EFFECTIVE COMMUNICATION OF IMMUNIZATION DATA

ABSTRACT

The aim of this document is to encourage and support effective communication of data related to vaccine-preventable diseases, vaccines and immunization (collectively referred to here as 'immunization data'). It is written for staff of immunization programmes or related entities to help build their capacities and interest in optimizing data communication to further achievement of immunization targets and goals.

Abbreviations

DTP   diphtheria, tetanus, pertussis
GIS   geographic information systems
HPV   human papillomavirus
MMR   measles-mumps-rubella
NPAFP   non-polio related cases of acute flacid paralysis
SOCO   single overriding communication objective

Acknowledgements

CONTENTS

INTRODUCTION

The aim of this document is to encourage and support effective communication of data related to vaccine-preventable diseases, vaccines and immunization (collectively referred to here as immunization data). Whether you, the reader, work in a national immunization programme or related entity, and whether you are new to this task or an experienced data communicator, the authors hope the information provided will help you effectively share the important 'stories' contained in your data to the intended audience.

National immunization programmes generate, use, analyse and communicate an endless stream of data. Many people, within these programmes and beyond, depend on the data to guide their decisions, from elected officials who decide health system budgets to parents who make vaccination decisions for their children.

Those who compile and analyse data work hard to ensure the timeliness, accuracy and consistency of the numbers. But when (and if) the numbers are communicated to the 'outside' world, this tends to be with little thought or resources invested in optimizing this process to achieve an intended objective.

Immunization data

Immunization data cover a wide range of information collected on a daily, monthly and annual basis, and at health facility, district, national and global levels. Many datasets, including those listed in Fig. 1, are needed to administer immunization programmes, monitor and improve programme performance, monitor the effectiveness and safety of vaccines and to identify and respond to outbreaks of vaccine-preventable diseases.

Fig. 1: **Immunization data**
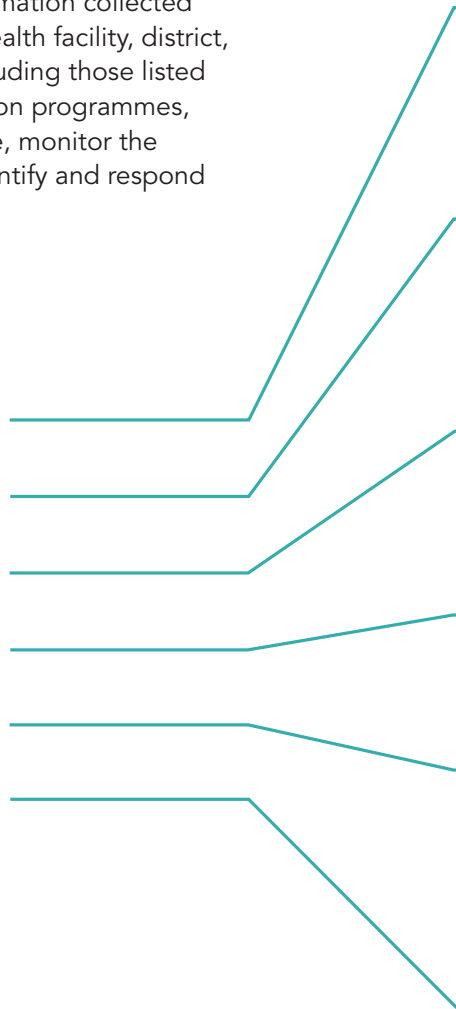
POPULATION DATA

- Enumerated by age group
- Enumerated new arrivals (migrants, asylum seekers)
- Enumerated unregistered residents
- Consideration of internal migration (rural to urban)
- Enumerated by district and health facility

SUPPLY DATA

- Vaccine doses purchased / distributed / administered
- Procurement projections and global supply
- Cost-effectiveness
- Price per dose
- Routine coverage per district / population group

SURVEILLANCE DATA

- Suspected and confirmed cases
- Imported and discarded cases
- Case-based data of confirmed cases: age, vaccination status
- Complications, hospitalizations and deaths

IMMUNIZATION SCHEDULES

- National
- Risk groups
- WHO recommended

VACCINE ADMINISTRATION

- Routine coverage per district / population group
- Coverage in supplemental immunization activities
- Coverage in catch-up campaigns
- Adverse events following immunization
- Wastage rate
- Contraindications

VACCINE SAFETY

- Safety profiles of vaccines / expected rates of adverse events
- Adverse events following immunization
- Vaccine production data
- Vaccine ingredients
- Peer-reviewed scientific findings

What is effective data communication and why is it important?

Communicating data can be a challenge. Your target audience is busy and may not get beyond the first glance at a presentation or first page of a lengthy report. Numbers can also be overwhelming for many people.

In today's information-rich and fast-paced world, we all increasingly expect visual aids and shortcuts to help us find meaning and translate complex information into simple-to-digest pieces. Our brains process visual information faster than words and we are highly effective in detecting changes and making comparisons between quantities, sizes, shapes and colours (1).

Visualizing data, by means of graphs, charts, icons, infographics and other formats (collectively referred to here as data visualizations), can help you communicate complex information clearly and efficiently, help your audience understand better and remember, or help persuade them to take the action you are aiming for. Even simple changes to the way data is presented could lead to a greater impact, whether this be better programme performance, increased funding or higher vaccination uptake. In the world of immunization that means protecting more people with vaccines and ultimately saving lives.

From numbers to communication products

The following chapters provide suggestions for creating effective data visualizations. An iterative process involving technical, communications and graphic design experts to collectively produce an optimal product is ideal. However, if collaboration with external designers is not possible, training to increase internal communication and graphic design capacities can be a cost-effective first step.

The information provided in this publication is based on generally accepted best practice, lessons learned by WHO and consulted experts, and published research. But taste is also subjective, so what works best in a particular context, for a specific target audience or even for two people in the same group can also differ. Focus group testing of any communication product is therefore recommended. If this is not feasible, consider sharing your products with as many colleagues, friends, family or others as possible. Anyone who is unfamiliar with the content can be a good judge of how well the information and messages are communicated. Someone who is not comfortable or used to working with numbers can be an especially useful source of feedback.

SECTION 1:
DEFINE

SECTION 2:
DESIGN

SECTION 3:
DISSEMINATE

SECTION 4:
WRAP UP AND RESOURCES

SECTION 1:
DEFINE

Before considering how to communicate, you will first need to **define what it is you want to achieve** (the objective), **what you want to communicate** (the story or message) and **who needs to hear it** (the target audience). Defining and then keeping these three in mind will help you stay on track as you work with large amounts of data and information.

You will normally start with a desired objective (such as new legislation) and work to ensure that the right target audience receives the information they will need (the story in the data) to make this change come about. Alternatively, imagine for example that you have discovered a story in your data (such as a spike in disease cases) that needs to be communicated. You will then have to decide who needs to know and what you aim to achieve by communicating the information to them. Or you may have identified a target audience (such as undervaccinated health professionals) and want to communicate relevant data to them (potential risk of nosocomial infection) to achieve an objective (ensure they understand the need to get fully vaccinated).

Fig. 2: **Process of effective data communication**

1
DEFINE

Story
Objective
Target audience

2
DESIGN

Format
Messages
Graphic elements

3
DISSEMINATE
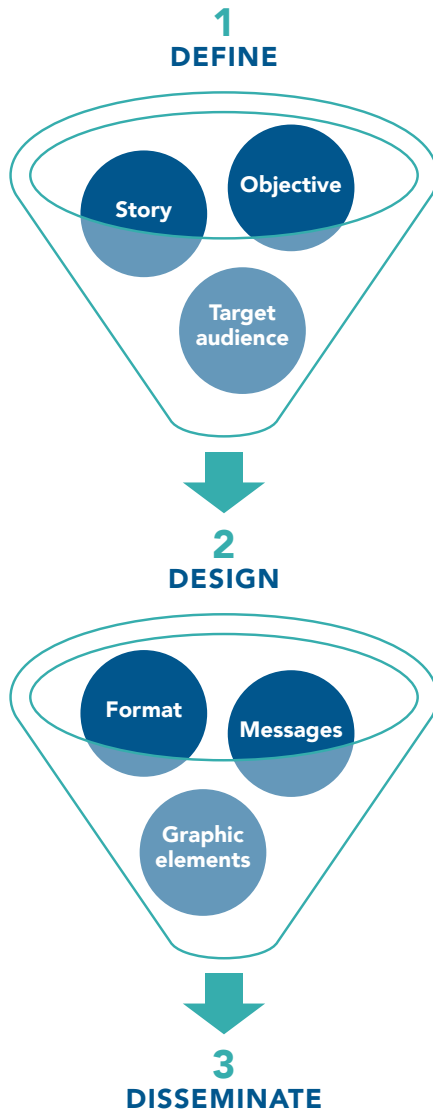
1.1 OBJECTIVE
What do you want to achieve?

One of the first steps in your communication process should be to establish the desired objective, which will guide the rest of your efforts. In the communications field, this is often referred to as the Single Overarching Communication Outcome (SOCO). The objective is the outcome or change you want to see as a result of your communication. By considering the objective first, it will be much easier to decide what needs to be included in your visualization and what format will work best.

The objective could be to ensure that a target group is well-informed, and thereby resilient to misinformation, or it could be to encourage immediate action such as to change policy, increase funding or vaccinate.

1.2 STORY
What information do you want to convey?

Before you decide how to present the data, you will need to think carefully about what you want to say with it. You may discover a story in a series of data points – it could be a trend, an outlier, an increase of cases or decrease of coverage. Or a story may be revealed when you compare multiple datasets. What conclusions can you draw? What risk or achievement does the data represent? What do you see in the data that you want to share with others?

Try explaining the story in words first. This will help you pull out the main message and potentially sub-messages that you want to convey.

Recognizing a story in the data

Imagine a scenario in which national coverage with the second dose of measles-containing vaccine in country X is 90%. This is the highest rate ever achieved in the country, however still below the 95% level needed to reach herd immunity. Subnational data also reveal that 2 of the 50 health districts in the country are reporting coverage below 75%. This includes a rural, sparsely populated district and a large urban area. The urban area includes a hospital where only 30% of staff are vaccinated against measles, according to a recent survey. There have been no measles cases in the country for the past 5 years, but neighbouring countries are experiencing a spike in cases. One such outbreak is spreading in an area with a major border crossing into one of the districts with low coverage in country X. Based on historic coverage and measles surveillance data, it can be calculated that at least 30 000 children and adults in these two districts alone are susceptible to measles.

The story revealed by these various sources of data is that *country X, and particularly two underperforming districts, is at risk of experiencing a large measles outbreak.*

Amid monthly reports of increasing national coverage and no measles cases, these district outliers may not have attracted any attention; and the underlying story may continue to be missed if the information is presented as another monthly table of national data to all stakeholders. A table will not convey the urgency of taking action to prevent an outbreak.

1.3 TARGET AUDIENCE
Who do you want to reach?

To be most effective in achieving the desired outcome, you will need to identify who you are 'speaking' to and choose a communication and presentation strategy that fits your audience best.

Your most important audience is the people whose behaviour can help you achieve your objective. Based on the example on the previous page, you may want political decision-makers to commit greater resources for immunization, healthcare professionals to get vaccinated to prevent nosocomial infections and parents in the districts or in the communities with lowest vaccination to vaccinate their children.

Alternatively, for a campaign to increase uptake of HPV vaccination, you will need to reach out to the target group of girls aged aged 9-14 and their parents. Teenagers are more involved in decisions about their health than younger children, so they will need to understand why vaccination against HPV at this age is important.

If the goal is to increase uptake of influenza vaccination among older adults, they will be the group you will be speaking to.

The more you know about those you will be communicating to, the better you can take into account their preferences, motivations, level of understanding and interest in the topic. This is especially important when communicating data. Every target audience will want to know 'how does the information affect me or my choices?' You may think you know a lot about your audience already, but some extra insights gained through audience research can go a long way.

Personas

In many fields, including graphic design, web design and marketing, communicators create audience profiles to help them focus on who they are talking to. A 'persona' is a detailed description of a fictive person representing a larger target audience. The description can include details such as age, family status, profession, interests, beliefs, political preferences, lifestyle etc. Not all individuals in the target group will share all these characteristics, however keeping this persona in mind as you create a communication product will help you stay on track and steer away from your own biases and preferences. To be effective, your messages need to be personally relevant to the people you are 'speaking' to. Several examples are described below.

Policy-maker

This is Pia. She began her career as a medical doctor and is currently a Member of Parliament. She is a strong proponent of vaccination. Thanks in part to her consistent support, the budget for the national immunization programme has remained steady despite an overall decline in the government's overall health budget in the past two years. Her party's platform prioritizes children's health and education.

Before taking action to influence policies and budgets, Pia needs to see the potential for political gain and evidence to support the need for change.

Healthcare professional

This is Ben. He is a paediatric nurse in a district hospital. When asked by parents about vaccination he refers them to their doctor, as he does not feel qualified to answer questions regarding vaccine ingredients, side effects or schedules. His own children are fully vaccinated, but he has no record of the vaccinations he received as a child and he does not get the annual flu vaccine.

To become more proactive in advising parents, he would need more training in vaccinology and communications. To change his own vaccination-related behavior he would need to know that he plays a vital role in disease prevention as well as care.

Parent

This is Natalia. She has a newborn and a 6-year old daughter. She maintains a healthy lifestyle, including making sure that she and her family have a balanced and nutritious diet. She has many friends who are also parents. Her 6-year-old daughter has received all recommended vaccines in the country's vaccination schedule so far, but she is thinking about not giving her baby the first dose of measles vaccine that is due soon, because she has heard stories from her friends about side effects of the vaccine. Natalia has not spoken to her baby's doctor about her concerns.

To choose vaccination, Natalia would need to know that it is the safest choice for her children.

Teenager

This is Julie. She is 14 years old and attends a secondary school, where she has many friends. Julie works hard at school and doesn't know yet what profession she wants to pursue when she gets older. Julie spends 1-2 hours per day on social media, mostly exchanging texts and photos with friends and following her favourite musicians and actors. She is in good health and generally not comfortable talking about diseases, or visiting a dentist or doctor. She is afraid of needles and any sight of blood.

Older adult

This is Georgi. He is 70 years old and a former farmer. Georgi has enjoyed good health throughout his life, and doesn't remember ever having had a serious flu or any other disease. Georgi has never had a flu shot. A friend said he got flu symptoms after getting the shot, so Georgi doesn't believe the flu vaccine is safe or necessary.

SECTION 1:
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SECTION 2:
DESIGN

Text, format and appearance of information all influence how engaging or persuasive a data visualization is and ultimately how successful it will be in helping you achieve the desired outcome. Research shows that combining text and illustrations increases the accessibility and understanding of information *(2, 3)*, especially when the text is technical or complex.

The following sections provide some tips for choosing a format and optimizing content and design.

2.1
Shaping the messages

In the example on p. 18, action is needed to avoid an outbreak. The available data would need to be communicated to different target audiences in different ways to achieve different objectives. The objectives for three target audiences could be formulated as follows:

- Policy-makers become aware of the risk posed by this suboptimal coverage and initiate action to prevent a large measles outbreak.
- Healthcare professionals are reminded of their key role in preventing a measles outbreak, so they take steps to mitigate the risks by advising parents to vaccinate and by being sure they are immune themselves.
- Parents trust that immunization is the right choice and bring their children's vaccinations up to date.

You will need to shape the key messages and numbers accordingly.

Consider also the voice: the language used should fit the 'speaker'. A government agency is expected to speak in a somewhat official tone, whereas a representative of a civil society organization or other speaker can use a more colloquial approach.

Patterns of perception and behaviour

Before designing a visualization aimed at influencing the target audience's understanding or behaviour, it may be useful to consider insights from the field of behavioural science.

People absorb and act on information in predictable patterns. By taking these patterns into account when shaping messages, you can better reach your target audience and maximize your chances of achieving a desired outcome *(3)*.

Behaviour change theories and applications are not new – they are one of the keys to successful marketing used by companies to draw our attention and convince us to buy their products. But they are underused in other fields, like public health, where they have great potential to help people make healthier choices and achieve better health and wellbeing *(4)*.

As an introduction to how behavioural science can help us communicate more effectively, some predictable patterns of behaviour are presented in this section.

Status quo bias and nudging

People don't like change. 'Status quo bias' is the tendency to favour decisions that maintain the existing state of affairs. By sticking with the current situation, people are in fact choosing the default option, but it does not feel like they are making a decision *(5)*. And the more choices they have, the greater their preference for the status quo.

To help overcome the preference for no action, the choice to take desired action should be made as easy as possible. 'Nudging' is based on indirect encouragement and enablement to make the 'right choices'. Nudges do not remove alternative options but make the 'right' choice more visible, desirable or easier *(4)*.

If your objective is to convince unvaccinated older adults (like 'Georgi' introduced above) to get vaccinated against flu, you will need to convince them to change the status quo. A poster or webpage explaining all relevant information – such as the general incidence of flu infection, risk of complications, data on the vaccine's effectiveness in the past several years, uptake among older adults and possible side effects – may be overwhelming, making it easiest for Georgi to take no decision at all, and thus remain unvaccinated. Alternatively, a simple graphic or standalone poster focused on the benefits of vaccination with instructions on where to get vaccinated may encourage him to view vaccination as the default option.

A preference for the status quo can also cause people to hold on to their existing beliefs and perceptions even when provided with evidence that disproves them. This complicates the task of debunking vaccination myths *(6)*.

Fig. 3: **Focusing on the benefits of vaccination can help people see it as the default choice**

"By protecting myself I am protecting her."

If you're 65 years or older, getting a flu shot is the best way to protect yourself and those around you from flu.

The flu benefit is a covered service for Medicare and for children enrolled in Medicaid and CHIP.

http://www.cdc.gov/flu | 1-800-CDC-INFO

©CDC

Framing effect

Choices can also be presented in a way that highlights the positive or negative aspects of the same decision, leading to changes in the choice's relative attractiveness. Framing theory suggests that how something is presented to the audience (called 'the frame') influences the choices people make about how to process and/or act on that information (7). For example, positively framed information regarding vaccine safety could lead to more positive attitudes toward the vaccine and potentially positive vaccination-related choices (8).

Imagine you would like to convince 'Natalia', the hesitant mother in the persona presented above, to vaccinate her child. Because she is more afraid of potential side effects of the measles vaccine than the disease itself, it is important to reassure her of the safety of the vaccine. Explaining that 'There is a 90% chance your child will experience no side effects' may be more effective than presenting the same information in a negative frame: 'There is a 10% chance that your child will experience some mild side effects.'
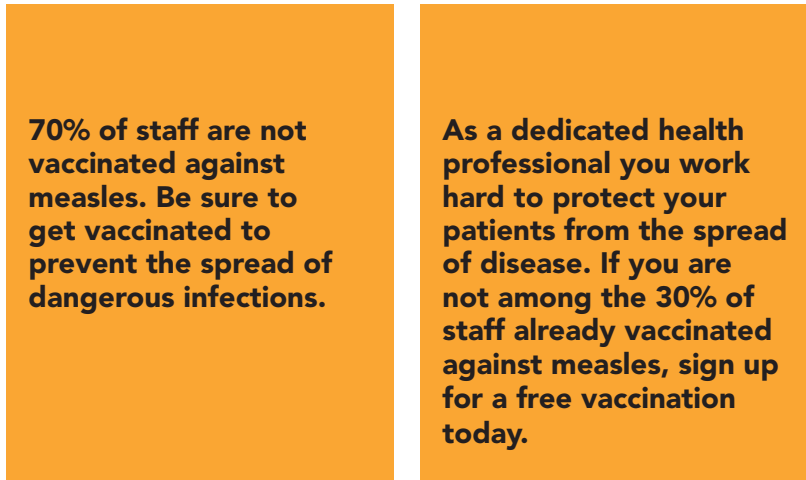
Positive reinforcement

Research shows that emotion plays an important role in decision making *(9)*. People need acknowledgement, appreciation and gratitude to be motivated. Positive reinforcement is the practice of praising good effort instead of, or in addition to, criticizing bad effort. It can increase the chances of a desired behaviour reoccurring in the future *(9)*.

When positive reinforcement is used, the focus is less on what people are doing wrong and more on what they're doing right. In the context of data communcation aimed at improving the performance of health professionals for example, it could help to praise or at least note what they are doing right, in addition to encouraging better performance.

In the case of 'Ben' and his colleagues, the text on the left in Fig. 4 may be less effective in convincing them to get vaccinated than the one on the right.

Fig. 4: **Motivation through positive reinforcement**

70% of staff are not vaccinated against measles. Be sure to get vaccinated to prevent the spread of dangerous infections.

As a dedicated health professional you work hard to protect your patients from the spread of disease. If you are not among the 30% of staff already vaccinated against measles, sign up for a free vaccination today.

Note that context plays an important role in how people respond to criticism and positive reinforcement. To be sure a campaign has the intended effect, it is always best to test the materials and messages among members of the target audience.

Subjective norm

The subjective norm is defined as a person's perception or opinion about what relevant groups or persons such as family members, friends, and peers believe the person should do (i.e., perform or not perform a behaviour in a specific situation) or general social pressure (10). Humans tend to follow the lead of others and are more likely to choose a behaviour that is the norm among their peers .

Social norms are known to have a strong influence on vaccination decisions. This supports the overwhelming majority of parents in choosing vaccination, but it also leads in some specific cases to clusters of unvaccinated children in select schools, religious or cultural groups.

2.2
Choosing and shaping the numbers

You have a story to convey and a mountain of data to back it up. A lot of work has gone into collecting and analysing the data at your disposal, but to clearly communicate the story you may not need to show all of the data. It is easy to overwhelm your audience with numbers and graphs.

For example, it takes a lot of data and calculations to determine that your country achieved 90% national immunization coverage against measles last year. To understand what this number represents, and to be motivated to take action, your target audience may not need to see all the data that supports it. Would the supporting information strengthen or actually dilute the message?

Data communication should be built on a solid base of high-quality data, but the final product should not include any extraneous information that is not key to telling the story. Paring down the information to its simplest form – stripping away the noise entirely – will increase the efficiency with which an audience can understand the message. But be careful: presenting simplified information to a technical audience can potentially cause frustration or even distrust.

■   Consider what can be removed rather than what can be added. Ask yourself: will these data help or hinder my audience in understanding and acting on the story in the numbers?

Fig. 5: **Narrowing down the numbers**

Data used to tell the story

Data relevant to the story

Available immunization data
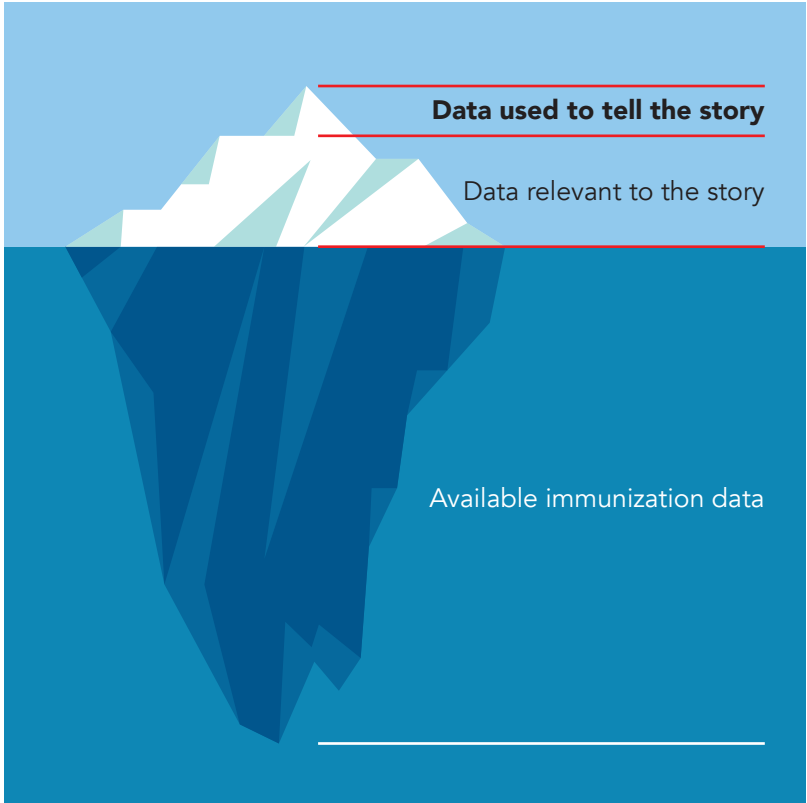
Once you have chosen the numbers, you will also need to consider how to shape them to fit the audience. The following tips may help.

- Consider your target audience's literacy and numeracy. Clear and straightforward numbers will be effective in conveying a complicated message. For example, '90%' is easier to register quickly than '21 209 (89.66%) of 23 655 children'. Rounding off numbers is preferred in most situations, but be sure to round off numbers consistently either up or down.
- For some audiences, natural frequencies may work better than probabilities or percentages. For example, '1 out of 100 can develop a fever following MMR vaccination', may be easier to understand and remember than '1% can develop a fever following MMR vaccination'.
- The right balance between accuracy and comprehension depends on your audience. Too many numbers can distract from the point or be overwhelming, but verbal abstractions (like 'rare', 'common', 'around') will not help those who want to understand the precise nature of what you are communicating. For example, 'Fever following MMR vaccination is common' may be enough information to reassure a worried parent, but a medical professional administering a vaccine will want to know the precise risk.
- Absolute risk or change is easier to understand and less likely to mislead than relative numbers. If you write that measles cases increased by 25%, your audience will be left guessing the significance of this change. An increase from 4 to 5 cases is less significant than an increase from 400 to 500.
- Consider also your target audience's positive or negative perceptions of a number to decide which format suits your objective (see p. 36).

Examples of shaped messages and numbers

In applying the above considerations to the personas in Section 1.3, you will want to make sure key messages and the data that support them are aligned with what *your audience thinks is important* and *what you want to achieve*. Focus on their motivations and where they feel a responsibility to act.

Let's assume you want to communicate the 90% coverage mentioned on p. 18 to the following target audiences.

Fig. 6: **Three potential target audiences (policy-makers, healthcare professionals, parents) and their motivations**

I need information and evidence to make policy.

I need to be well informed and motivated.

I need to know that vaccinating my child is the right choice.

- **Policy-makers**
  If you communicate that the immunization programme has achieved 90% vaccination coverage 'Pia' might think, 'that sounds great –almost 100%'. But if you want to highlight that action is urgently needed, to support a request for an increased budget, you might want to turn it around: 'With 1 in 10 children not receiving their second dose of measles, an additional 8000 vulnerable children will enter the school system this year.'

  This will be a more powerful message, especially since her party's platform prioritizes children's health and education.

- **Healthcare professionals**
  Health professionals have strenuous jobs with many demands on their time. To motivate them to do even more it might be better to use positive reinforcement by emphasizing the important role they play rather than focusing on the people who have been missed with scheduled vaccinations. Here a better message for 'Ben' might be:

  'Vaccination coverage in the country has reached 90% and continues to increase thanks to health care professionals, who are the first line of defense in preventing the spread of infections.'

- **Parents**
  According to the subjective norm pattern described above, it might be reassuring (and convincing) for 'Natalia' to hear that most of her peers are vaccinating their kids. The message to her could therefore be: '9 in 10 parents choose vaccination as the safest way to protect their children from measles.'

2.3
Format

With many format options available, it can be difficult to choose the one that will communicate your data and convey your message accurately and most effectively.

The aim of this chapter is to introduce a systematic approach to exploring format options. Whether you are just becoming familiar with this topic, or a seasoned data communicator, it is always best to try several options and compare the clarity and simplicity of the different outcomes.

Step 1. Presentation type

There are generally four classic presentation types to choose from, depending on the objective of the visualization. To choose a presentation type first decide whether you want to show a comparison, composition, a distribution or a relationship.
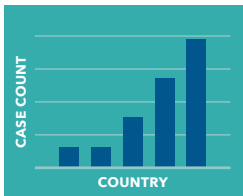
Comparison – used to show a comparison of two or more objects, phenomena or groups of data.
For example: measles cases across countries.
Common format types: bar chart, line chart.
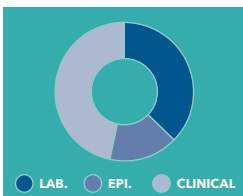
Composition – used to show how the whole is made up of several parts.
For example: reporting classification (laboratory confirmed, epidemiologically linked, and clinically compatible) of measles cases.
Common format types: pie chart, donut chart, tree chart, stacked columns.
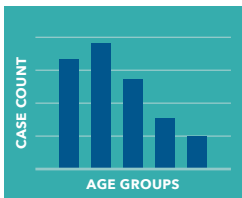
Distribution – used to display frequency, how data are spread out over an interval or are grouped.
For example: number of measles cases per age group.
Common format types: bar chart, histogram, box and whisker plot.
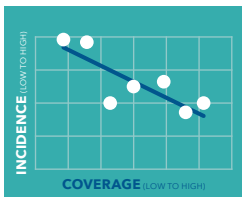
Relationship – used to show relationships and connections between the data.
For example: measles incidence and immunization coverage over time.
Common format types: line graph, Venn diagram, bubble charts, scatter plot.

Step 2. Format type

Within each presentation type there are countless format types, some of which can be used for more than one type of presentation. For example, a bar chart can be used to show comparisons, as well as compositions and distributions.

To help you decide which of the possible formats linked to the chosen presentation type is best suited to your needs, a few additional factors can be considered.

Number of variables and data points

Regardless of which presentation type you have selected, you will need to consider the number of variables and number of data points to be included. Table 1 shows examples of formats that work best for each category.

Each of the illustrated formats strives to communicate (what is often complicated) data as simply as possible by minimizing the complexity (colours and shapes) required to tell the same story.

SECTION 2: **DESIGN**

For example, multiple columns are a good option to distinguish between a small number of data points, but a larger set of points will be easier to plot and understand as one line on a line graph. A pie or donut chart can show how the whole is made up of separate variables, but it should not be used to compare more than eight variables and it cannot reflect variation within those variables.
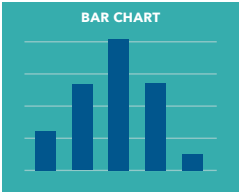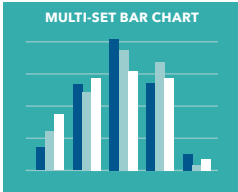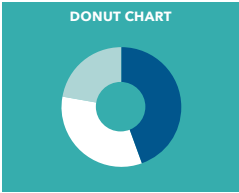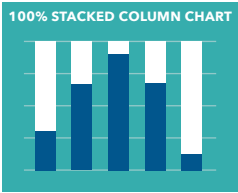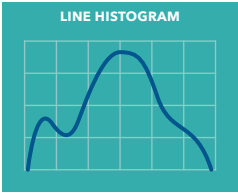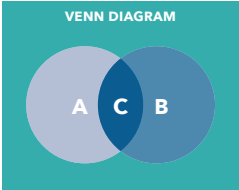
Fig. 7: **Donut chart**
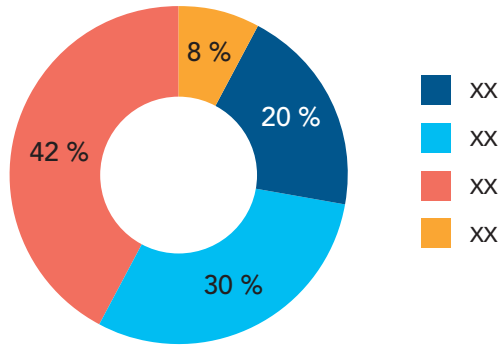
■ Good practice for pie or donut charts:
No more than eight pieces make up the whole; percentages always add up to 100%, and the first section starts at the '12.00' position.

The sub-components of the four variables can be better explored in a tree map; or if the variables and components are numerous, they can be illustrated in a stacked column chart. Venn diagrams are useful for simple relationships, but to illustrate multiple dimensions (variables) with one point (such as size, location, time) a bubble chart would work better; and to illustrate many data points a scatter plot could be used. Using a format type that is appropriate for the complexity of the data will not only minimize clutter in the visualization, but may also allow you to combine data sets and thereby reduce the overall number of visualizations needed.

Table 1: **Number of variables and data points help determine the most appropriate format**


|	BASIC	MULTIPLE VARIABLES	MULTIPLE DATA POINTS
COMPARISON	BAR CHART	MULTI-SET BAR CHART	LINE GRAPH
COMPOSITION	DONUT CHART	TREEMAP	100% STACKED COLUMN CHART
DISTRIBUTION	HISTOGRAM	BOX AND WHISKER PLOT	LINE HISTOGRAM
RELATIONSHIP	VENN DIAGRAM	BUBBLE CHART	SCATTER PLOT

Time and place

In public health, we are often concerned with exploring and communicating the occurrence of an event, so our visualizations sometimes need to answer who, when and where. Therefore, two other factors which require some attention are time and place.

Formats to illustrate the time variable
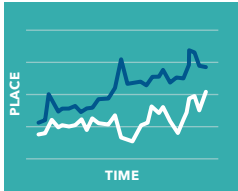
A line graph is an easily understood format used to display quantitative values over a continuous interval or time period. Lines are an effective way to show trends and how a variable has **changed over time**.
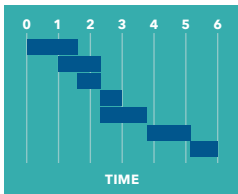
A simple horizontal bar chart can be used to depict **duration** with the rows representing each activity or event, the length of the bar representing duration, and the columns giving the time scale.

Formats to illustrate place variable

If your data includes a place descriptor, maps can be a powerful way to communicate your message. Two map examples are provided below – one to highlight **comparison** and the other to highlight **distribution**.
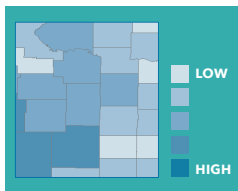
The choropleth map **compares geographical regions that are colored in relation to a data variable**. Advancements in charting software development have made mapping much more accessible to those without geographic information systems (GIS) software.

For resources and examples, see 'Design' in the Resources section on p. 90.
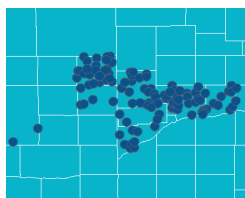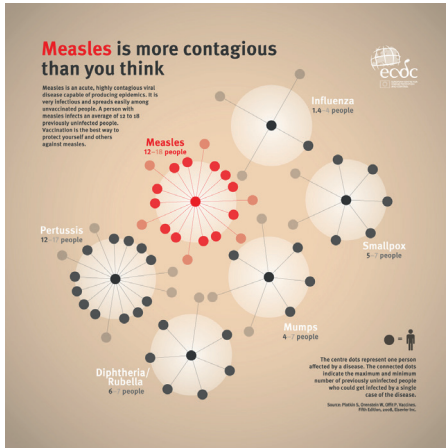
While not easily rendered without GIS software, the dot density map can be used for showing **distribution of data over a geographical region**.

Other factors that will influence your selection of a format are refenced elsewhere in this document. For example, the degree to which you can use colour (rather than only shades of grey) and the physical size of the desired output will help determine what is possible.

For a more extensive list of format options see 'Choosing and creating charts' in the Resources section on p. 90.

In addition to classic data presentation formats, consider also more creative representations that may be more effective in helping you achieve the desired outcome, especially if your audience is unfamiliar with data, or easily overwhelmed by charts and graphs. Infographics are a popular way to communicate complicated information to various audiences. They can be small and simple, communicating just one number on a social media tile, or long and complex, stretching into a lengthy poster. A designer can help you to develop a creative visualization of your data.

Fig. 8: **Examples of infographics**

©ECDC

©Measles & Rubella Initiative

■   Infographics allow you to illustrate numbers in creative ways and often include a call to action.

The chosen format and its intended use will of course inform what and how much text will be included and how the numbers will be presented. A poster presentation at a conference can hold more numbers and text than a social media tile. However, a poster that is intended to attract the attention of the general public as part of an awareness raising campaign should only comprise a minimal amount of text and numbers, as the viewer might only spend a few seconds looking at it. Whatever format you choose, make sure to include all the information needed for the audience to understand the story you want to tell and remove any details that do not contribute to this.

Developing communication products takes time and collaboration. To optimize the use of resources it may be useful to choose designs and formats that can serve as the basis for additional products in the future or multiyear campaigns or reporting. This will make it possible to use or adapt it to several platforms. A graph in a scholarly article can be used in an awareness raising campaign, presentation or even adapted for social media. If a more creative format is used, parts of a larger piece can be extracted for use on social media.

2.4
Design principles

Simplicity

A good design can help retain your audience's attention long enough for them to understand and absorb your main message. The most effective visualizations are compelling because they have one main message that is recognizable at first glance. After communicating this key message, the visualization can go on to provide additional information. Consider ending with a call to action, so that the audience is fully engaged in the content and understands why it is being communicated.

Most importantly, you do not want to make your audience work harder than necessary to understand the information you want to convey. A visualization that does not confuse, frustrate or inconvenience the audience will have a greater chance of succeeding in achieving the desired outcome.

Consider the following good practice tips.

- Remove clutter created by unnecessary layers, colours, shapes and effects, such as three-dimensional (3D) graphs. Every illustration, line or space should serve a purpose in providing necessary clues or in attracting and keeping the audience's attention (Fig. 9).
- It is easier to read horizontally than vertically. Although vertical or diagonal text is sometimes needed to label graph axes, avoid it where possible (Fig. 10).
- Group (or 'chunk') information where possible so that it is easier to remember (Fig. 11).
- Choose the format that is appropriate for the number of data points and variables (Table 1).

Fig. 9: **Extra effects**

AVOID
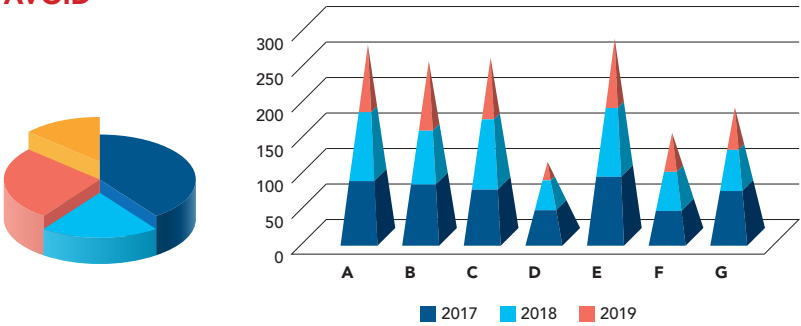
BETTER
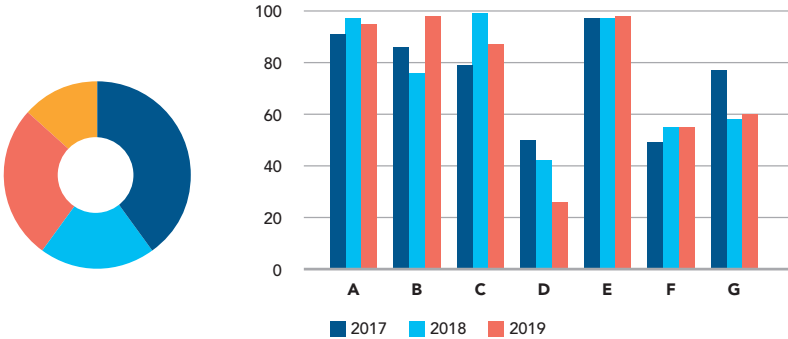
■ Avoid unnecessary effects like 3D, shading, bold or italics where it is not needed.

Fig. 10: **Horizontal presentation**

AVOID

Pertussis cases

BETTER

Pertussis cases per municipality
2014-2018
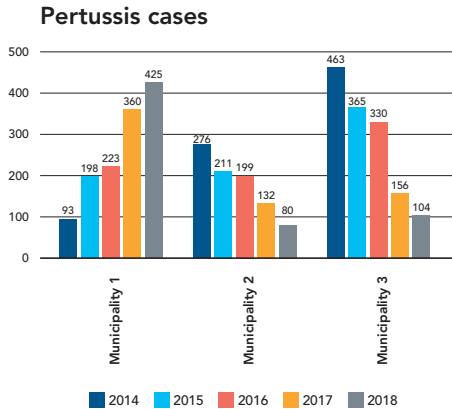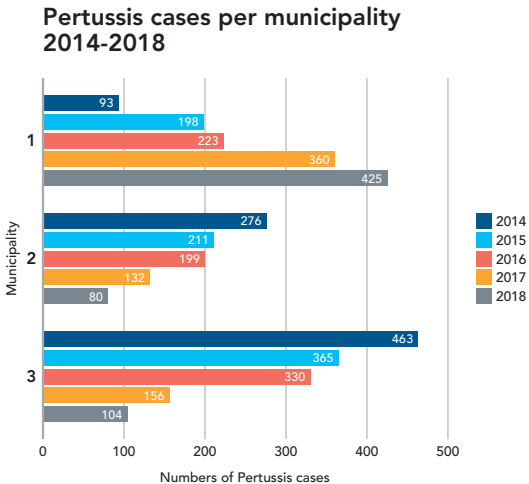
■   Help the audience by ensuring that all important information is clear and easy to find.

■   Most readers are accustomed to reading horizontally left to right, so consider making labels on the x-axis diagonal or horizontal if possible. If you wish to include data points consider switching the axes so that the numbers can be easily read.

Chunking effect

We can generally only keep 7 (plus or minus 2) things in our short-term memory at a time. By chunking information, that is, organizing and grouping separate pieces of information together so that they don't have to be considered individually *(11)*, we can remember more. Chunking is thus a short-term memory strategy.

In developing your visualization, try to identify similarities or patterns that can be used to group separate pieces of information into manageable units, so that the whole set, or just the main points, will be easier to remember.

Fig. 11: **Chunking to increase retention**

AVOID

Vaccination schedule for babies in country X:

Diphtheria (2, 4, 6 months)
Hepatitis B (birth, 1 month)
Measles (12 months)
Mumps (12 months)
Pertussis (2, 4, 6 months)
Polio (2, 4, 6 months)
Rubella (12 months)
Tetanus (2, 4, 6 months)

BETTER

Vaccination schedule for babies in country X:

Birth, 1 month:
    Hepatitis B

2, 4, 6 months:
    DTP (diphtheria, tetanus, pertussis)
    Polio

12 months
    MMR (measles, mumps, rubella)

■   The numbers and pieces of information will be much easier to remember in chunks.

Clarity

In communicating a story, you want to achieve something. In receiving the information, your audience wants to gain something – like knowledge, insight or maybe motivation. This is only possible if the main message is made loud and clear.

If the story you want to tell is hidden among many data points or competing messages it may be missed or forgotten. When presenting several data sets and major findings, consider ways to highlight the most important message and help the audience retain the specific information that serves your objective.
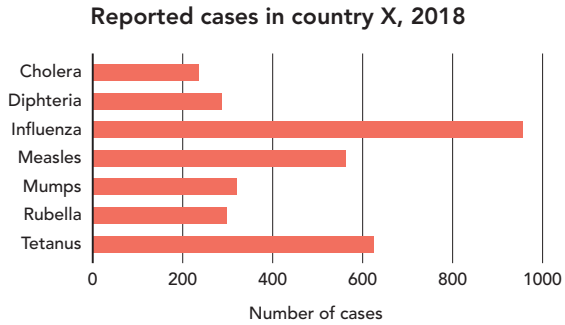
Remember, your audience has a short attention span. If they have to work to understand data and meaning, you will likely lose them quickly. To optimize the chances of achieving the desired outcome, make sure your data and message are clear. This sounds obvious, but as one quick web search will show, there are many ways to get it wrong!
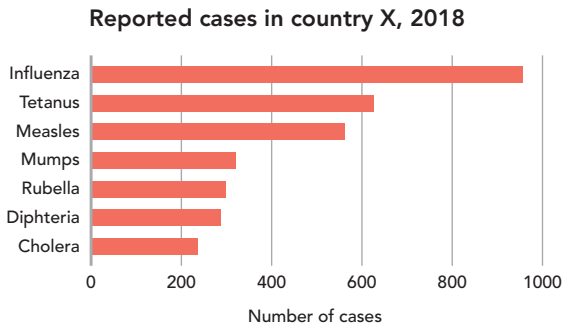
Consider the following good practice tips.

- The title of a graph or chart should clearly explain what information the chart or graph contains. Remember to include important parameters such as time period or location.

- If the exact number for a data point is important to the main or potentially a secondary audience, make sure the value is clearly labelled or can be determined from the context.

- Specify units of measurement.

- Make sure the legend to a map or graph is large enough to read.

- In a bar chart: order data from high values to low values, or vice versa (unless a different order is required, such as in a timeline) (Fig. 12).

- Consider visual weight: if a line is important make it stand out (with colour, pattern and/or thickness). If it is visible only for clarity or guidance make it thin and light (Fig. 13).

- Step back and look at what elements (if any) are dominant. Are they the elements that you want to emphasize? Does the story stand out from the rest (Fig. 13)?

- Where possible, smaller values should be on the bottom and higher values towards the top (Fig. 16).

- Organize content so that change progresses from left to right (Fig. 16).

Fig. 12: **Ordering values to increase comprehension**

Reported cases in country X, 2018

Number of cases

BETTER

Reported cases in country X, 2018

Number of cases

■   Order data from high to low values, or vice versa, rather than ordering according to alphabet or other factors. This allows the audience to see the hierarchy in values, even when the bar lengths are similar. In the upper chart, for example, it is not clear which is higher: the number of cases of diphtheria or of rubella.

Fig. 13: **Highlighting the story**

AVOID
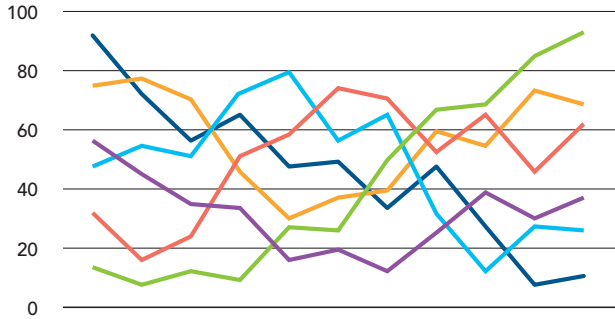
BETTER
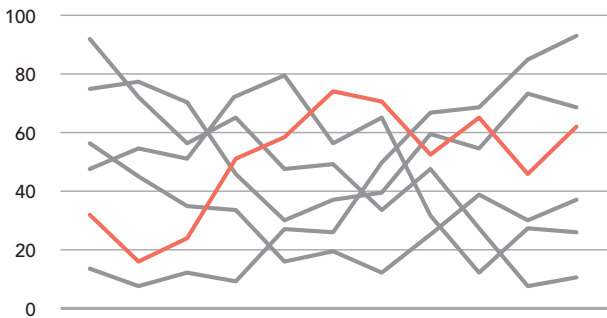
■ If every element has equal weight the main message will be lost.

Fig. 14: **Reducing clutter**

AVOID

BETTER

■ These two graphs show the same data, but too many lines and labels in the upper graph will make it difficult for the audience to find and remember the message.

Accuracy

Effective data visualization helps people understand the data and the story you want to tell. Creative design can help achieve this, but if it intentionally or inadvertently compromises accurac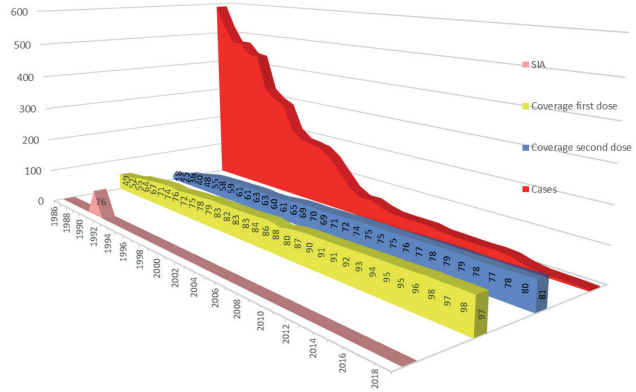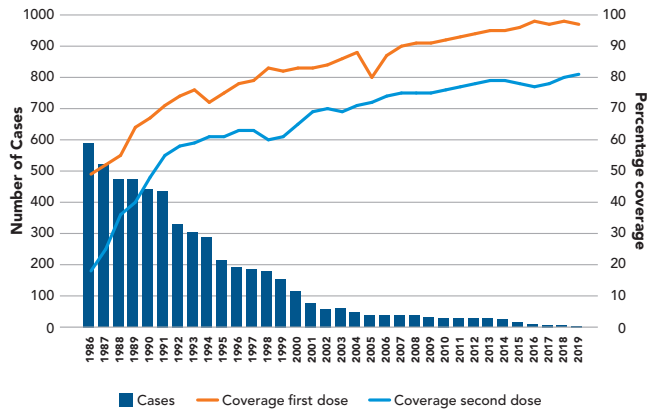y it can actually damage trust and reduce effectiveness. Following the below principles of good data communication can help ensure that your visualization is accurate and reliable.

- Be sure to provide a source for all numbers.
- If data are subject to change, include an 'as of' date.
- When presenting a series of numbers for comparison make sure they are based on the same criteria (e.g. time period, collection system, geographic area).
- Be consistent when rounding numbers up or down.
- The length of a line and the volume of a shape should accurately reflect the number it represents *(12)* (Fig. 15).
- A large number of shapes presented together with numbers suggests that the two are linked. Help the audience understand how they are linked, and if they are not, choose a different way to illustrate the message (Fig. 15).
- If using shapes to compare numbers, such as circles, make sure the relative difference in the numbers corresponds to the relative difference in the volume of the circles (Fig. 16).
- Ensure all data are accounted for, including missing data if relevant. Incomplete data can create uncertainty or misrepresent the facts, which may lead to distrust (Fig. 17).

Fig. 15: **Representation of numbers in shapes**

AVOID
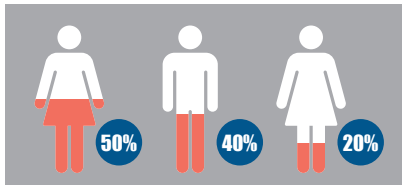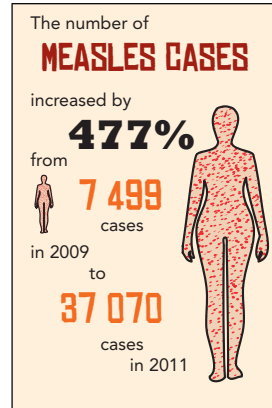
BETTER
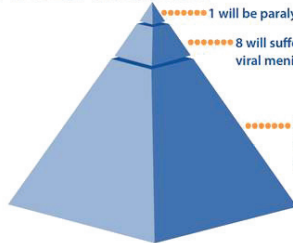
©CDC/GPEI

■ Shapes used to convey or compare numbers should accurately reflect the numbers or ratios they are intended to illustrate. It is not advisable for example to compare shapes whose volumes cannot be accurately calculated. In the above examples, sections of a pyramid are easier to calculate and compare than sections or multiples of a person icon. In Fig. 16 the difference in the volume of the circles should accurately reflect the difference in the numbers.

■ The number of shapes or icons should also correspond in some way to the numbers being communicated. In the banner on cervical cancer above, for example, it is not clear how the number of figures in the box relates to the numbers provided.

Fig. 16: **Visual conventions**

Pertussis in the WHO European Region

cases in 2013 — 28 170

63 037 — cases in 2017

124 %
increase of cases between
2013 and 2017

BETTER

Pertussis in the WHO European Region

63 037 — cases in 2017

cases in 2013 — 28 170

124 %
increase of cases between
2013 and 2017
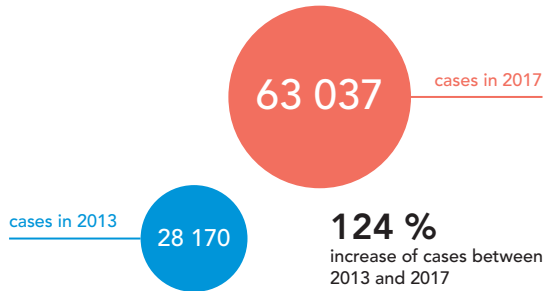
■ Remember that an illustration will be read from left to right, just as a text would be. Change should therefore progress from left to right. We are also used to looking up for something that is larger, so larger numbers should be placed higher than smaller numbers if possible.

Fig. 17: **Importance of indicating missing data**

AVOID

Polio vaccination status of NPAFP cases by year

BETTER
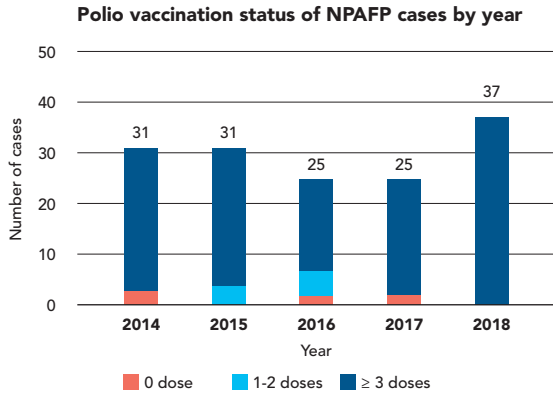
Polio vaccination status of NPAFP cases by year
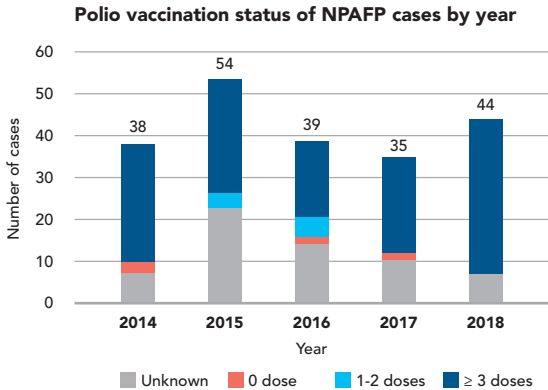
■ To give an accurate picture, it may be necessary to explain what you do not know. The above graphics relate to non-polio related cases of acute flacid paralysis (NPAFP) in country X. In the first example, it appears that nearly all of cases were fully vaccinated against polio. However, with the 'unknown' vaccination status category added in the second graph, it becomes clear that this may not have been the case.

2.5
Colours and patterns

Colour is not just an aesthetic choice, but also a tool to improve simplicity, clarity and understanding *(13)*. For example, shades of colour can be used to illustrate links between data points or progression. Poor use of colour, however, can make a visualization difficult to understand or even misleading. The following tips on choosing and using colours can help you use colour to your advantage *(14)*.

- Use the same colours or shapes for the same variables – do not reuse the same colour or shape for a different variable elsewhere if it can be avoided.
- Ensure there is enough contrast to preserve readability.
- Mind where your colours appear in relation to each other – if shades of one colour are shown far apart it will be difficult to distinguish between them. This is a common challenge on maps.
- Specific colours can have political or cultural connotations in a given context. Check with representatives of the target group about what colours you might need to avoid.
- Provide a colour key or legend to explain what the colours mean if appropriate.
- Too many colours, especially more than 7, in the same graph or chart will make it difficult to grasp the information quickly (Fig. 18). If it is not possible to limit the number of colours, choose another chart type or put data into categories.
- Generally, if using colour grading, light colours should represent low values and dark colours should represent high values (Fig. 19).

Fig. 18: **Choosing colours**

Reported cases in country X, 2018

Number of cases

BETTER

Reported cases in country X, 2018

Number of cases
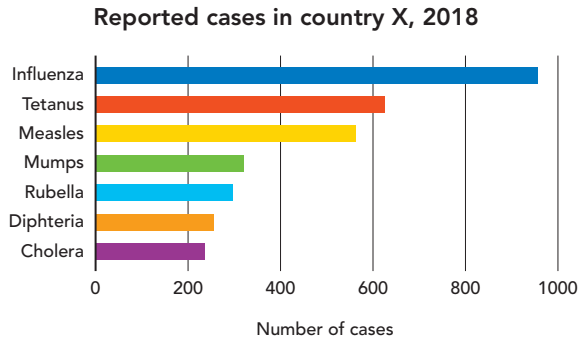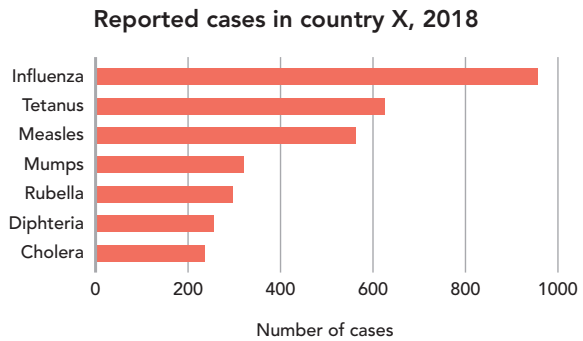
■   Avoid using multiple colours if they are not necessary. The complexity is distracting and the audience may search for meaning in the colours.

Fig. 19: **Grading colours**

AVOID
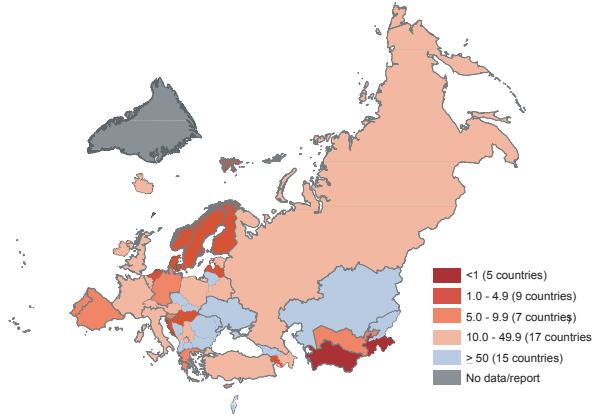
Measles incidence rates, WHO European Region, Jul 2018 to Jun 2019
(data as of 30 July 2019)

Legend:
<1 (5 countries)
1.0 - 4.9 (9 countries)
5.0 - 9.9 (7 countries)
10.0 - 49.9 (17 countries
> 50 (15 countries)
No data/report

BETTER

Measles incidence rates, WHO European Region, Jul 2018 to Jun 2019
(data as of 30 July 2019)

Legend:
<1 (5 countries)
1.0 - 4.9 (9 countries)
5.0 - 9.9 (7 countries)
10.0 - 49.9 (17 countries
> 50 (15 countries)
No data/report
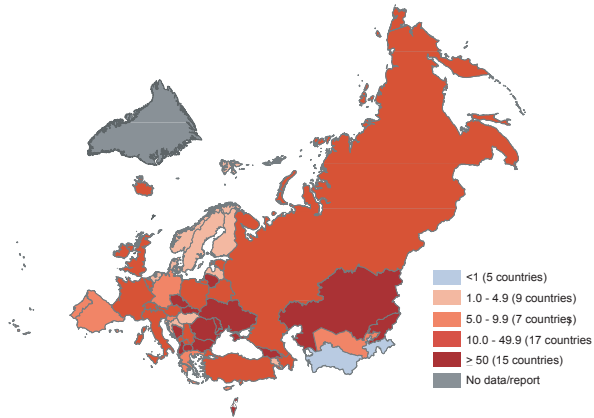
■ Colour grading can direct attention to the data you want to highlight. In this example it is good practice to make low numbers light and high numbers dark *(14)*.

Fig. 20: **Shaping design**

EXAMPLE 1   WHO/UNICEF coverage estimates for 1980-2018,
as of 1 July 2019 (Update of 2019/July/15)

Vaccine	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
BCG	●	●	●	●	●	●	●	●	●	●	●	●
DTP1	●	●	●	●	●	●	●	●	●	●	●	●
DTP3	●	●	●	●	●	●	●	●	●	●	●	●
HepB_BD	●	●	●	●	●	●	●	●	●	●	●	●
HepB3	●	●	●	●	●	●	●	●	●	●	●	●
Hib3	●	●	●	●	●	●	●	●	●	●	●	●
MCV1	●	●	●	●	●	●	●	●	●	●	●	●
MCV2	●	●	●	●	●	●	●	●	●	●	●	●
PCV3	·	●	●	●	●	●	●	●	●	●	●	●
Pol3	●	●	●	●	●	●	●	●	●	●	●	●
RCV1	●	●	●	●	●	●	●	●	●	●	●	●
RotaC					·	·	●	●	●	●	●	●
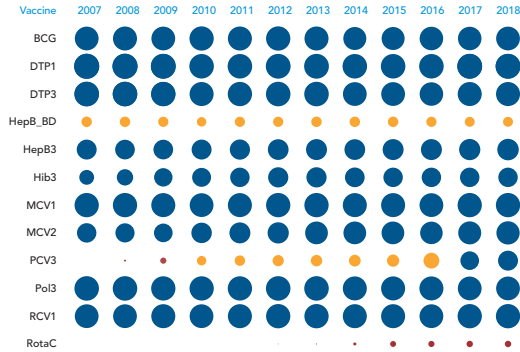
EXAMPLE 2   WHO/UNICEF coverage estimates for 1980-2018,
as of 1 July 2019 (Update of 2019/July/15)

Vaccine	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
BCG	93	94	94	95	94	95	94	90	90	92	92	93
DTP1	98	98	97	96	96	97	97	96	96	96	97	97
DTP3	96	96	95	94	95	96	96	93	93	92	94	94
HepB_BD	41	41	40	37	40	40	41	41	41	40	39	39
HepB3	78	77	77	78	79	81	82	81	82	82	83	84
Hib3	58	64	72	74	76	79	79	77	76	76	76	76
MCV1	95	95	94	93	94	95	95	94	94	93	95	95
MCV2	76	75	73	80	82	83	89	89	89	88	90	91
PCV3		8	24	37	41	44	45	46	48	62	73	78
Pol3	96	96	95	95	95	96	96	94	94	94	93	93
RCV1	93	93	94	93	94	95	95	94	94	93	95	95
RotaC	0	0	0	1	1	3	4	12	23	24	25	25

■   Similarly sized objects are difficult to distinguish. The illustration on the bottom therefore replaces circle size with the actual number.

■   Which version is better? This may depend on the desired target audience or outcome: the illustration on the top is useful for a quick overview that compares coverage between vaccines and clearly shows differences in when each was introduced into the national programme. This would be a better way to communicate these data if the desired outcome is to make policy-makers aware of the status of new vaccine introductions. The illustration on the bottom is more useful for a target audience interested in the actual coverage per vaccine.

Meaning of colour

Colour can have different meanings in different cultures. For example, a colour could be strongly associated with a political party or movement in a particular country and might need to therefore be avoided. Some colours, like those in a stoplight, are nearly universally attributed the same meaning, so it is best not to give them the opposite meaning in your visualization.

Red symbolizes warning or something negative.

Yellow symbolizes caution or a middle value that is neither positive nor negative.

Green symbolizes clearance or a positive value.

Colour vision deficiency and black-and-white printing

Approximately 1 in 12 men and 1 in 200 women in the world have some difficulty distinguishing between certain colours, such as between red and green, or between similar shades of one colour. Several steps can be taken to reduce the chance that some of your audience will miss or misinterpret your data. Make sure there is a variation of brightness and consider:

1) choosing colour combinations that are less likely to be confusing (avoid the red/green combination for example);

2) linking a symbol to each colour; or

3) including simple patterns to help emphasize difference *(15)*.

Fig. 21: **Considerations for accessible design**

STATUS ON PROGESS	
On track	
Not achieved	
Validation pending	
At risk	

■ Choose colour combinations that are clear to everyone, or add patterns or symbols to aid understanding.

■ You can use an online tool to make sure that people in your target audience with colour vision deficiency can distinguish the colours you have chosen. See 'Colour vision deficiency' in the Resources section on p. 91.

Another advantage of using simple patterns is that it will make your visualization understandable in black and white. Some people either do not have a colour printer or prefer to print in black and white. Since you will not have control over how the end product will be seen, it is best to keep black and white printing in mind in creating the design.

Patterns

Like colours, patterns can be used as a tool to increase clarity, but if not used wisely they can instead create confusion.

- While patterns may be added to improve clarity for colour vision deficiency and black-and-white printing, avoid patterns that do not serve any purpose. Excessive patterns make it difficult to distinguish between shapes and sizes at a quick glance, and they may distract from the main message (Fig. 22).
- Space is also an important consideration. For example, too little space between numbers or crowded content will make the numbers difficult to decipher. But too much space between data displays may make them difficult to compare (Fig. 22).
- Remove any lines that do not serve a purpose. If grid lines are needed for clarity, make them less prominent, for example by switching from solid to dotted lines and from black to a lighter shade of grey (Fig. 23).

Fig. 22: **Minimizing patterns and optimizing space**

AVOID

Measles catch-up campaign expenses

BETTER

Measles catch-up campaign expenses
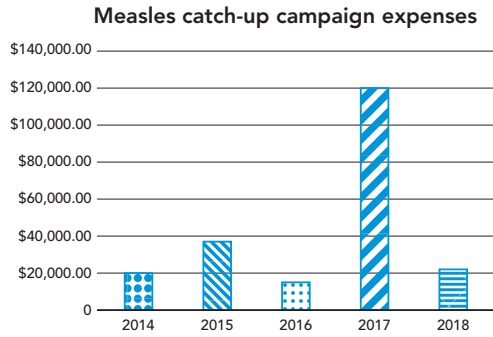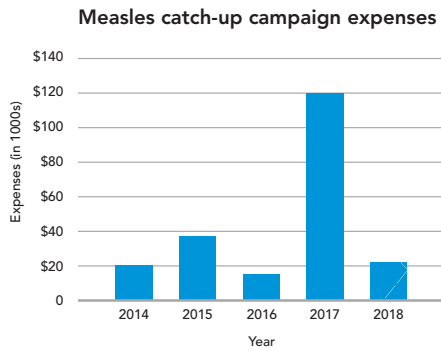
■ Remove any unnecessary digits on y-axis, patterns that create clutter and wasted space between the bars. The space between the bars does not need to be larger than half of the width of one bar.

Fig. 23: **Grid lines**

AVOID

Measles cases
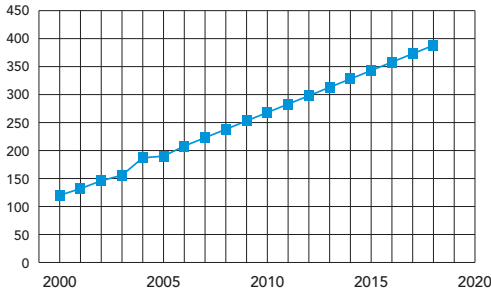
BETTER

Reported measles cases, 2000-2018
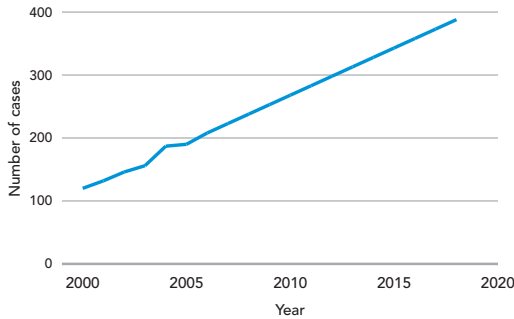
■   Unnecessary grid lines are distracting. Necessary grid lines can be faded to ensure the important information is most prominent.

■   While it is important to remove clutter, make sure to give the audience all the information needed to understand the numbers. A clear and comprehensive title, for example, will help the audience anticipate or understand what the data is showing.

2.6
Icons and photographs

Icons and photographs can make your visualization more attractive and accessible.

Icons

Icons are a common and easily understood visual language. If used wisely, they can grab attention quickly and help your audience follow your logic and understand the message. This means they should be simple, without excessive detail or 3D effects, and be easily understood.

Fig. 24: **Icon array**

9 out of 10 women infected with the rubella virus early in pregnancy will lose their baby, or it will be born with congenital rubella syndrome.

■ Icon arrays that present relative frequencies have been shown to improve the understanding of risk and reduce misunderstandings *(16)*.

The number of different icons used in one document and how they are used should be carefully considered. Too many or unnecessary icons will only distract and confuse. Also, icons associated with negative emotions or situations, or that depict a group unfavourably, can distract from your message *(17)*.

Many websites offer royalty-free icons and icon arrays or provide the option of designing your own. See 'Design' in the Resources section on p. 90.

Photographs

Photographs, especially of faces, are an excellent way to capture attention. Advertisers use this natural attraction to good effect by placing a face close to the words or products they want potential customers to remember. But care must always be taken when using photographs. Most organizations or government agencies have rules governing the sourcing and use of photographs. These usually include instructions for obtaining model consent, what may be shown in the photos and how they may be used. If allowed by internal rules, photographs can be purchased online from 'stock' photo companies. However, be aware that such a purchase does not usually grant the buyer exclusive rights to the photos. This means the photo could appear somewhere else, in an unrelated advertisement for example. Always check your institution's photo and copyright policies in advance.

In addition to internal rules and policies, in most cases it is also not legally permitted to reproduce visual materials from the internet without permission. Be sure to arrange permission in advance and always credit the owner of any externally sourced graphic illustration, icon or photograph.

When choosing photographs (or icons) avoid imagery that could have a negative emotional impact on the target audience (such as depictions of blood or syringes) and avoid any that may reinforce negative stereotypes (of older people or a particular minority group for example – see Fig. 25). Consider also the target audience and choose photographs taken in their context. Photographs that are clearly taken elsewhere will not make the target audience feel that the messages you are trying to convey relate to them personally. In this way the photographs will not support the objective of the communication product.

Fig. 25: **Negative and positive imagery in icons and photographs**

AVOID

Avoid icons that could evoke negative emotions (like syringes with blood and sharp needles) or that enforce negative stereotypes (like depicting an older person as frail).
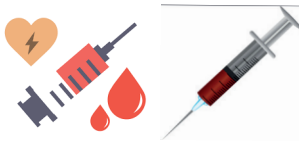
BETTER

Focus preferably on the protective aspect of vaccines. If a syringe must be used, make sure it is a 'softer' drawing.

■   In some cases an image may work better than an icon to reach the target audience. To convey the message that healthy older adults should get the flu shot, for example, the image on the right will be more effective than the demeaning icon on the left.

2.7
Working with a designer

Creating a quality product is an iterative process, ideally involving input from technical, communication and design experts. Often budgets are limited for communication and design, even though all three working closely together can make the most of available data.

Once you have identified the objective, target audience and data, and you have an idea of how the data should be visualized, a designer can help with the next steps. It can save time to find a designer who is familiar with the topics and/or experienced in visualizing data. Working together, you can develop a fruitful relationship, in which the designer fully understands the context of your work and the strategy you are pursuing to meet your objective.

Training of existing staff to create or improve standard graphs or social media tiles can also be a cost-effective investment.

The more detailed information the designer receives, the better the end product will be. In the annex you will find an example for a design brief template. This can help you compile all of the important information and share it with the designer.

Fig. 26: **Iterative design**

Technical & communications roles

Design roles

Collect data

Find the story

Define the audience

Draft messages

Refine messages

Visualize data

Design layout

Choose colours and fonts

Draw graphics

Prepare final product
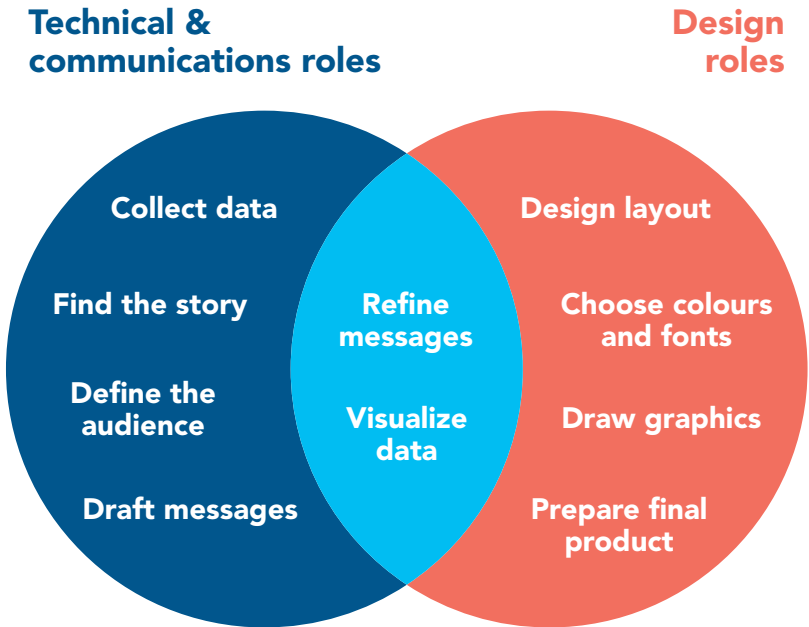
■ Some roles and responsibilities are shared between those who provide content and the person responsible for designing the final product. The middle, iterative part of the design process takes time, as it may involve several people and rounds of revisions.

SECTION 1:
DEFINE

SECTION 2:
DESIGN

SECTION 3:
DISSEMINATE

SECTION 4:
WRAP UP AND RESOURCES

SECTION 3:
DISSEMINATE

Data can be disseminated in many ways. It is best to put some thought into this before you start, because in some cases this will determine how much space you have to work with and thus how much information to include. The main question to guide you is 'where am I going to place it so that my audience will see it?' Once the product is completed, be sure to consider all possible ways for it to reach this chosen platform and thus the target audience, including distribution through existing networks, non-governmental organizations, professional associations, interest groups (e.g. parents' groups), bloggers, professional online discussion fora, etc.

Different platforms have different requirements. This section provides a few examples of how you might disseminate your data and what to consider in choosing the right platform. The examples given are not mutually exclusive, but can rather be seen as inspirations for data visualization that are applicable to one or several of the platforms.

Website

Considerations for visualization

Websites provide the opportunity to create subpages with separate, tailored content for different target audiences, and with various depths of information and technical detail. The use of animation, videos and interactive dashboards or databases can help visitors to a website find the stories you want to communicate and the background or data they need to understand them.

Possible target audiences

- Health care staff and administration
- Immunization programme staff
- Policy-makers
- Journalists
- Civil society groups

Inspiration and examples

1RE
CAUSE DE PNEUMONIE BACTÉRIENNE COMMUNAUTAIRE ET DE MÉNINGITE DE L'ADULTE

10 À 30 % :
MORTALITÉ ESTIMÉE

> 800 000
ENFANTS DE MOINS DE 5 ANS MEURENT CHAQUE ANNÉE DANS LE MONDE

© Sante Publique France

Antal fall: **43**

2018

© Public Health Agency of Sweden

Number of country introductions

PENTAVALENT — ROTAVIRUS

© GAVI

Social media

Considerations for visualization

Some target audiences will be difficult to reach if the dissemination plan does not include social media. Visualization of data is especially important in this platform in which your content will be competing for attention within a constant stream of information. Creative and colourful posts will be most effective in drawing people in. Animations and videos work particularly well (if the first seconds are compelling), and they increase the space available to communicate a story. Two-way communication enables you to interact with your audience – keep in mind that it requires sustained resources to respond to comments or questions that your audience might raise in reaction to your social media post.
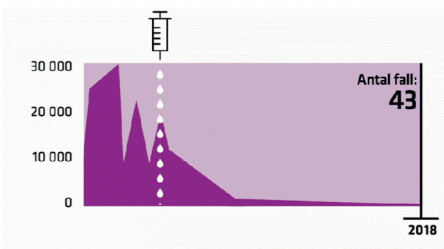
Possible target audiences
- Health care staff and administration
- Immunization programme staff
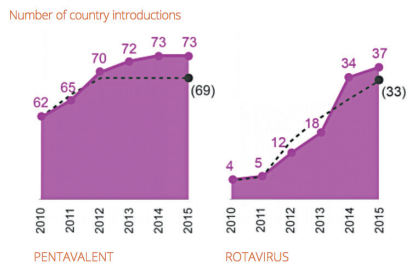- Policy-makers
- Journalists
- Civil society groups

Inspiration and examples

Report

Considerations for visualization
Written reports are usually text heavy. Visualizations using colour, icons or patterns can make them easier to read, draw attention to key numbers, and make information easier to remember for the readers.

Possible target audiences
- Policy-makers
- Health care staff and administration
- Journalists
- Technical experts
- Potentially also general public

Inspiration and examples

The website in figures

2.5 million users	16% increase in users to the entire site compared to 2017
1.5 million home page views	65 000 views of data and statistics page
350 000 downloads of key publication	25 000 respondents to pop-up survey on health-related behaviours
25 000+ views of June press release	61% of traffic from search engines
FR DE RU — 30% of all pages viewed are in languages other than English.	60% increase in visits to news pages compared to 2017

Presentation / poster presentation

Considerations for visualization

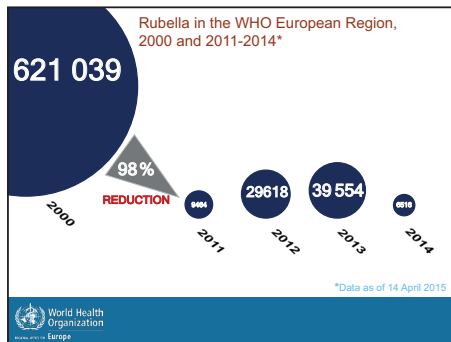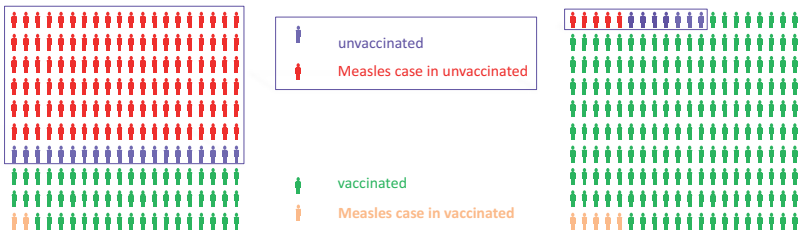Though you are speaking to a captive audience when presenting or displaying a poster at a conference or meeting, it can still be difficult to hold the viewers' attention. Try to reduce the written text on the slides or poster to a minimum. Visualizations can help you emphasize key numbers and make it easier for the audience to identify and remember important information.

Possible target audiences

- Health care staff and administration
- Policy-makers
- Scientists, epidemiologists, public health experts

Inspiration and examples

**With increased vaccine coverage
increased proportion of vaccinated cases is expected**

Rubella in the WHO European Region, 2000 and 2011-2014*

621 039

98 % REDUCTION

2000

9484 — 2011
29618 — 2012
39 554 — 2013
6518 — 2014

*Data as of 14 April 2015

World Health Organization
Europe

Training course

Considerations for visualization

Visual clues can make it easier to teach and understand new concepts. Breaking up lectures or study texts with animation, videos or other visualizations can also help hold the learners' interest and attention, emphasize key numbers, and make new information easier to remember.

Possible target audiences

- Health care staff and administration
- Policy-makers
- Journalists
- Technical experts

Inspiration and examples

7 Teams

Multiple national-level offices

6 Province Health Offices

12 District Health Offices

24 Health Facilities

Brochure

Considerations for visualization

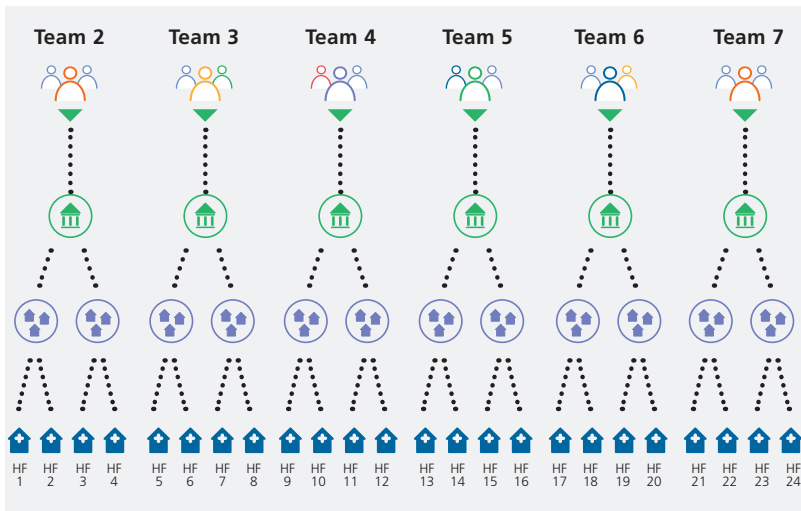Brochures usually require a balanced use of visualizations and text to convey all of the important information. Avoid text-heavy content that is not inviting to look at. If the brochure is intended to be folded, consider putting the main message and call to action on the front and back covers, and the supporting information and messages inside.

Possible target audiences

- Meeting or conference participants
- Specific target audience like expectant parents
- Health care staff
- Potential partners

Inspiration and examples

World Health Organization

CLOSE THE IMMUNIZATION GAP

SIX GOALS OF THE GLOBAL VACCINE ACTION PLAN

IMMUNIZATION AGAINST DIPHTHERIA, TETANUS AND PERTUSSIS

Target
90% Immunization coverage with 3 doses of diphtheria, tetanus and pertussis vaccines

Gap: **65 countries**
18.7 million children unvaccinated

MEASLES MORTALITY REDUCTION

Target
At least 4 WHO Regions to eliminate measles in 2015

Gap: **15%**
15% of all children not being immunized with one dose. Only one Region has eliminated measles

RUBELLA ELIMINATION

Target
Eliminate rubella from at least two WHO regions in 2015

Gap: **1/2**
Half of all children do not receive the rubella vaccine

MATERNAL AND NEONATAL TETANUS ELIMINATION

Target
Eliminate maternal and neonatal tetanus in 59 priority countries

Gap: **21 countries**
21 countries have not yet eliminated maternal and neonatal tetanus

POLIO ERADICATION

Target
A world free of polio

Gap: **2 countries**
Remain polio endemic

USE OF NEW OR UNDERUTILIZED VACCINES

Target
90 At least 90 low- and middle-income countries introduce one or more new or underutilized vaccine

On **TRACK**
86 low- and middle-income countries added at least one new or underutilized vaccine

IMMUNIZATION FOR ALL THROUGHOUT LIFE

WORLD IMMUNIZATION WEEK 2016
www.who.int/campaigns/immunization-week/2016/en

Meeting visual (banner, roll-up)

Considerations for visualization
Each roll-up or banner should ideally comprise one main message that can be easily identified by the audience either through its content or design. Use visualizations to attract the participants' attention, and be sure to reduce the text to a minimum.

Possible target audiences
- Health care staff and administration
- Policy-makers
- Scientists, epidemiologists, public health experts
- Journalists

Inspiration and examples
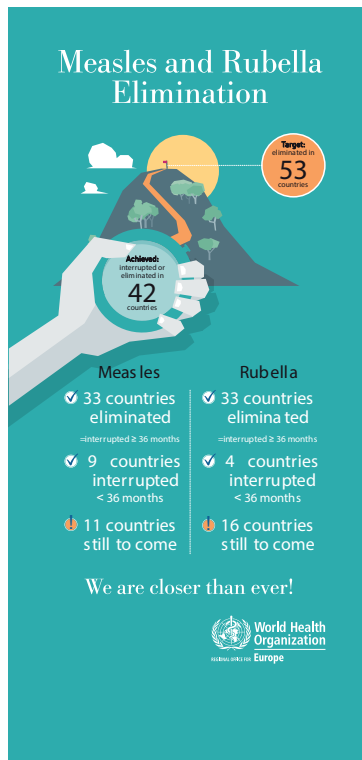
Note: 2016 data

Press packet (for press conference)

Considerations for visualization

A press packet should help journalists quickly find and understand the data and facts they need. Visualizations help guide the focus, emphasizing key numbers you want them to see and making technical information easier for them to understand and communicate to their readers/viewers.

Possible target audiences

- Journalists
- Media users
- Policy-makers

Inspiration and examples

Routine immunization profile
Sweden

World Health Organization
REGIONAL OFFICE FOR **Europe**

Progress towards achieving European Vaccine Action Plan goals, 2017

Goal	Indicator	Status	Goal	Indicator	Status
1	Sustain polio-free status[a] *(Current risk)*	Yes *(Low)*	4	Meets vaccination coverage targets	Yes
				DTP3 national immunization coverage ≥95%[d]	Yes
				≥90% DTP3 coverage achieved in ≥90% of districts[e]	Yes
2	Measles elimination status[b]	Eliminated	5	Make evidence-based decisions about introduction of new vaccines[*][f]	Yes
	Rubella elimination status[b]	Eliminated		NITAG made a recommendation about PCV	No
				NITAG made a recommendation about RV	Yes
				NITAG made a recommendation about HPV	Yes
3	Control hepatitis B infection[c]	Validation pending	6	Achieve financial sustainability of the national immunization programme[**][c]	Yes

*New vaccines introduced or not introduced based on NITAG evidence-based recommendations
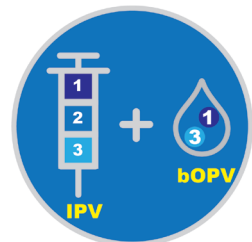**Country self-sufficient for procuring routine vaccines

Demographic, income and health expenditure summary, 2017

Total Population[f]	9 910 701
Live births	121 221
Surviving infants	120 981
<5 years	589 973
<15 years	1 737 836
Neonatal mortality rate (per 1000 live births)[f]	1.7
Infant mortality rate (per 1000 live births)[f]	2.3
Number of districts[e]	290
GNI (per capita, in USD)[g]	52 270
Health spending as % of total government expenditure[g]	18

Immunization schedule, 2017[a]

3M	DTaPHibHepBIPV, PCV
5M	DTaPHibHepBIPV, PCV
12M	DTaPHibHepBIPV, PCV
18M	MMR
5Y	DTaPIPV
6-8Y	MMR
10-12Y	HPV (2x)
14-16Y	Tdap

Pre-switch
All 3 poliovirus types in OPV

IPV + tOPV
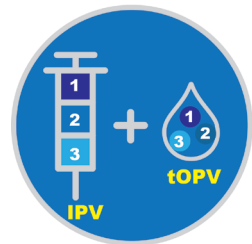
Post-switch
Only 2 poliovirus types in OPV

IPV + bOPV

SECTION 1:
DEFINE

SECTION 2:
DESIGN

SECTION 3:
DISSEMINATE

SECTION 4:
WRAP UP AND RESOURCES

SECTION 4:
WRAP UP AND RESOURCES

The aim of this document was to introduce several concepts that can help you see the immunization data at your disposal somewhat differently, present it in a way that fits your target audience, and utilize it better to achieve short or long-term objectives. This guidance is in line with an increased global focus by WHO and international partners on the vital role played by data in the fight against vaccine-preventable diseases.

While the document only scratches the surface of much broader fields, including data management, communications and psychology, it offers a first concrete step to significantly increase impact. Even small changes in presentation can make the difference between a missed opportunity and a successful call to action.

The following free online resources can provide more depth and detail related to the concepts discussed, as well as tools to help create effective data visualizations. This list is not exhaustive, nor based on any comprehensive quality assessment of available resources and tools. Rather it is intended as a good place to start for inspiration and to learn more about effective communication of data.

Resources for inspiration

Data

What is high-quality data?

Article
Bloland P, MacNeil A, 2019. Defining & assessing the quality, usability, and utilization of immunization data. *BMC Public Health*, 19: 380.

Why visualize data?

Data visualization beginner's guide: a definition, examples, and learning resources
www.tableau.com/learn/articles/data-visualization

Article
Dilla WN, Raschke RL, 2015. Data Visualization for fraud detection: Practice implications and a call for future research, *Intl Journal of Accounting Information Systems* 16: 1-22
http://cis.bentley.edu/vmrs/wp-content/uploads/2016/04/Dilla-Raschke-IJAIS-2015.pdf

Technical report
Measles and rubella elimination: communicating the importance of vaccination. ECDC, 2014
https://www.ecdc.europa.eu/en/publications-data/measles-and-rubella-elimination-communicating-importance-vaccination

Immunization data

Imunization data, statistics and graphics, WHO
www.who.int/immunization/monitoring_surveillance/data/en/

Measles and rubella monthly surveillance data, WHO/Europe
http://www.euro.who.int/en/health-topics/disease-prevention/vaccines-and-immunization/data-and-statistics

National immunization coverage scorecards estimates for 2017, WHO, 2018
https://apps.who.int/iris/bitstream/handle/10665/276969/WHO-IVB-18.12-eng.pdf?ua=1

Report of SAGE working group on quality and use of immunization and surveillance data, WHO, 2019
www.who.int/immunization/sage/meetings/2019/april/2-SAGE_report_master_11March2019_NO_Refs.pdf?ua=1

Communication

Audience   *Article*
Schmidt KL et al., 2008. Targeting or tailoring? Maximising resources to create effective health communications, 28: 32-37 www.ncbi.nlm.nih.gov/pmc/articles/PMC2728473/

Presentation
Makulec A, 2014. Identifying your audience and finding your story, JSI Center for Health Information, Monitoring & Evaluation
https://www.slideshare.net/AmandaMakulec/identifying-your-audience-40086476

Statistical literacy   *Article*
Gigerenzer G et al., 2008. Helping doctors and patients make sense of health statistics, Association for Psychological Science, 8:2
http://library.mpib-berlin.mpg.de/ft/gg/GG_Helping_2008.pdf

Free data and teaching resources: Gapminder
www.gapminder.org

Risk communication   *Article*
Trevena L et al., 2013. Presenting quantitative information about decision outcomes: a risk communication primer for patient decision aid developers. BMC Medical Informatics and Decision Making 13 (Suppl 2): S7.
https://bmcmedinformdecismak.biomedcentral.com/track/pdf/10.1186/1472-6947-13-S2-S7

Design

**Free online
design tools**

Graphic design: Canva
www.canva.com

Chart gallery: Google
https://developers.google.com/chart/interactive/docs/
gallery

Charts, maps and tables: Datawrapper
www.datawrapper.de/

Visualizing spreadsheets: RAWgraphs
https://rawgraphs.io/

Statistical computing and graphics: The R Project
www.r-project.org

Vector graphics software: Vectr
https://vectr.com/

Icon displays for communicating risk: Iconarray
www.iconarray.com/

**Choosing and
creating charts**

Data visualization principles and chart types
https://material.io/design/communication/data-visualization.
html#style

Data visualization – How to pick the right chart type?
https://eazybi.com/blog/data_visualization_and_chart_
types/

How to create map charts in Excel: Microsoft
https://support.office.com/en-gb/article/create-a-map-
chart-in-excel-f2cfed55-d622-42cd-8ec9-ec8a358b593b

*Guidelines for presentation of surveillance data.
Stockholm: ECDC, 2018*
https://ecdc.europa.eu/sites/portal/files/documents/
Guidelines%20for%20presentation%20of%20
surveillance%20data-final-with-cover-for-we..._0.pdf

The Data Visualization Catalogue
https://datavizcatalogue.com/index.html

*Data visualization design process: A step-by-step guide
for beginners*
https://depictdatastudio.com/data-visualization-design-
process-step-by-step-guide-for-beginners/

Choosing colours	*Article* Stone M. n.d. Expert color choices for presenting data www.stonesc.com/pubs/Expert%20Color%20Choices.pdf
	Article Few S, 2008. Practical rules for using color in charts www.perceptualedge.com/articles/visual_business_ intelligence/rules_for_using_color.pdf
Colour vision deficiency	*Automatic colour check: Datawrapper* https://blog.datawrapper.de/colorblind-check/
	Colour blindness simulator: Coblis http://www.color-blindness.com/coblis-color-blindness- simulator/
	Colour advice for maps: Colorbrewer http://colorbrewer2. org/#type=diverging&scheme=RdYlBu&n=5
Using icons	*Collection of icon designs: iconmonster* https://iconmonstr.com/?s=health
	Collection of icon designs: Noun Project https://thenounproject.com/
Inspiration: examples of good practice and guidance on what to avoid	*Interactive vaccination coverage map: Robert Koch Institute, Germany* www.vacmap.de/
	Infographics: Public Health Agency of Sweden https://www.folkhalsomyndigheten.se/vaccin-funkar/ material/
	Animated video: National Public Health Agency of France https://vaccination-info-service.fr/Generalites-sur-les- vaccinations/Qualite-securite-et-efficacite-des-vaccins/ Efficacite-de-la-vaccination-pour-la-protection-de-la- collectivite
	Infographics: Gavi the Vaccine Alliance www.gavi.org/library/audio-visual/infographics/
	Global vaccination graphs: Our World in Data https://ourworldindata.org/vaccination
	Blog: Chibana N, n.d. Bad infographics: 11 mistakes you never want to make https://visme.co/blog/bad-infographics/
	Gallery of data visualization: The best and worst of statistical graphics http://www.datavis.ca/gallery/

Behavioural insights

Framing

Article
O'Connor H, n.d. Carrot or Stick? Message framing to motivate health behaviour change
https://believeperform.com/performance/carrot-or-stick-message-framing-to-motivate-health-behaviour-change/

Multimedia learning

Article
Mayer RE, Moreno R, 1998. A split-attention effect in multimedia learning: evidence for dual processing systems in working memory. Journal of Educational Psychology 90(2):312
https://pdfs.semanticscholar.org/1e50/7522bf42468dbe19bf5ad9394a3eca7be62d.pdf

Nudging

Article
Vlaev I et al., 2016. The theory and practice of "nudging": changing health behaviors, Public Administration Review, 76L 550-561

Article
Richard S, 2018. 10 examples of nudge theory
www.skipprichard.com/10-examples-of-nudge-theory/

Status quo bias

Article
Samuelsen W, Zeckhauser R, 1988. Status quo bias in decision making, Journal of Risk and Uncertainty, 1: 7-59. (https://sites.hks.harvard.edu/fs/rzeckhau/status%20quo%20bias.pdf)

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3. Levin JR, Mayer RE, 1993. Understanding illustrations in text. In: Britton BK, Woodward A, Binkley M, editors. Learning from textbooks: theory and practice. Hillsdale, NJ: Erlbaum; 95–119.

4. Thaler S, Sustein C, 2008. Nudge. Improving decisions about health, wealth, and happiness. New Haven, CT: Yale University Press

5. Samuelsen W, Zeckhauser R, 1988. Status quo bias in decision making, Journal of Risk and Uncertainty, 1: 7-59. (https://sites.hks.harvard.edu/fs/rzeckhau/status%20quo%20bias.pdf)

6. Nyhan, B et al., 2014. Effective Messages in Vaccine Promotion: A Randomized Trial *Pediatrics*, April 2014, 133-134 (https://pediatrics.aappublications.org/content/133/4/e835.abstract?sid=4c82b05f-5ad9-4ab5-b91e-b187e909c237)

7. Tversky A, Kahneman D, 1981. The framing of decisions and the psychology of choice, Science 211: 453-458 (www.uzh.ch/cmsssl/suz/dam/jcr:ffffffff-fad3-547b-ffff-ffffe54d58af/10.18_kahneman_tversky_81.pdf)

8. Bigman, C et al., 2010. Effective or ineffective: Attribute framing and the human papillomavirus (HPV) vaccine, Patient Educ Couns. 81S1: S70-S76 (www.sciencedirect.com/science/article/pii/S0738399110005355)

9. Skinner BF, 2014. Science and human behavior, BF Skinner Foundation.

10. Ajzen I, 1991. The Theory of Planned Behavior. Organizational Behavior and Human Decision Processes 50, 179-211. (http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.317.9673&rep=rep1&type=pdf)

11. Miller G, 1994. The magical number seven, plus or minus two. Some limits on our capacity for processing information, Psychological Review, 101:2, 343-352 (www.psych.utoronto.ca/users/peterson/psy430s2001/Miller%20 GA%20Magical%20Seven%20Psych%20Review%201955.pdf)

12. Tufte E, 1991. The visual display of quantitative information, Cheshire, Conn: Graphics Press

13. Stone M, 2006. Choosing Colors for data visualization (www.perceptualedge.com/articles/b-eye/choosing_colors.pdf)

14. Rost L, 2018 What to consider when choosing colors for data visualization. (www.dataquest.io/blog/what-to-consider-when-choosing-colors-for-data-visualization/)

15. N.N, 2017: Designing and printing for color blindness. (www.imagetoner.com/blog/printing-for-color-blindness/)

16. Fagerlin A, Wang C, Ubel PA, 2005. Reducing the influence of anecdotal reasoning on people's health care decisions: is a picture worth a thousand statistics? Med Decis Making 25(4):398–405. (https://www.ncbi.nlm.nih.gov/pubmed/16061891)

17. Lenaerts S, 2014. Use and abuse of icons in the modern age. Envato Tuts+ (https://webdesign.tutsplus.com/articles/use-and-abuse-of-icons-in-the-modern-age--webdesign-17064)

All web links accessed 20 Sept. 2019

ANNEX 1:
Design checklist

The below checklist can help the design team assess and revise draft versions of data visualizations.

Define

- What is the main (and potentially secondary) target audience?

- What is the story?

- What is the objective of telling this story?
  What would be the optimal outcome?

Design

Format, words and numbers

- Is the format appropriate for the data and messages?

- Do the numbers effectively support the key messages?

- Are the numbers and text shaped in the most effective way for the intended audience?

- Are the messages framed in a positive way?

- Do the messages motivate the target audience to behave in the desired way?

- Is there a call to action?

- Can any of the text or graphic elements be removed without decreasing clarity or impact?

- Do data progressions move from left to right?

- Are units of measure specified?

Simplicity, clarity and accuracy

- Are all necessary data included to create an accurate picture?

- Can the text or numbers be misinterpreted?

- Does the title of each chart or graph clearly describe the information it contains?

- Can any design elements be removed, simplified or brought to the background (if not the primary focus)?

- Is all necessary information provided (eg names of axes, values, data sources and dates)?

- Are legends clear, large enough to read and comprehensive? Do the colours in every legend correctly correspond to the data in the graphic?

- If shapes or sizes are to be compared: are they accurate representations of the data, and are they close enough to each other to enable the audience to visually compare them?

- Does the product as a whole look aesthetically pleasing?

- Is it easy to find the main message or is it lost among too many competing elements?

- Is it easy to distinguish data points and values or are they placed too close together?

Colour

- Is the colour scheme accessible for someone with colour vision deficiency? If not, can simple patters be added to aid understanding?

- Are the colours easy to distinguish from each other?

- Are the colours used consistently?

- Do the colours have unrelated (political or cultural) meaning for the target audience?

Icons and photographs

- Are icons easy to understand and recognize?

- Is the number of icons appropriate (enough to serve a clear purpose, but not so many that they will create clutter and confusion)?

- Do icons or photographs depict anything that could elicit a negative emotion among the target audience?

- Do icons or photographs depict anything that could be considered negative stereotyping?

- If a syringe is depicted, is it shown in a way that is subtle and would not frighten or intimidate?

- Have all applicable copyright, usage and model consent requirements been satisfied?

Disseminate

- What is the intended dissemination platform?

- Is this the best way to reach the target audience(s)?

- What other platforms can be used to reach them? Can all or part of the data visualization be shared through these other platforms?

- Can the visualization be shared with immunization programmes in other countries for their adaptation and use?

- Can the visualization serve as a template for future campaigns/reports/presentations, etc.?

ANNEX 2:
Sample design brief template

Summarize context in a short paragraph:

Describe target audience in detail (include a persona if available)**:**

Summarize desired outcome:

Proposed title:

Key message:

Sub-messages:

Description of data:

Style requirements (eg logos, standard colours or branding):

Tone (e.g. formal or familiar and jargon-free):

Product:

☐ dashboard   ☐ infographic   ☐ poster
☐ interactive map   ☐ webpage   ☐ presentation
☐ social media banner or tile   ☐ brochure   ☐ roll-up

☐ Other

Intended platforms:

☐ website   ☐ social media (specify)
☐ meeting   ☐ media

Timeline:

Number of revision rounds included in the price:

Other important information:

The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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