissemination and Implementation model web tools (57) that can support decision-making. There is, however, some overlap between these frameworks, and rigorous adherence to the approach outlined by one of the models may be more important than the choice of model. Examples of how these models have been applied to implement immunization programmes are available online (58, 59). The WHO TIP guide (24) describes in detail how to design an intervention based on realistic and affordable activities, matched to barriers identified through research, which addresses specific components of the COM-B model (see an example in Table 5). Because of the existing WHO guidance detailing how to apply COM-B to tailor an immunization programme, it may be advisable to use COM-B over other theoretical frameworks, unless there is specific local expertise in using another framework or a context-specific reason whereby using another model presents an advantage.

Fig. 10 describes how factors pertaining to the population, the barriers identified, the intervention and the policy context influence the likelihood of success of initiatives that aim to reduce inequalities in immunization.

Fig. 10. Factors influencing the success of immunization inequality initiatives



Source: Authors

Table 5. An example of how to map and document planned interventions

Goal	Barrier	Theoretical domain (COM-B)	Type of Intervention	Type of activity	Mode of evaluation	Indicator	Overall measure of success
To improve MMR vaccine coverage in migrant population X in country Y to national average	Clinics too busy and – health-care workers do not speak the language	Physical opportunity	Environmental restructuring	Extended clinic hours with interpreters	Data; questionnaires	Vaccine coverage; process data (number of attendances by time slots); patient satisfaction	Vaccine coverage among 15-month-old children in population X compared to general population; trends in coverage difference between population X and national average

Source: Adapted from the WHO TIP guide (24)

Defining success and indicators

Any intervention that is implemented should be designed in a way that can be evaluated, otherwise it is not possible to determine whether the intervention was a success or not. Indicators should be specific and measurable; how success will be measured should be decided at the time the intervention is designed and not once it is completed. See Section 3, Step 4 for further details on evaluating interventions

aimed at improving equity within the immunization programme. It is important to note that evaluating an intervention is not a substitute for active surveillance of the immunization programme and its equity.

Stakeholder mapping

The successful implementation of an intervention targeting a particular population requires buy-in and engagement from a range of stakeholders. The nature of the stakeholders, and the extent to which they are engaged, depends on the context and also the degree of influence and interest each stakeholder has. The power interest matrix (Fig.11) can guide the intervention team in classifying and managing stakeholders. The Middlesex London Health Unit's Engage stakeholders concept guide provides further guidance (60). Stakeholders will include the target group, health-care providers and any others who may have a specific interest in the target population, but not necessarily any official institutions; however, there may be stakeholders whose approval must be obtained even though targeting the group of interest for immunization is not their priority.

For example, if the objective is to improve vaccine coverage among recently arrived migrants, it can be helpful to engage a local nongovernmental organization that is focused on advocating for this community – who can provide insights and access to the population – as well as municipal authorities, even if they have other priorities, to seek authorization and avoid future legal or political barriers.

Fig. 11.
The Power–Interest Matrix
Source: Authors



Project management

Once there is consensus on what shape the intervention will take, who will need to be engaged and how it will be evaluated, a project management approach will help deliver an implementation according to objectives, on time and on budget.

A project management approach includes:

- breaking the project into manageable tasks (“workstreams”)
- assigning these tasks to individuals (“workstream leads”)

- assigning time limits for each deliverable
- identifying interdependencies
- anticipating problems and mitigation strategies
- continuously assessing progress and risks to the project.

Success of one deliverable may depend on previous deliverables being successfully completed, and a Gantt chart can help you visualize interdependencies and adjust timelines accordingly. In practice, the implementation of an intervention to reduce vaccination inequalities will require:

- a tool, that can either be a dedicated software application, or if such software is not available, a spreadsheet (Fig. 12);
- a project coordinator that gets updates from workstream leads, manages update meetings, anticipates issues and monitors and reports on progress; and
- regular meetings at which every workstream lead updates on progress from their workstream and the tool is updated.

Fig 12. Example of a project management spreadsheet^a

ID	DUE DATE	ACTIVITY / DELIVERABLE	RAG	UPDATE	DEPENDENCIES	INTERNAL PARTNERS & EXTERNAL ORGANISATIONS	RISKS/ISSUES	COMPLETION STATUS
CO1	30.10.2023	Identification of clinics serving the target population	GREEN					NOT COMPLETE
CO2	15.02.2024	Denominator estimated for each clinic	GREEN		CO1		IT system not in place	NOT COMPLETE
VO3								NOT COMPLETE
VO4								NOT COMPLETE
VO5								NOT COMPLETE
VO6								NOT COMPLETE
VO7								NOT COMPLETE

^a The different workstreams can be seen at the bottom, and activities within a selected workstream, including interdependencies, risks and objectives, can be seen in the relevant fields.

While each organization may use their own template, essential elements in the document include:

- a) a description of the project objective
- b) a breakdown of the activities/deliverables that need to be completed to achieve the objective
- c) clear accountability for each deliverable as well as the overall project
- d) the main risks/issues that threaten each activity as well as the overall project.

More complex projects may include additional information such as how different activities are inter-connected and the role of different stakeholders (see section on stakeholder mapping). Complex projects may also be divided into workstreams, with each workstream following the same structure. The project team should meet regularly to update the progress of each activity and whether each activity, and therefore the project, is advancing according to schedule. Colour coding such as RAG rating (Red/Amber/Green) where activities flagged as green are progressing according to schedule, amber are at risk of delay/non delivery and red at high risk of delay/ non delivery may help prioritise resources and attention.

Scalability

The management of immunization programmes is a continuous process, and interventions to improve equity within programmes need to be scaled and sustained to maintain any positive outcomes. While it is outside the scope of this document to offer guidance on scaling up from an intervention to a continuous programme, the following points should be considered when designing the intervention:

- Budget: what is the cost of the intervention? Can cost-effectiveness be demonstrated?
- Resources: what are the needs beyond money (in terms of staff and infrastructure)? Are these available and sustainable?
- Adaptability vs fidelity: could the intervention be simply increased in size and scope, or would scaling up require changes to the intervention? Would these changes alter the nature of the intervention?
- Policy environment: what are the competing priorities? How can national policy-makers be engaged on the topic? (see Section 2 for further details).

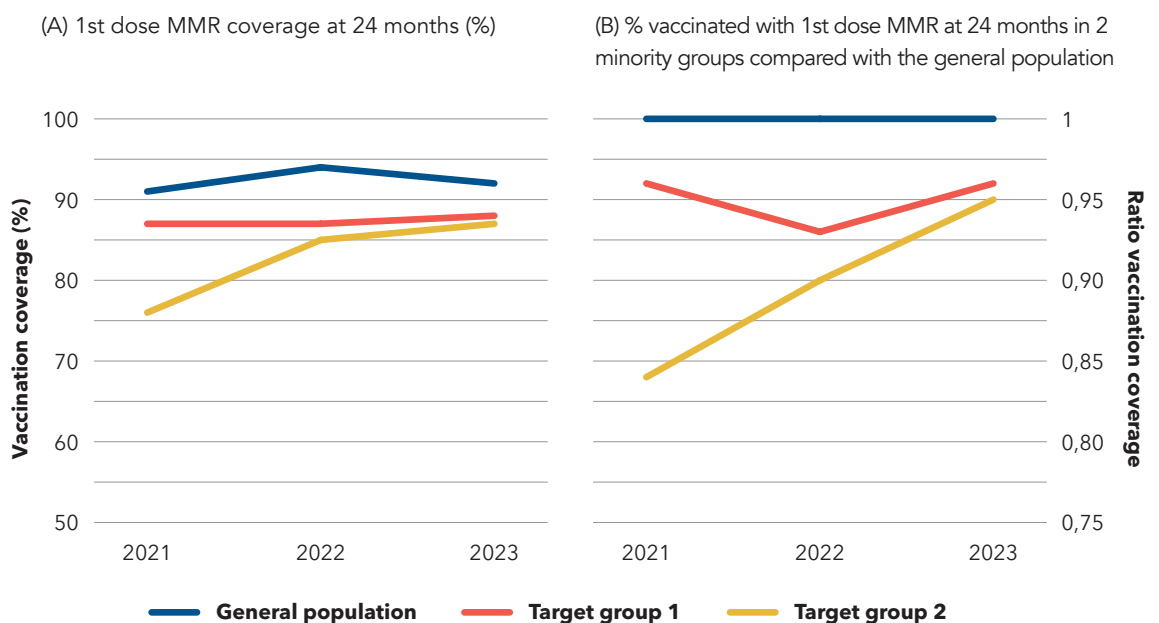
Step 4. Monitoring, evaluating and disseminating the impact of the interventions

Take away messages

- An intervention can be evaluated in many different ways – consider what the key attributes are that you want to evaluate, your budget and your timeline.
- There are many study designs that can be used to evaluate an intervention – consider them and choose the one most appropriate for your context. Seek collaboration if your intervention requires a more complex design.
- Make sure the results of evaluation reach those who need to know by devising a dissemination strategy.
- Following evaluation of the intervention, equity within the programme should be continuously monitored to understand the long-term impact of interventions and identify new and emerging inequalities.

Fig. 13 illustrates the use of vaccine coverage and coverage equity as indicators (using fictitious data). Both indicators are important but give different information. Between 2020 and 2021, MMR1 vaccine coverage in target group 1 was stable; however, because vaccine coverage increased in the general population, the ratio of coverage between the general population and target group 1, and therefore equity in vaccine coverage, decreased. By contrast, although vaccine coverage in target group 2 is consistently lower than the general population or than target group 1, it is the group that has progressed the most with regard to equity.

Fig. 13. The use of vaccine coverage (A) vs coverage equity (B) in the evaluation of an intervention to reduce inequalities in immunization (simulated data)



Source: Authors

Because of the delays in obtaining coverage data, it may be necessary to consider earlier indicators to evaluate whether an intervention has succeeded or not. These indicators can focus on the outcome of the intervention, or on the implementation process itself. Examples of indicators can include:

- satisfaction with the service from the target population and/or health-care service (using a survey or interviews);
- intention to vaccinate (before and after the intervention);
- acceptability of the intervention (from the target population and those involved in its implementation); and
- feasibility of the intervention (technical and/or economic evaluation).

None of these measures replace the ongoing monitoring of coverage among different population groups and of the magnitude of disparities between the target population and the general population or the baseline group. However, these indicators may provide early insight into the success of interventions. Regardless of what the outcomes being measured are, there are different study designs that can be used to obtain the relevant information. Each of these has pros and cons, and they are not mutually exclusive. Depending on the objectives, it is possible that several of these approaches are required. Table 6 summarizes approaches that can be used, their roles and limitations. It is beyond the scope of this document to provide detailed guidance about conducting each of these studies and expert opinion should be sought. As with Section 3, Step 2, collaborating with partners such as academics or FETPs may bring additional human resources and expertise.

Table 6. Study designs that can be used to evaluate interventions aimed at reducing inequity within immunization programmes

Type of study	Examples	Type of insight generated	Advantages	Disadvantages
Intervention studies	<ul style="list-style-type: none"> • Randomized control trials • Non-randomized trials • Cluster trials 	<ul style="list-style-type: none"> • Vaccine coverage • Numbers needed to vaccinate • Number of cases averted 	<ul style="list-style-type: none"> • Generates high-quality evidence • Limits bias 	<ul style="list-style-type: none"> • Can be long and expensive • Can be technically challenging (e.g. cluster sampling)
Observational impact studies	<ul style="list-style-type: none"> • Before and after studies • Time series analysis • “Natural experiments” (intervention vs non-intervention areas) 	<ul style="list-style-type: none"> • Vaccine coverage • Disease incidence 	<ul style="list-style-type: none"> • Can make use of routinely collected coverage and surveillance data • Cheaper than intervention studies 	<ul style="list-style-type: none"> • Prone to bias • Takes a long time to get results • Prone to ecological fallacy • Cannot exclude other reasons for observed changes
Economic evaluations	<ul style="list-style-type: none"> • Cost-effectiveness analysis • Cost-benefit analysis • Cost averted 	<ul style="list-style-type: none"> • Cost per quality-adjusted life year (QALY) • Money saved 	<ul style="list-style-type: none"> • Useful output for programme planners • Powerful argument for decision-makers 	<ul style="list-style-type: none"> • Requires expertise in health economics • May be based on assumptions when data is not available
Surveys	<ul style="list-style-type: none"> • Cross sectional surveys 	<ul style="list-style-type: none"> • Coverage • Satisfaction with services • Intention to vaccinate 	<ul style="list-style-type: none"> • Rapid • Relatively cheap to run • Can be repeated over time for trends 	<ul style="list-style-type: none"> • Prone to bias • Obtaining representative sample of population can be challenging • Intention to vaccinate does not always translate to vaccinations
Qualitative studies	<ul style="list-style-type: none"> • Semi-structured interviews • Focus groups 	<ul style="list-style-type: none"> • Changes in behaviour • Satisfaction with services • Perception of barriers and enablers • Perception of changes post intervention 	<ul style="list-style-type: none"> • Can capture in-depth information not captured in surveys • Can focus on patients and/or health-care workers • Gives option for interviewees to mention their own points 	<ul style="list-style-type: none"> • Not representative • Cannot measure impact of an intervention • May not be sufficient evidence for decision-makers

Dissemination strategy

Regardless of what approach is taken to evaluation, the results need to be disseminated to the relevant audience, which may include a range of stakeholders, such as:

- decision-makers within government or the health-care system
- public health professionals around the world
- the broader health-care community
- the target population.

Depending on who the audience is, it is important to think about the most appropriate communication channel to make sure the results of the evaluation reach them. These can include:

- peer-reviewed literature
- official reports
- briefings to relevant stakeholders (minister, director of public health etc.)
- social media
- traditional media, especially those reaching the population of interest
- posters, leaflets.

It is good practice to devise a communication strategy to decide who to reach and how to reach them. Depending on the scope, scale and reach of the intervention, communication can be handled within the immunization team, via the public health agency's or health ministry's communication team, or even outsourced to an external agency. What matters is that the intended audience is reached.

I have successfully evaluated my intervention – what happens next?

It is essential to think about inequity within the immunization programme as an ongoing issue that requires systematic, continuous monitoring. Addressing inequity within the programme is not a project with a beginning and an end, and just like achieving high vaccine coverage, equity needs to be worked towards and maintained. Therefore, when an intervention has been evaluated as successful and integrated into the national programme, returning to the first step (monitoring inequities) is essential to ensure that any improvements in equity are maintained, and to identify any other existing or emerging disparities between groups in the national population, whether these are defined according to ethnicity, religion, immigration status, or any other characteristic defined earlier. Thus, monitoring equity becomes embedded within the management of the NIP, and equity can be reported on a regular, ongoing basis, similarly to vaccine coverage. This guide provides several suggestions as to what indicators to use (see "How can data be analysed?" section). Encouraging Member States to consider equity monitoring as an integral and ongoing part of managing the NIP is one of the key objectives of this document.

Annex 1



Documents addressing inequities in immunization

Publications	Why relevant?
WHO publications	
TIP: Tailoring Immunization Programmes (24)	Step-by-step guide to developing interventions to improve vaccine coverage in identified groups
Rapid qualitative research to increase COVID-19 vaccination uptake: a research and intervention tool. (44)	Pragmatic guide to investigating barriers to vaccination in a population; focus on COVID-19 but applicable to all vaccines; useful templates and frameworks
Handbook on the use, collection and improvement of immunization data (draft) (34)	Practical guidance on immunization data management
Triangulation for improved decision-making in immunization programmes [website] (41)	Technical guide to making best use of existing data for decision-making in immunization programmes
SAGE April 2019 (26)	Outlines roles and responsibilities for using immunization data at different levels of the health-care system; offers recommendations and resources to improve data quality and use
Handbook on health inequality monitoring with a special focus on low- and middle-income countries. (40)	Comprehensive resource presenting health inequality monitoring concepts, aiming to promote the integration within health information systems
Inequality monitoring in immunization: a step-by-step manual (29)	Introductory guide to inequality monitoring in immunization, aiming to build capacity for the uptake and improvement of inequality monitoring practices in immunization
Inequality monitoring in immunization eLearning course (61)	eLearning course that introduces the general steps of inequality monitoring in immunization, which should be an integral part of a country's immunization programme
Health Inequality Data Repository (62)	The largest global collection of disaggregated data about health and determinants of health; includes immunization data
Health Equity Assessment Toolkit [website] (38)	Software application that facilitates the interactive exploration, analysis and reporting of health inequality data; includes immunization data
WHO Consolidated guidelines on HIV prevention, testing, treatment, service delivery and monitoring: recommendations for a public health approach (63)	Practical guidelines that include equity
A guide for conducting a situational analysis of immunization programme performance (64)	Suggests measuring equity as part of performance and suggests some indicators and how to measure them
Why gender matters: immunization agenda 2030 (16)	This document explains the need for mainstreaming of gender across the core principles and strategic priorities of Immunization Agenda 2030 (IA2030)

Behavioural and social drivers of vaccination: tools and practical guidance for achieving high uptake (51)	This guidebook supports the use of the behavioural and social drivers (BeSD) of vaccination tools to understand what drives uptake of vaccines. It is intended for immunization programme managers, research advisors and others who are collecting, analysing and using data for immunization programme planning and evaluation. Routine tracking of BeSD data will offer insights into how to continually improve programme implementation
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National publications

PHE immunization inequalities: local action plan template (65)	Practical guide aimed at the national and subnational levels
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Publications from other public health programmes

Global AIDS Strategy 2021–2026: End inequalities. End AIDS (UNAIDS) (66)	Example of how equity can be embedded in strategy
Getting to equity in obesity prevention: a new framework (National Academy of Medicine) (67)	Practical guidelines that include equity

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The WHO Regional Office for Europe

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