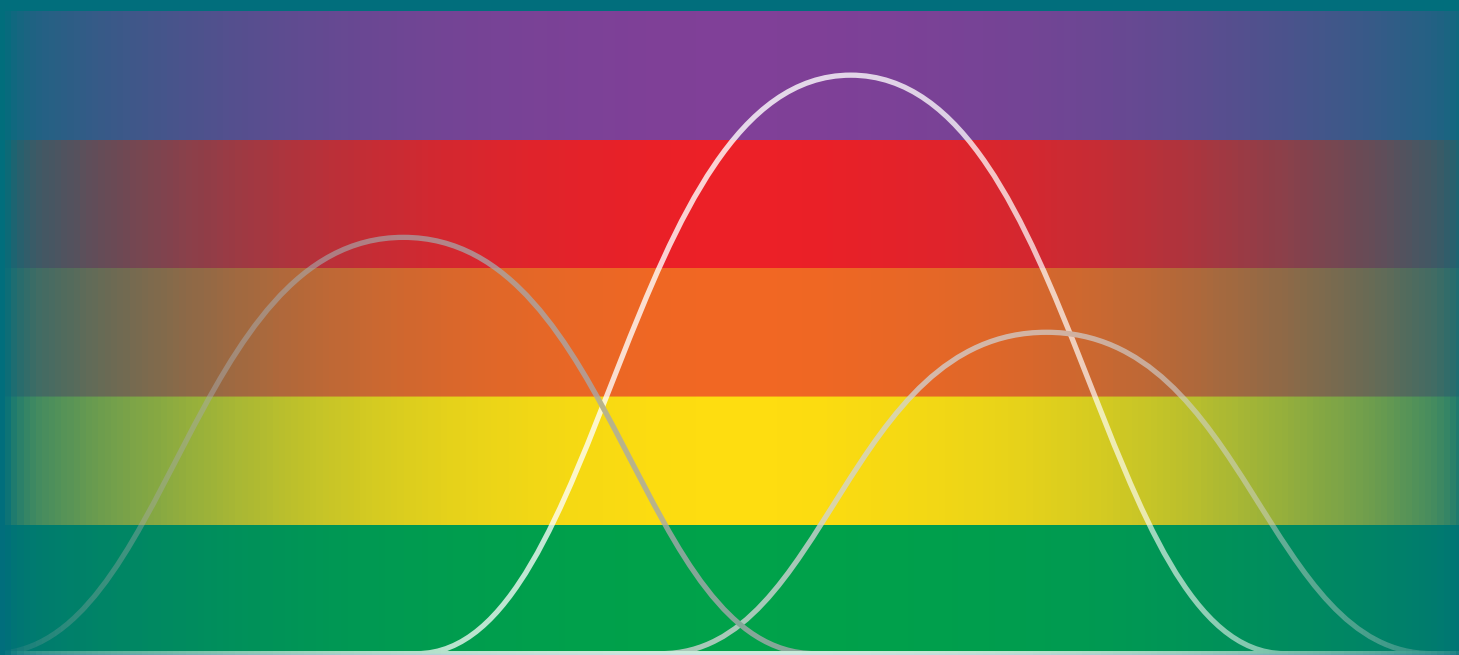


Pandemic influenza severity assessment (PISA)

A WHO guide to assess the severity
of influenza in seasonal epidemics
and pandemics, second edition



World Health
Organization

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Abbreviations and acronyms

ARI	acute respiratory infection
ACM	Average Curve Method
COVID-19	coronavirus disease 2019
ICU	intensive care unit
ILI	influenza-like illness
MAARI	medically attended acute respiratory illness
MEM	Moving Epidemic Method
PHSM	public health and social measure(s)
PISA	pandemic influenza severity assessment
SARI	severe acute respiratory infection

Glossary

Admission: formal acceptance, by a health facility, of a patient who is to receive medical or paramedical care while occupying a health facility bed (1).

Arithmetic mean: the sum of all values of a set of observations divided by the number of observations (1).

Average epidemic curve: the usual level of influenza activity that occurs during a typical year. This is the calculated average of several epidemic years. The average epidemic curve level will vary throughout the year.

Baseline: the lowest level of influenza activity which occurs between seasons or epidemics.

Confidence limits: the upper and lower limits of the interval in interval estimation. The interval itself is called the confidence interval or confidence range. Confidence limits are so-called because they are determined in accordance with a specified or conventional level of confidence or probability that these limits will in fact include the population parameter being estimated. Thus, 95% confidence limits are values between which we are 95% confident that the population parameter being estimated will lie. Confidence limits can often be derived from the standard error (1).

Cumulative: adding current data to data from previous weeks in a defined period (since the beginning of the season, epidemic or pandemic wave) to give an assessment which uses all the data collected so far. This is used for the seriousness of disease indicator, as ratios and proportions otherwise fluctuate when measured on a weekly basis and therefore cumulative data provide a more stable and useful estimate of activity.

Disease surveillance: the systematic, continuing assessment of the health of a community, based on the collection, interpretation and use of health data. Surveillance provides information necessary for public health decision-making (2).

Geometric mean: a mean derived by multiplying together the n individual values in a series of observations and calculating the n th root. The logarithm of the geometric mean is thus the arithmetic mean of the logarithm of individual values (1).

Incidence rate: the rate at which new events occur in a population. The numerator is the number of new events that occur in a defined period; the denominator is the population at risk of experiencing the event during this period, sometimes expressed as person-time. The incidence rate most often used in public health practice is calculated by the formula:

(Number of new cases in a specified period/number of persons exposed to risk during this period) $\times 10^n$

In a dynamic population, the denominator is the average size of the population, often the estimated population at the mid-period. If the period is a year, this is the annual incidence rate.

Indicator: one of the four components (transmissibility, seriousness of disease, morbidity and mortality, impact on health care capacity) that make up the severity assessment. Each indicator is assessed separately and can be based on data from one or more parameters.

Level of significance: the probability of a difference arising purely by chance, below which it is considered sufficiently “unlikely” for the difference to be considered statistically significant (conventionally 0.05). The probability of wrongfully rejecting the null hypothesis (1).

Median: value that divides a distribution into two equal halves; central or middle value of a series of observations when the observed values are listed in order of magnitude (1).

1-tailed and 2-tailed tests: when the difference being tested for significance is not specified in direction (that is, takes no account of whether $X_1 < X_2$ or $X_1 > X_2$), then the probabilities in both tails of the sampling distribution are used in the test: a 2-tailed test is required. When the difference being tested is directionally specified beforehand

(when $X1 < X2$, but not $X1 > X2$, is being tested against the null hypothesis $X1 = X2$), then a 1-tailed test is appropriate because we are only concerned with the probability $P(X1 < X2)$ and not $P(X1 > X2)$ (1).

Parameter: a variable which can be used to assess activity and inform one of the four PISA indicators.

Percentiles: those values in a series of observations, arranged in ascending order of magnitude, which divide the distribution into 100 equal parts (thus the median is the 50th percentile) (1).

Proportion: defined as the fraction $a/(a + b)$ for mutually exclusive groups with elements a and b . The b elements may belong to more than one group, each mutually exclusive of the group with the a elements (1).

Rate: a measure of the “speed” at which events are occurring (for example, rate of incidence of a specified disease is a measure of the “speed” with which new cases occur in the community (1).

Ratio: defined as the fraction a/b for two mutually exclusive groups with elements a and b (conventionally expressed as $1:b/a$) (1).

Reliability: the degree to which the result of a measurement, calculation or specification can be depended on to be accurate.

Risk communication: the real-time exchange of information, advice and opinions between experts, community leaders or officials and the people who face a threat (hazard) to their survival, health or economic or social well-being. Its ultimate purpose is to enable everyone at risk to take informed decisions to mitigate the effects

of the threat (hazard) such as a disease outbreak and to take protective and preventive actions.

Seasonal threshold: the seasonal threshold defines a value above which the country or area is considered to be in an influenza season. The seasonal threshold is also sometimes referred to as the epidemic threshold. This value indicates an increased likelihood that a respiratory illness seen by a treating clinician in the community is actually related to influenza because influenza is transmitting in a sustained manner.

Sentinel surveillance: the systematic collection of data on a routine basis from a limited number of surveillance sites (2).

Standard deviation: root mean square deviation, where deviations have been taken from the mean. This equals the square root of the variance, expressed in the units of the original observations (1).

Threshold: a boundary which differentiates between levels of activity. In PISA, such thresholds are determined according to the distribution of historical data and can be set using various statistical and non-statistical methods.

Threshold setting: assigning a boundary which differentiates between levels of influenza activity, so that quantitative values can be categorized into qualitative levels (such as below baseline, low, moderate, high and extraordinary). Thresholds are set at values that exceed the average epidemic curve values by a previously established amount such that the levels of influenza activity indicate the occurrence of a specific situation, such as the start of a season or unusually high seasonal activity.

Executive summary

The updated WHO pandemic influenza severity assessment (PISA) framework set out in this document provides a systematic approach for interpreting data collected through existing surveillance systems and improving their usefulness for risk communication and decision-making. The approach enables the severity of current influenza and syndromic respiratory illness activity to be assessed relative to previous years by using historical data to set thresholds that then allow for the qualitative categorization of such activity. PISA is designed to be implemented continuously based on stable/routine reporting systems, enabling activity during epidemic and pandemic periods to be compared. Information to assess severity especially early and throughout the course of a pandemic will also be provided through investigations, studies and modelling. However, this guidance focuses mainly on the information collected during routine influenza surveillance. Data from virtually any respiratory illness surveillance system can be used, so long as the data are available on a weekly basis and are considered to be a useful indicator of influenza or respiratory illness activity. PISA can be implemented using only a single surveillance parameter (for example ILI or SARI cases) but can also be applied using multiple parameters to assess different aspects of activity in order to improve the completeness of, and confidence in, the assessment. The guidance provided is intended to be flexible and should be adapted according to the needs of the implementing country.

Since the publication of the 2017 WHO PISA guide, several key developments have taken place (see Table 1). Following the production of a public online self-learning course in 2018, and multiple onsite training events involving WHO regional offices and country representatives, more countries have become familiar with the PISA framework and are now implementing severity assessments aligned with it. In addition, the WHO Global influenza strategy 2019–2030 (3) was launched, which has led to strengthened surveillance and improved data utilization to better understand the impact and burden of influenza. Promoting the development of national capacities to perform real-time influenza severity assessments will support many of the key strategic objectives and actions set out in the global strategy. Lastly, the experience gained from the coronavirus disease 2019 (COVID-19) pandemic can now be leveraged to improve respiratory disease surveillance activities during both interpandemic and pandemic periods, and to review and enhance suitable data sources. The updated guidance provided in the current document incorporates these and other insights gained in recent years, and has been aligned with innovative new approaches to collaborative surveillance such as the mosaic approach to respiratory disease surveillance (4).

Table 1. Changes made in this update to the PISA guidance

Changes to guidance	Rationale
Additional indicator Impact on Health Care Capacity for monitoring the ability of systems to manage experienced demand.	• Several countries initiated, enhanced or streamlined data-collection systems in hospitals during the COVID-19 pandemic • The demand for and capacity of health care facilities often informed decision-making on public health and social measure (PHSM) needs
Option to report on syndromic respiratory illness activity as well as on influenza-specific activity.	• Syndromic data were timely and useful for capturing increased respiratory virus activity during the COVID-19 pandemic, especially in settings with limited or fluctuating testing capacities • Data that are not pathogen specific may be more useful for monitoring stresses on health care capacity and for informing PHSM than influenza-specific data
Extended list of suggested PISA parameters, with additional table on using modelled metrics such as R_t and forecasting for countries with capacity and interest	• The diversity of surveillance systems currently in place across countries was not reflected in the existing list of examples • Since 2017, new approaches to respiratory virus surveillance have been developed and lessons from PISA implementation have been learned • New parameters identified during the COVID-19 pandemic, including the use of modelling and forecasting may be useful for influenza surveillance
Additional guidance on threshold setting methods, including using non-statistical methods where limited historical data are available.	• Since the publication of the 2017 PISA guidance, lessons have been learned from country experiences with different threshold setting approaches • During the COVID-19 experience, non-statistical methods such as expert consensus were used to set thresholds rather than statistical methods due to limited historical data
Make PISA outputs publicly accessible	• Data sharing benefits all countries and aligns with WHO's data sharing policy.

1 Introduction

1.1 Background and document development history

Following the 2009 H1N1 influenza pandemic, the 2011 World Health Assembly adopted a report by the Review Committee on the Functioning of the International Health Regulations (2005) and on Pandemic Influenza (H1N1) 2009 (5). The Review Committee recommended that WHO should develop and apply measures that could be used to assess the severity of every influenza epidemic. Such a severity assessment provides the scientific information needed to inform the timing, scale, emphasis, intensity and urgency of response actions. Additionally, the report stated that, “by applying, evaluating and refining tools to measure severity every year, WHO and Member States can be better prepared to assess severity in the next pandemic” (5).

After the World Health Assembly had highlighted this need, WHO developed its first framework for pandemic influenza severity assessment (PISA) (6) that was intended to be flexible and adaptable for use during seasonal epidemics as well. The first version of the PISA framework was developed through a process of meetings, expert consultations, collaborative WHO projects and the establishment of a technical working group (TWG) on pandemic influenza severity assessment. This framework defined influenza severity in terms of three indicators: transmissibility, seriousness of disease and impact.

As part of the development of the first PISA framework, interim WHO guidance on assessing influenza severity was developed in collaboration with the Robert Koch Institute, and was first piloted in 2014 in selected countries in the southern hemisphere¹ followed by further

countries during 2014–2016.² In March 2017, the first PISA framework was launched at a global meeting and countries were encouraged to start implementing it to assess their seasonal influenza activity using routine surveillance data. The first version of the PISA guidance was published shortly after in May 2017.

Since then, WHO has provided assistance to countries in using the PISA framework to assess the severity of seasonal influenza epidemics through:

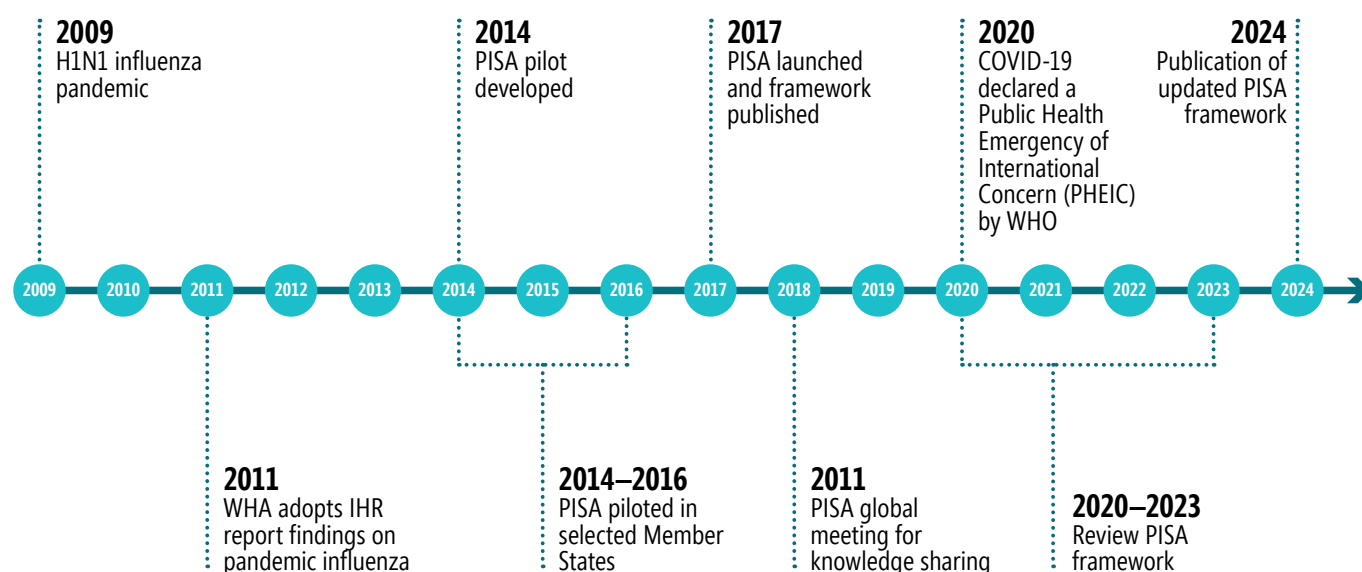
- the development of open-access training materials;
- regional workshops for country-level training and recruitment in line with the published WHO PISA guidance and the experiences of implementing countries;
- continued exploration of threshold setting methods for temperate and non-temperate countries, and developing tools to make these methods accessible;
- developing communication messages, infographics and strategies for use at all three levels of WHO and within countries; and
- building a network of PISA framework users, including country-level users, technical experts and stakeholders, for seamless sharing of ideas and resources.

A global meeting was held in November 2018 for PISA stakeholders to share knowledge and experiences and to inform the potential future updating of the PISA guidance (Fig. 1). By the end of 2019, the number of countries implementing the PISA framework had increased to 28.

1 Australia, Chile, New Zealand and South Africa.

2 Bangladesh, Canada, China, Egypt, France, Germany, India, Iran (Islamic Republic of), Ireland, Japan, Madagascar, Norway, Portugal, Singapore, South Africa, Spain, Thailand, the United Kingdom of Great Britain and Northern Ireland, and the United States of America.

Figure 1. PISA development timeline



In 2020, the spread of SARS-CoV-2 and subsequent COVID-19 pandemic highlighted the need to strengthen WHO guidance on severity assessment during pandemics caused by non-influenza viruses. The pandemic also highlighted the importance of differentiating between syndromic and pathogen-specific severity assessments, and presented an opportunity to consider expanding the PISA framework to assess the severity of non-influenza respiratory viruses with pandemic potential. The TWG was reinstated to review the use and performance of the PISA framework during the COVID-19 pandemic, while a specialized TWG focusing on threshold setting methods was also established.

In particular, the review aimed to understand how parameter choice and threshold setting approaches differed for influenza and SARS-CoV-2, and to identify the challenges faced by countries in maintaining routine surveillance for respiratory viruses and implementing PISA methods during the pandemic. The review included a survey open to all countries and a review of publicly available information published by ministries of health and public health institutions focused on those countries already implementing the PISA framework.

The review found that:

- Very few countries continued to report to the PISA platform during 2020–2022. Routine surveillance systems were heavily disrupted due to changes in health care seeking behaviour, referral protocols and testing, and because systems became overwhelmed due to high demand and staff absences.
- Several countries initiated, enhanced or streamlined data-collection systems in hospitals, and the demand for, and capacity of, health care facilities (particularly hospitals) often informed decision-making on public health and social measure (PHSM) needs.
- Although some surveillance parameters used during the pandemic were common to those used in influenza surveillance, parameters not commonly used for seasonal influenza were also identified, including most notably the effective reproduction number (R_t) and national universal COVID-19 case counts. While influenza surveillance in most countries is typically based on sentinel surveillance, SARS-CoV-2 surveillance was typically conducted using universal data,

supplemented by participatory surveillance and discrete investigations and studies.

- Syndromic data were timely and useful for capturing increased respiratory virus activity during the COVID-19 pandemic, especially in settings with limited or fluctuating testing capacities. Data that are not pathogen specific may be more useful for monitoring stresses on health care capacity and for informing PHSM than data specific to influenza.

These review findings highlighted both the challenges of conducting surveillance during a pandemic and the additional opportunities that increased attention and funding can bring for enhanced surveillance during a pandemic. Based on the review findings, potential changes to the WHO PISA guidance were identified by both PISA TWGs. A consultation was held in June 2023 to bring together TWG members, as well as representatives from selected countries, to discuss and reach consensus on proposed changes to the PISA guidance, resulting in the publication of this current version of the PISA framework in 2024 (Fig. 1).

To consolidate the lessons learned both from the post-implementation period of the original PISA framework and from the COVID-19 pandemic, this updated guidance now includes:

- an extended list of suggested PISA parameters to better reflect the diversity of surveillance systems in place across countries including an additional table on using modelled metrics such as R_t ;
- an additional indicator for monitoring health care system capacity, and therefore the ability of systems to manage experienced demand;
- additional guidance on threshold setting methods, including using non-statistical methods where limited historical data are available;
- a framework for reporting on syndromic respiratory illness, as well as on influenza activity specifically; and

- details of a shift away from the previously restricted access of PISA outputs towards open access, in line with WHO's data sharing policy.

1.2 Scope and purpose of this WHO guide

In this document, we describe the use of PISA methods to assess influenza and syndromic acute respiratory illness activity in the context of historical data. The methodology can also be applied to assess the activity of other epidemic-prone pathogens, such as Respiratory Syncytial Virus (RSV) and SARS-CoV-2, as well as future respiratory viruses of pandemic potential.

This guide has been developed for use by countries as part of influenza pandemic preparedness (<https://www.who.int/teams/global-influenza-programme/public-health-preparedness>) and in line with published WHO guidance on Preparedness and resilience for emerging threats (PRET) module 1: planning for respiratory pathogen pandemics (<https://iris.who.int/handle/10665/376312>) to assess the severity of influenza during both seasonal epidemics and pandemics.

As well as benefiting routine seasonal influenza situation assessments and reports, establishing routine PISA analysis and reporting during seasonal epidemics will enable countries to assess severity more easily and efficiently during a pandemic.

This guidance focuses mainly on information collected during routine respiratory virus surveillance. In order to rapidly characterize the risk of pandemic spread, transmission and potential severity of a newly emerging outbreak, additional tools will be needed. It should be noted that in the early stages of an emerging pandemic or other outbreak, where there is limited transmission of a new virus in the community, information will mostly come from investigations and studies. Template protocols, tools and other support for conducting specialized investigations and studies to estimate key transmission and epidemiological parameters early and throughout the course

of a pandemic are available through the Unity Studies initiative (<https://www.who.int/teams/global-influenza-programme/surveillance-and-monitoring/influenza-investigations-studies-unity>). Rapid characterization of the virus to assess its pandemic potential will be guided by the WHO Tool for influenza pandemic risk assessment (TIPRA) (7). Tools for early situation assessments for public health decision-making are also available, including the WHO Rapid risk assessment of acute public health events (8).

1.3 Target audience

This document is intended for use primarily by public health professionals at the national level who perform or plan to perform national influenza or syndromic respiratory illness severity assessments, and who can contribute towards the development of global severity assessments.

Box 1. Before starting

Timely and complete data is key to successful implementation of PISA. Using and communicating the PISA framework can be a way to advocate for sustained robust and timely surveillance data. Dedicated staff-time is also essential to the initial planning and implementing stages. Once a protocol for assessing and reporting severity is put in place, the time requirements for generating weekly assessments is minimal and the assessments can be easily integrated into existing influenza bulletins.

2 Aim of the influenza severity assessment

The aim of the influenza severity assessment at the national level is to:

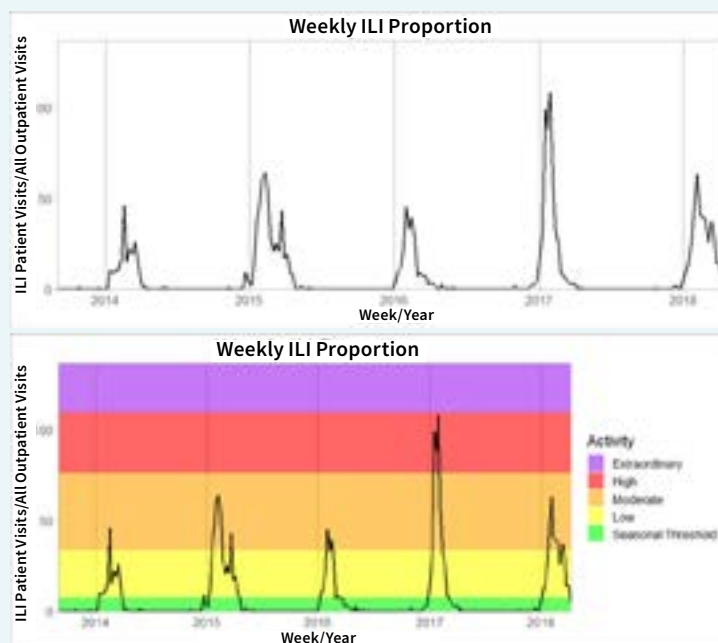
- describe the epidemiological situation in the context of historical data and assess the severity of an influenza epidemic or pandemic based on all reliable information available;
- inform national and global risk assessments; and

- inform public health preparedness, response and recovery measures, as well as resource allocation.

The global influenza severity assessment will be used by WHO to monitor and understand the global situation, and to inform and support global decisions and recommendations on public health interventions.

Box 2. What is the added value of implementing influenza severity assessments at the national level?

- Describing the epidemiological situation:
 - The parameter-specific thresholds that are determined in line with the PISA framework can enhance the visualization of influenza data. Thresholds serve as quantitative reference lines that allow the viewer to compare data points against a categorical scale. Note the difference in the images below where the one on the right shows the same data points as that on the left but with the addition of threshold reference lines and coloured categorical scale. **The end result is the improved communication of influenza surveillance data.**



- Informing national and global risk assessments:
 - Severity assessment is a critical component of overall pandemic risk assessment, both nationally and globally.
- Inform public health preparedness, response and recovery measures, as well as resource allocation:
 - Severity and risk assessments can ensure that national actions are implemented that are commensurate with the assessed risk.

3 Influenza severity assessment concept and definitions

3.1 Indicators

In the original version of the WHO PISA framework, influenza severity was defined in terms of three indicators: transmissibility, seriousness of disease and the impact of the epidemic or pandemic on health care systems and society. Since then, the COVID-19 pandemic has highlighted the crucial importance of understanding impact on health care capacity in order to adapt PHSM. Therefore, in this updated guide, the impact indicator has been split into two separate indicators to reflect two related but separate components – the level of morbidity and mortality associated with influenza, and the impact of this on health care capacity. These terms are defined in detail below and in Table 2.

3.1.1 Transmissibility

The transmissibility indicator measures how many people get sick with influenza and therefore reflects the ease of movement of the influenza virus between individuals and communities. Several factors affect transmissibility, including the ability of the virus to spread from person to person, the dynamics of the spread and the susceptibility of the exposed population. Transmissibility will also be influenced by external forces, such as social or environmental factors. During seasonal influenza epidemics, transmissibility is usually measured by routine surveillance systems using a proxy for incidence (for example, how many people are seeking health care for ILI). The transmissibility indicator can be reported for influenza-specific data (for example, the proportion of ILI attributable to influenza) and/or syndromic data (for example, the number of people seeking health care for ILI).

Box 3. Influenza-specific or syndromic assessment?

Some countries may find it more useful to report on respiratory disease activity generally (that is, syndromically) rather than reporting on the severity of influenza specifically. This may be due to various reasons, including:

- sufficient influenza-specific data are not available due to low testing rates;
- broad case definitions are used which likely capture activity from various pathogens;
- insufficient historical data for influenza-specific parameters; and
- syndromic assessments are considered to be more informative for risk communication and for informing PHSM.

The latter might particularly be the case when measuring impact on health care capacity. Syndromic parameters might be based, for example, on ILI, ARI, MAARI, fever and cough, SARI, pneumonia or groups of International Classification of Diseases (ICD) codes.

Influenza-specific parameters will use data where influenza detection has been confirmed or there is an influenza-specific diagnosis – for example, the number of hospitalizations with an influenza discharge code. Using a composite parameter in which a subset of cases fitting an ILI, ARI or SARI case definition is tested for influenza and the proportion positive applied to all cases can be considered to be an influenza-specific approach.

3.1.2 Seriousness of disease

The seriousness of disease indicator describes the extent to which individuals become ill when infected with an influenza virus. This indicator is based on **ratios or proportions** which describe the frequency of serious outcomes following influenza infection, such as severe illness requiring ICU admission or death. The seriousness of disease depends on the virus – for example, an influenza virus with a high level of clinical seriousness can result in a disproportionate number of people with serious illnesses, some of whom will be hospitalized and some of whom will die. Seriousness of disease also depends on host factor characteristics – for example, the presence of underlying medical conditions that predispose individuals to develop severe illness, a history of vaccinations that may be protective, the person's age and their access to health care. Therefore, an influenza infection is likely to be much more serious for some segments of a population than for others, and descriptions of the groups at increased risk are useful for understanding this indicator. Seriousness of disease is calculated by comparing the number of people experiencing serious disease to the number experiencing less serious illness, for example by reporting on the ratio of ICU admissions to general hospital admissions, or on the proportion of hospitalizations that result in death. It therefore may use the same data sources as parameters feeding into the transmissibility, and morbidity and mortality indicators. This indicator should

only be reported for influenza-specific data as seriousness of disease ratios are not informative when multiple pathogens are contributing to overall respiratory virus activity. The seriousness of disease indicator is also unlike the other three PISA indicators in that it should be based on cumulative data from the start of the season and be reported twice a year (near the midpoint and end of the season) as weekly ratios and proportions often fluctuate considerably (see Box 6).

Seriousness of disease ratios and proportions may be affected by health care capacity, particularly during periods of high health care demand when admission criteria for hospitals and ICU may change. Interpretation of this indicator should therefore consider that seriousness of disease may be underestimated during the most severe seasons. Monitoring other PISA indicators, particularly morbidity & mortality and the impact on health care capacity is important for contextualizing this indicator.

3.1.3 Morbidity and mortality

This indicator measures the level of serious disease and death in the population due to respiratory disease. It will typically be informed by data from hospital-based and mortality surveillance. Counts can be used when the catchment population remains the same over time. However, population denominators are important for interpreting data if the catchment

Box 4. Severity? Seriousness? Impact?

Users of this guide may associate these terms with something other than what is intended here and disentangling these terms is not straightforward. “Severity”, as used in this guide, refers to the outcome of assessment of the four indicators as they relate to an influenza epidemic or pandemic, not to the clinical disease state. The likelihood of serious infection or death is represented by the “seriousness of disease” indicator and describes an individual case’s conditional probability of requiring hospitalization (case hospitalization risk), intensive care (case hospitalization to ICU admission risk – mostly calculated as a proportion of all hospitalized cases) or ending in a fatal outcome (case fatality risk – mostly calculated as a proportion of all hospitalized cases or those admitted to ICU). The fourth indicator, “impact on health care capacity”, assesses how the influenza activity captured by the three other indicators relates to the health care system’s ability to manage demand.

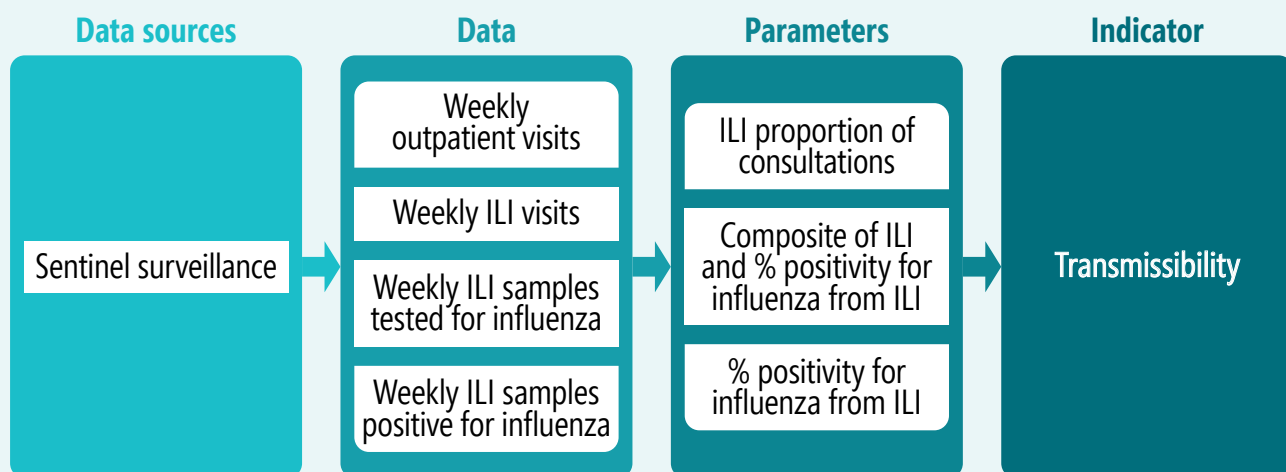
population changes. For example, if the number of reporting hospitals varies from week to week, SARI per 1000 catchment population is more informative than the total number of SARI cases. The total number of hospitalizations can also be used as a denominator. The morbidity and mortality indicator is a particularly useful component of severity assessments because, as a measure of serious adverse outcomes, it is typically less affected by health care seeking behaviour than the transmissibility indicator. This indicator can be reported for influenza-specific and/or syndromic data.

3.1.4 Impact on health care capacity

This indicator describes how the epidemic or pandemic is affecting health care system capacity. If demand for health care is high, health care resources may be stressed, and may even become overwhelmed, leading to lower

quality of care. The impact will be affected by public concern, the behaviour of the affected population and the implementation of PHSM. This indicator might be based on data on health care usage relative to capacity (for example, the proportion of ICU or hospital beds occupied due to the epidemic) as well as data on the health care workforce (for example, health care worker absenteeism). The impact on health care capacity might also be seen indirectly through the cancellation or postponement of elective interventions and non-urgent services, or the activation of surge capacity. Impact on health care capacity may be a particularly useful indicator for assessing PHSM needs as it gauges the ability of the health care system to cope with demand. Although this indicator can be reported for influenza-specific and/or syndromic data, assessing syndromic impact as a whole may be more useful for informing PHSM needs.

Box 5. PISA terminology and examples

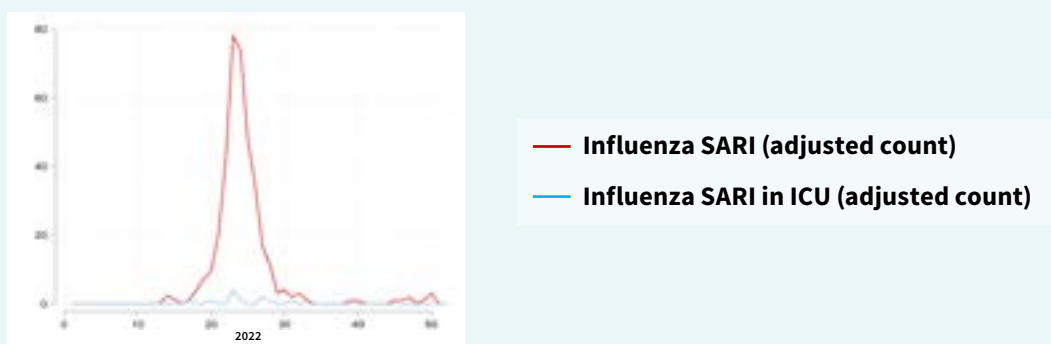


Box 6. Why is seriousness of disease assessed only once or twice per epidemic?

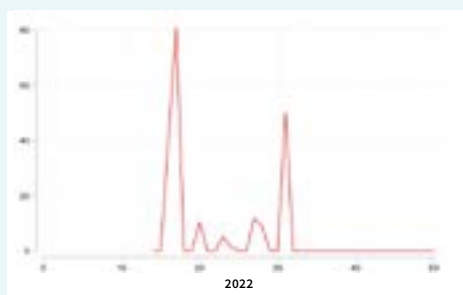
As seriousness of disease parameters are based on ratios or proportions which fluctuate from week to week (especially when few cases with severe outcomes are reported), cumulative rather than weekly data must be used. Using cumulative data also minimizes the effect of the lag caused by the time taken to deteriorate to more severe outcomes. Because the cumulative proportions only become stable around the peak, seriousness of disease should only be reported around or after the peak.

The example below is based on data from New Zealand for the 2022 influenza season and illustrates how estimates for seriousness of disease stabilize only after the peak in activity. In this example, the cumulative ratio of influenza SARI in ICU to influenza SARI should not be reported until after around week 25. As proportions and ratios should be relatively stable after the peak, they do not need to be reported weekly – they can be reported once near the peak and, if desired, again at the end of the epidemic.

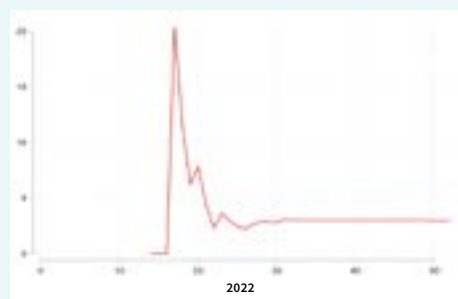
Weekly SARI admissions for influenza and SARI ICU admissions for influenza



Weekly ratio of influenza SARI in ICU: influenza SARI



Cumulative ratio of influenza SARI in ICU: influenza SARI



The start and end of the cumulative period needs to be defined before cumulative ratios or proportions can be calculated. Countries with a well-defined season may decide to start and end at the same week every year. Alternatively, the cumulative period can start at the beginning of the epidemic period, as defined by:

- The first week with non-zero activity for a selected parameter
- Crossing of the epidemic threshold for a selected parameter

The parameter selected for ascertaining the beginning of the epidemic may or may not be one of the parameters contributing to the calculation of the seriousness of disease indicator.

There is no fixed minimum length of time over which data should be cumulated - the time needed to accumulate sufficient numbers to calculate stable ratios or proportions will vary according to the size of the surveilled population and the incidence of serious outcomes. In considering when to report seriousness of disease results, the advantages of timeliness should be balanced with the need for a stable estimate. The timing of reporting of the seriousness of disease indicator may therefore vary from year to year within a country. If desired, reporting can be initiated when the numerator or denominator reach predetermined values. Alternatively, the passing of the epidemic peak and stabilization of the ratio or portion can be visually assessed.

Table 2. Summary of the indicators used to describe influenza severity

Indicator	Describes	Influenced by	Informed by	Report for
Transmissibility	How many people in a population get sick on a weekly basis	• Ease of movement of virus between individuals (virus shedding, virus replication and virus binding) • Immunity and vaccination status of the population • Contact patterns and health seeking behaviour • Climatic factors	Routine surveillance parameters Parameters should represent incidence of influenza or respiratory illness in the population	Influenza and/or syndromic
Seriousness of disease	How ill individuals become when infected with the influenza virus	• Virus factors • Host factors • Context (for example, access to health care and availability of ventilators)	Hospital-based surveillance parameters and mortality data Parameters should represent a proxy for the case fatality risk as a ratio or proportion. The numerator should include more serious illness or other outcome and the denominator should include all cases or cases in a less serious category. Both the numerator and denominator should be based on cumulative counts from the start of the epidemic.	Influenza
Morbidity and mortality	How many people in a population experience serious disease or death	• Virus factors • Host factors • Number of infections	Hospital-based surveillance and vital statistics (for example, death records)	Influenza and/or syndromic
Impact on healthcare capacity	How the influenza epidemic or pandemic affects the health care system	• Health care use • Public concern • Health care resources • Implementation of PHSM	Hospital-based surveillance, health care usage data and health care workforce absenteeism Parameters should represent the extent to which cases are occupying health resources, with the denominator representing the capacity of the reporting unit	Influenza and/or syndromic

3.2 Parameters

Each indicator described above can be derived using various parameters from virological and epidemiological surveillance, and from clinical sources. Data on these parameters are often collected on a routine basis by a country's public health surveillance systems (2), but may also be obtained from specific investigations and studies. This guide focuses on information collected through routine surveillance rather than from discrete investigations and studies (which would mainly be conducted during influenza pandemics or other unusual events). However, the PISA approach can also be applied to these and other sources of data, so long as sufficient historical data are available to enable comparison between levels of activity.

With regard to parameter selection, this guide is intended to be flexible and should be adapted to the local context. Each country has a unique surveillance system and should select, based on their experience, any combination of parameters from their surveillance systems that would inform the PISA indicators. Likewise, they may choose to assess those indicators for which they have data and which best meet their surveillance objectives. Depending on the types of data available, countries may choose to use both influenza-specific and syndromic data in their assessments. Examples of suitable parameters for each indicator are provided in the following chapter.

4 Steps for assessing influenza severity

4.1 Step 1: Choose the parameters that will be used to assess each indicator

There are four key steps to assessing influenza severity:

- 1. Choose the parameters that will be used to assess each indicator.**
- 2. Set the thresholds for each parameter using historical data.**
- 3. Interpret data to assess severity.**
- 4. Communicate and report the severity assessment findings.**



Box 7. Getting started – evaluating surveillance systems

The first step in assessing severity is to identify data and parameters from existing surveillance systems that could inform one or several of the four PISA indicators. Listing the available data sources and parameters, along with their characteristics, in a table is useful for determining which ones to use.

More information on evaluating an influenza or other respiratory virus surveillance system is provided in the WHO Global epidemiological surveillance standards for influenza (2). Additionally, if a recent formal evaluation of the surveillance system has been conducted, the report should be consulted to allow for familiarization with the characteristics of the system when choosing parameters for use in assessing severity.

Guidance on developing a surveillance approach using complementary data sources is also available on the WHO Mosaic respiratory virus surveillance framework web page at: <https://www.who.int/initiatives/mosaic-respiratory-surveillance-framework>.

Certain criteria should be considered when selecting the parameters that will be used to assess the PISA indicators:

- Parameters should be:
 - reliable and come from a surveillance system that is stable over time and which is unlikely to be severely disrupted during periods of unusual activity, such as pandemics (or from a system in which changes and disruptions are well documented)
 - timely and available on a weekly basis
 - as indicative of influenza or syndromic respiratory illness activity as possible – for influenza-specific reporting, data on influenza-confirmed cases should be prioritized;
- Historical data must be available (on past seasonal epidemics or pandemics) for the selected parameters; and
- Where possible, denominators should be available to calculate proportions or rates, especially if the catchment population changes over time. Denominators can be related to the total catchment population or can be used to calculate the proportion of health care presentations related to influenza or ARI.

Example parameters for each of the PISA indicators are provided in Tables 3–6. The most suitable parameters will vary for different countries. In addition to these proposed parameters, countries may include other suitable parameters based on their own

Box 8. Notes on using composite parameters

Where numerators and denominators are used, it is important to use data from the same reporting sites or surveillance systems. When creating a composite measure, data for ILI and SARI and percentage positivity should, where possible, come from the same surveillance system.

surveillance systems, provided they have confidence in the data.

Countries may use as many parameters as they are able to collect suitable data for. For the transmissibility, morbidity and mortality, and impact on health care capacity indicators, these data should be available on a weekly basis to allow for weekly assessments. As the seriousness of disease indicator does not need to be reported weekly, parameters for which data are available less frequently can be used.

Countries may choose to monitor the dynamics of the suggested parameters to capture changes in parameter values over time. For example, this could include week-on-week percentage

change, weekly growth factor or doubling time for a chosen parameter. Such trends can be used to contextualize data and adjust assessments of severity (see **Step 3: Interpret data to assess severity** below). Additionally, thresholds may be set on these dynamic parameters as well as on their static equivalents, if desired.

Countries with data modelling capacity may also consider using effective reproduction number or nowcasts and forecasts in their assessment. These may be used either as parameters with their own thresholds or as a source of contextualizing information for upgrading or downgrading an assessment score based on other parameters (see Table 7).

Table 3. Useful parameters for assessing transmissibility

Transmissibility	Example parameters	Considerations
	Weekly medically attended ILI or ARI cases as a proportion of total visits or incidence rates	Transmissibility may be captured to different extents by different syndromic parameters depending on the characteristics of the circulating strains. It may therefore be useful to assess multiple syndromic parameters (for example, ILI and SARI) to capture different disease presentations. While syndromic indicators are not influenza specific, they may be helpful when testing capacity is limited or unevenly accessed. Specificity can be improved by using composite parameters (see next example parameter below). Syndromic parameters are also useful for setting baselines that are not pathogen specific, which can be useful in the event of the emergence of a pandemic virus for which there are no pathogen-specific historical data. Ideally, this data should be collected only from sentinel sites. This parameter will be affected by changes in health care seeking behaviour for non-influenza or non-ILI, for example, as a consequence of PHSM or changes in health care policies (especially likely to occur during pandemic periods).
	Composite (product) of weekly ILI or ARI proportions or rates and weekly percentage positivity for influenza – that is, the Goldstein index (2, 9)	Proportions or incidence rates and percentage positivity data should come from the same time period and, if possible, from the same surveillance sites.
	Percentage positivity for influenza from specific syndromic presentations (for example, ILI, ARI and MAARI)	Sampling criteria should be consistent over time. Care should be taken in interpreting this parameter as it is affected by changes in the activity of other pathogens. Percentage positivity can fluctuate and may not be representative of true activity when small numbers of people are being tested. This parameter should be used with caution at the beginning and end of the season, or when testing is not common or consistent. It might be decided to only report this parameter when the number of samples being tested is above a chosen level. This parameter can be used alongside other parameters but should not be used alone to assess transmissibility.
	Number of influenza outbreaks reported in aged care facilities or other susceptible group settings	This parameter may be used to provide contextualizing information for interpreting other parameters, or may have its own thresholds set but only if appropriate data can be collected to establish baselines. This parameter may be useful as an early signal of influenza activity.
	Other health care system usage for mild respiratory illness (for example, health hotline calls, consultations for coughs/fever, searches on health advice websites, etc.)	This parameter may be affected by changes in population behaviour as a consequence of public health messaging and control measures.
	Data from participatory surveillance (for example, incidence of symptomatic illness)	Data from participatory surveillance can complement other sources as it can capture illness which is not medically attended, and may therefore more accurately measure illness in cohorts which are underrepresented in other surveillance systems. Participatory surveillance can also provide contextual information on health care seeking and testing behaviours, and on public sentiments towards public health messaging and interventions. However, it is subject to self-selection bias as those who choose to participate are not likely to be representative of the general population. Using reports from consistent participants can help to avoid biases resulting from changes in reporting behaviour – for example, due to increased media attention during the influenza season.

Table 4. Useful parameters for assessing seriousness of disease

Reminder: Seriousness of disease is reported using cumulative data, ideally near the middle and end of the season

Seriousness of disease	Example parameters	Considerations
	Death: hospitalization ratio (for respiratory hospitalizations or ideally for confirmed influenza cases and cases with outcome or discharge data)	Ideally this parameter would include confirmed cases and cases with outcome or discharge data. It is important that these data come from the same reporting sites. If hospitalization criteria are not consistent over time, changes should be characterized and considered in the interpretation of this parameter. Cumulative data since the start of the epidemic wave should be used, partly due to the lag between hospitalization and registration of death but mainly because this parameter is likely to be unstable at the beginning of an epidemic and as such is best measured around and after the epidemic peak.
	ICU: hospitalization ratio (for respiratory hospitalizations or ideally for confirmed influenza cases)	Ideally this parameter would include confirmed cases and cases with outcome or discharge data. It is important that these data come from the same reporting sites. This parameter will be affected by hospitalization and ICU admission criteria, which may vary for different age groups. If these are not consistent over time, changes should be characterized and considered in the interpretation of this parameter.
	Influenza/SARI/respiratory illness patients requiring oxygen support: total influenza/SARI/respiratory illness patients ratio	Capturing cases which require oxygen support may be useful for measuring serious disease in systems where admission criteria for ICU are not consistent.
	Proportion of emergency department presentations which are admitted to hospital (for respiratory illness or ideally for confirmed influenza cases)	Emergency department data may be available on a more timely basis than hospital data.
	SARI: ILI or SARI: ARI ratios	This parameter should only be considered when data for other seriousness parameters are not available. This parameter can be challenging to use as data should come from the same catchment populations. Ideally, the proportion of activity attributable to influenza should be known.

Table 5. Useful parameters for assessing morbidity and mortality

Morbidity and mortality	Example parameters	Considerations
	Weekly number of hospital or ICU admissions for influenza/SARI/respiratory illness, or rate per unit population	This parameter may be used if reporting sites consistently notify counts. If reporting sites change from week to week, the counts may not reflect true changes in activity, therefore rates or counts adjusted according to the number of reporting sites should be used. Hospital and ICU data may not be available during normal seasons, but may become available during pandemics if surveillance is expanded. Alternatively, data may only be available from sentinel hospitals, with more or all hospitals participating during pandemics.
	SARI proportion or influenza-confirmed SARI proportion of all hospital or ICU admissions	This parameter will be affected by changes in health care seeking behaviour for non-influenza or non-SARI illness – for example, as a consequence of PHSM or changes in health care policies.
	Composite (product) of weekly SARI rate and weekly percentage positivity rates of SARI cases for influenza	Incidence rates and percentage positivity data should come from the same time period and, if possible, from the same sites.
	Weekly number of hospitalizations for influenza/SARI/respiratory illness requiring oxygen support	This parameter captures only cases which require oxygen support. This may be a useful way to capture serious disease in systems where admission criteria for ICU are not consistent.
	Weekly influenza deaths, pneumonia and influenza deaths, or all-cause mortality	Depending on the size of the population and the way in which mortality is captured, deaths may be too few to make for a reliable parameter. The timeliness and specificity of mortality reporting should also be considered. Mortality data may be more complete and representative than data for other parameters.

Table 6. Useful parameters for assessing impact on health care capacity

Impact on Healthcare Capacity	Example parameters	Considerations
	Number of patients currently in hospital, ICU or beds with oxygen support with influenza/SARI/ respiratory illness, or rate per unit population	Unlike parameters which measure admissions, this parameter is affected by the length of stay in hospital/ICU. This parameter may be used if reporting sites consistently notify counts. If reporting sites change from week to week, the counts may not reflect true changes in activity, therefore rates or counts adjusted according to the number of reporting sites should be used. Hospital and ICU data may not be available during normal seasons, but may become available during pandemics if surveillance is expanded. Alternatively, data may only be available from sentinel hospitals, with more or all hospitals participating during pandemics.
	Proportion of all hospital beds, ICU beds or beds with oxygen support currently occupied for influenza/SARI/ respiratory illness	This parameter measures remaining hospital or ICU capacity and is therefore affected by changes to total capacity – for example, if surge capacity is engaged. The percentage occupation relative to initial capacity can be used to ensure that the measurement of this parameter remains consistent throughout extraordinary periods. Unlike parameters which measure admissions, this parameter is affected by the length of stay in hospital/ICU.
	Health care workforce absenteeism	Health care capacity is typically tightly linked to staffing levels. Measuring health care workforce absenteeism can therefore be useful for assessing health care system capacity.
	Primary health care capacity for mild presentations (measure of saturation)	This parameter should be a measure of service saturation and might for example include the proportion of services reporting that they are overwhelmed.

Table 7. Additional approaches for countries with modelling capacity

Example parameters	Considerations
Effective reproduction number	May be calculated in many ways (for example, based on cases, hospitalizations, or deaths) depending on the surveillance systems in place. May not be useful for assessing transmissibility without other estimates such as generation time or serial interval, and so other parameters such as the growth rate may be preferred.
Forecasting and nowcasting, especially for hospital/ICU admissions and occupancy	Depending on how hospitalization and ICU data are reported and collected, data on hospitalized cases might not be timely or complete. As hospital data lag behind case identification, forecasting and nowcasting may be required to model current and likely future hospital usage for planning PHSM. Forecasting can be applied to the parameters already described in the tables above. Alternatively, forecasting can be used to predict when hospital capacity is likely to be overwhelmed. This requires that the level at which a system is considered to be overwhelmed be defined, with thresholds set on the time (for example, number of weeks) within which this level is forecast to be reached.

Where possible, and when enough data are available, the parameters should be stratified by age group, so that age specific thresholds can be set. The suggested minimum set of age groups are: under 15 years, 15–64 years and 65 years or over. At the beginning of a season, the data might be insufficient to stratify by age group but it is important to collect age-specific information from the start. In addition, if there are subnational variations (for example, in climatic patterns), assessments can also be stratified by region – any region with elevated or unusual activity can then be flagged up alongside the national assessment.

For the seriousness of disease, and morbidity and mortality indicators, the parameters should, where possible, take into account the presence or absence of underlying chronic diseases or conditions known to be linked with adverse outcomes for influenza (for example, asthma, HIV/AIDS, pregnancy, and heart or lung disease). Further information on pre-existing conditions associated with increased risk of serious outcomes for influenza is provided in Appendix 3 of the WHO Global epidemiological surveillance standards for influenza (6).

In addition to the parameters proposed in Tables 3–6, countries can include other parameters based on their own surveillance systems, provided they have confidence in the data.

Influenza severity assessment: Step 1 – Key points

- Use the criteria described in this guide to select the parameters to be used.
- Document the following information on the selected parameters:
 - data source (for example, sentinel outpatient or hospital surveillance);
 - range of historical data available;
 - strengths and limitations of the parameter; and
 - proportion of data that is laboratory confirmed.



4.2 Step 2: Set the thresholds for each parameter using historical data

4.2.1 Principles of threshold setting

As surveillance systems differ widely in different countries, the absolute values of the parameters cannot be used to make meaningful comparisons between countries. However, within a country, it is possible to determine how the value of a parameter compares with its values in previous seasons and, more specifically, how the parameter value compares with the peak values of previous seasons. Thus, using historical data, each country can qualitatively describe the level of epidemic or pandemic activity compared to previous seasons using thresholds.

Establishing thresholds requires the analysis of multi-year influenza surveillance data to understand typical seasonal patterns and define varying levels of influenza activity. When calculated rationally and with sufficient historical data, thresholds have the potential to delineate different disease activity levels. These thresholds are designed to categorize intensity levels ranging from “no activity or below epidemic threshold” to “low”, “moderate”, “high” and “extraordinary”. These categories not only facilitate communication but also aid in implementing public health responses that are proportionate to the degree of disease activity and to the impact on community health.

In the PISA framework, two types of thresholds are used: the epidemic threshold and the intensity thresholds. The epidemic threshold is the lowest threshold and is also referred to as the seasonal baseline. It marks the start and end of the influenza season³. This baseline helps identify early signs of unusual influenza activity occurring outside of the expected period. The intensity thresholds are used to categorize weekly values during the epidemic period against the historical epidemic peak values. Different methods to calculate thresholds are described by indicator below.

Before setting thresholds, the type and characteristics of the data to be used should be understood. Most of the methods recommended in this guidance typically require a minimum of 3 years of data. Where there are no historical data, thresholds can be set based on expert opinion or the experiences of other countries. The data should first be plotted to better understand gaps, seasonality and the typical range of values. Years in which significant events impacted surveillance systems, such as the 2009 H1N1 influenza pandemic and the COVID-19 pandemic, may yield data that are less representative of typical influenza activity. Additionally, during such periods, the degree of confidence that the data reflect the actual situation might be reduced. Therefore, data from these years should be considered with caution or excluded when setting influenza-specific thresholds.

When deciding on methods for setting the epidemic threshold, consideration should be given to how sensitive and specific the threshold is, and to what actions may be taken when the threshold is breached. If the threshold is highly sensitive, it will capture the start of an epidemic early. If a threshold is highly specific, the rate of false positives will be minimal. The epidemic threshold can also be set manually using expert consensus or informed judgment to strike the optimal balance between timeliness, sensitivity and specificity.

Ultimately, a good set of thresholds will separate out usual disease levels from unusual ones. Therefore, most of the peaks should fall under the “low” or “moderate” categories. Only rare, serious events should be labelled “high” or “extraordinary”. Ideally, carefully selected thresholds should categorize data in such a way that approximately 10% of peaks fall above the high threshold and approximately 2.5% above the extraordinary threshold. This division ensures that the thresholds are both informative and indicative of unusual activity, especially for extraordinary

3 While the epidemic threshold or seasonal baseline as used in PISA is a critical metric for monitoring influenza activity, it should be recognized that the actual determination of the start and end of the influenza season may involve different criteria. This can include local epidemiological trends and public health assessments.

cases, and that thresholds generated using different methods are broadly comparable. If the distribution of peaks does not generally follow this pattern (for example with too many events falling into the “high” or “extraordinary” categories) it may be necessary to re-examine the threshold levels. If the thresholds are also too close to each other and do not provide enough warning before the next level is reached, they can be adjusted.

It is important to remain flexible when setting thresholds as diseases and surveillance systems change. Methods that worked previously might not work in the future, and so it is important to adjust the approach to incorporate new information. This can include adapting an existing methodology to better suit the current circumstances or newly discovered data.

Where possible, it is best to avoid relying too heavily on a single source of data. Thresholds can be generated for several parameters, and the assessments for the different parameters used collectively to produce a more comprehensive and informed assessment. Combining information from various sources can provide a broader perspective, improve confidence in the assessment and strengthen the decision-making process.

Over time, the values of the selected parameters may change – for example, due to changes in the characteristics of the population or surveillance system. It is therefore important to use recent data to calculate thresholds. Recalculating thresholds at the end of the influenza season, including the most recent season, is a good approach in this regard.

If age-stratified data are collected, setting thresholds separately by age group can help to ensure that age-specific patterns in activity are not obscured by other patterns in other age groups.

4.2.2 Thresholds for transmissibility, and morbidity and mortality parameters

To set the thresholds for transmissibility and morbidity and mortality parameters, the following methods are recommended:

- WHO average curve method (ACM) (2,10) adapted to set fixed thresholds around the peak epidemic values of the average curve (see Box 9) or
- Moving epidemic method (MEM) (11,12); or
- percentile method; or
- country-specific statistical or empirical approaches, depending on the intrinsic properties of the systems.

Table 8 lists the suggested cut-off points for transmissibility, morbidity and mortality and impact on health care capacity parameters for MEM and WHO ACM.

MEM and ACM share a common fundamental methodology in their approach to setting intensity thresholds. However, although both methods use data points around the peak, they also have some important differences, including that MEM is sensitive to the number of historical years⁴ used in the threshold calculations. In contrast, ACM is relatively stable in its use of data points around the peak. Both methods can be optimized using data transformation techniques according to user preference.

4.2.3 Thresholds for impact on health care capacity parameters

Thresholds for this indicator may be calculated in the same way as described above for the transmissibility and morbidity and mortality indicators. However, it may also be possible to set useful thresholds with very limited historical data based on prior experience of an extreme epidemic.

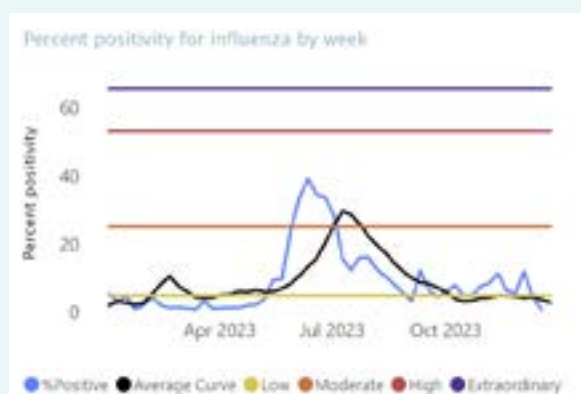
Thresholds for the impact on health care capacity indicator can be aligned with trigger points for interventions. A single extreme event may therefore be sufficient to determine appropriate thresholds. For example, depending on the parameters chosen, and on whether the data collected at the time are comparable to ongoing surveillance, data from the COVID-19 pandemic may be very useful for setting thresholds. As an example, if during the COVID-19 pandemic, elective procedures were postponed when hospital bed

4 For both methods, it is recommended that at least three years of historical data are used.

Box 9. Setting fixed thresholds

In the PISA framework, thresholds are set at a fixed level and do not fluctuate weekly in line with expected seasonal activity. This fixed approach allows for a consistent comparison of influenza activity across weeks throughout the year. In cases where a country encounters one or more epidemics of a similar scale within a year, a single set of thresholds is established for the entire year, as illustrated by the example from Nicaragua. Conversely, in countries that experience several distinct epidemic periods—some being dominant and others less pronounced within the same year—distinct thresholds can be designated for each separate epidemic period, as demonstrated by the example from Peru. It is important to note that the WHO Average Curve Method and the Moving Epidemic Method are highly adaptable and, if desired, can be used to apply separate thresholds to different epidemic periods, even if they have similar peak intensities.

Nicaragua



Peru

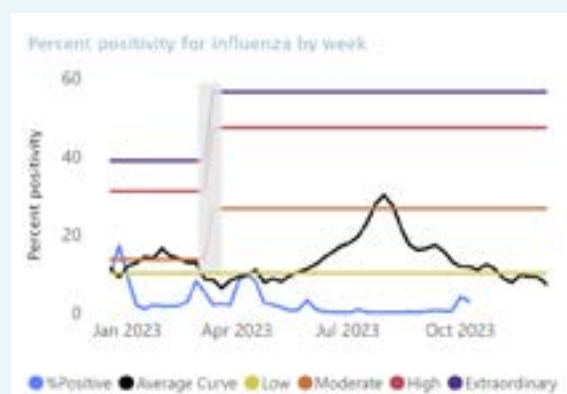


Table 8. Suggested cut-off points by method for threshold setting for transmissibility, morbidity and mortality and impact on health care capacity parameters

Ranges of activity	MEM	WHO Average Curve Method
None or below seasonal threshold	Below the seasonal threshold as set by MEM	Below the seasonal threshold as set by the WHO ACM (annual median value)
Low	Between the seasonal threshold and the upper limit of the 40% one-sided CI of the geometric mean	Between the seasonal threshold and the upper 40% CI of the mean peak value ^a of the average curve
Moderate	Between the upper limit of the 40% and 90% one-sided CIs of the geometric mean	Between the upper limit of the 40% and 90% CIs of the mean peak value ^a of the average curve
High	Between the upper limit of the 90% and 97.5% one-sided CIs of the geometric mean	Between the upper limit of the 90% and 97.5% CIs of the mean peak value ^a of the average curve
Extraordinary	Above the upper limit of the 97.5% one-sided CI of the geometric mean	Above the upper limit of the 97.5% CI of the mean peak value ^a of the average curve

CI = confidence interval.

^a When the peak values are very different from one season to another, it is best to use the geometric mean of the peak values instead of the arithmetic mean.

occupancy for SARI reached around 30%, this could be a useful threshold for delineating “high” activity. If ICU reported becoming overwhelmed when occupancy reached 60%, this could be used for the “extraordinary” threshold. Not all thresholds need to be associated with a public health action – for example, if only one threshold is associated with an intervention, the other thresholds can be spaced around this. The thresholds can be subsequently adjusted if, for example, it was found that the thresholds were too close to each other.

Equally, all the thresholds may be set on the basis of expert consensus, especially if historical data are missing.

It is important to remember that the values of the thresholds may vary considerably from country to country due to differences in surveillance systems and response capacities. This is why absolute threshold values have not been proposed in this guide.

4.2.4 Thresholds for seriousness of disease parameters

The parameters for the seriousness of disease indicator (i.e. cumulative ratios and proportions) fluctuate at the beginning of an epidemic and only become stable when the peak of the

influenza activity occurs. Therefore, country-specific thresholds should be calculated using the end-of-season cumulative values of previous seasons. Suggested threshold values for assessing seriousness of disease using the mean and standard deviation are provided in Table 9, however other thresholds and threshold setting methods, such as percentiles, can also be explored.

Countries may choose to conduct more in-depth analyses, for instance assessing seriousness of disease separately for each epidemic wave rather than for the whole season. This approach is particularly insightful when combined with records of the predominant virus subtypes during each wave, offering a more nuanced understanding of the clinical seriousness of the different viruses circulating within a single season.

Age-specific thresholds should be set when sufficient data are available, as seriousness of disease is expected to vary significantly by age. Age-specific analysis can be particularly beneficial for targeting PHSM and medical interventions to at-risk age groups and understanding the interplay between age and susceptibility to different circulating influenza subtypes.

Table 9. Suggested cut-off points for threshold setting for seriousness of disease parameters

Low	< Mean
Moderate	Mean to mean + 1 SD
High	Mean + 1 SD to mean + 3 SD
Extraordinary	> Mean + 3 SD

SD = standard deviation

Influenza severity assessment: Step 2 – Key points

- Identify suitable methods for threshold setting, considering the occurrence of one or multiple waves of influenza activity. Evaluate and adjust these methods as needed to ensure their relevance and accuracy. Set thresholds for qualitative levels of activity for each parameter and document the threshold values for each parameter.
- Document the methods and the historical data used.



4.3 Step 3: Interpret data to assess severity

Ideally on a weekly basis after the beginning of the epidemic or pandemic, the thresholds should be applied to the contemporary parameter data for the transmissibility, morbidity and mortality, and impact on health care capacity indicators. As discussed above, assessing the seriousness of disease indicator should be done once influenza activity has peaked, ideally once near the peak for a timely estimate and again at the conclusion of the epidemic or pandemic. Therefore, for seasonal influenza, no assessment needs to be done outside the epidemic season for this indicator.

The severity assessment at the national level will be driven by quantitative data, but with inputs based on expertise and experience. A country will then produce a qualitative assessment for each indicator by looking at all parameters for that indicator, categorizing the values for the current situation in relation to their own historical data using thresholds, and triangulating information from different sources. Additional contextual information should be taken into account and could lead to upscaling or downscaling of the assessment (Fig. 2). Examples of contextual information include, but are not limited to:

- current perturbations to the surveillance system which might lead to over or underestimation of the parameter values;
- specific at-risk groups or subpopulations that are heavily affected and might not be reflected in the overall population estimates;

- other concomitant outbreaks or events that will affect the PISA parameters or overall response, or compete for the same health care services;
- information from neighbouring countries; and
- estimates from forecasting and nowcasting.

All available information should be used to scale up or down the overall indicator assessment so that the final score best reflects the current situation.

Knowing what factors may affect the data is important for characterizing uncertainty in assessments. The results of the assessment and the associated level of confidence should be used in national risk assessments and to inform public health decisions. Assessments should be recorded and the information that was considered documented, highlighting any important differences between age groups.

WHO proposes that for reporting to the global level, confidence levels should be assigned as high, medium or low (Table 10) for each week that the indicator is assessed. Indicator assessments and their associated confidence levels can be revised retrospectively as new data become available. Countries may however wish to develop their own methods or adapt the criteria for assessing confidence for national reporting. If an evaluation of the influenza surveillance system has been completed recently, the results may be useful in informing the confidence level for the severity assessment – especially information on surveillance data quality and completeness, timeliness, representativeness, flexibility and stability.

Figure 2. Example of how to interpret PISA scores together with contextual information to generate an indicator score

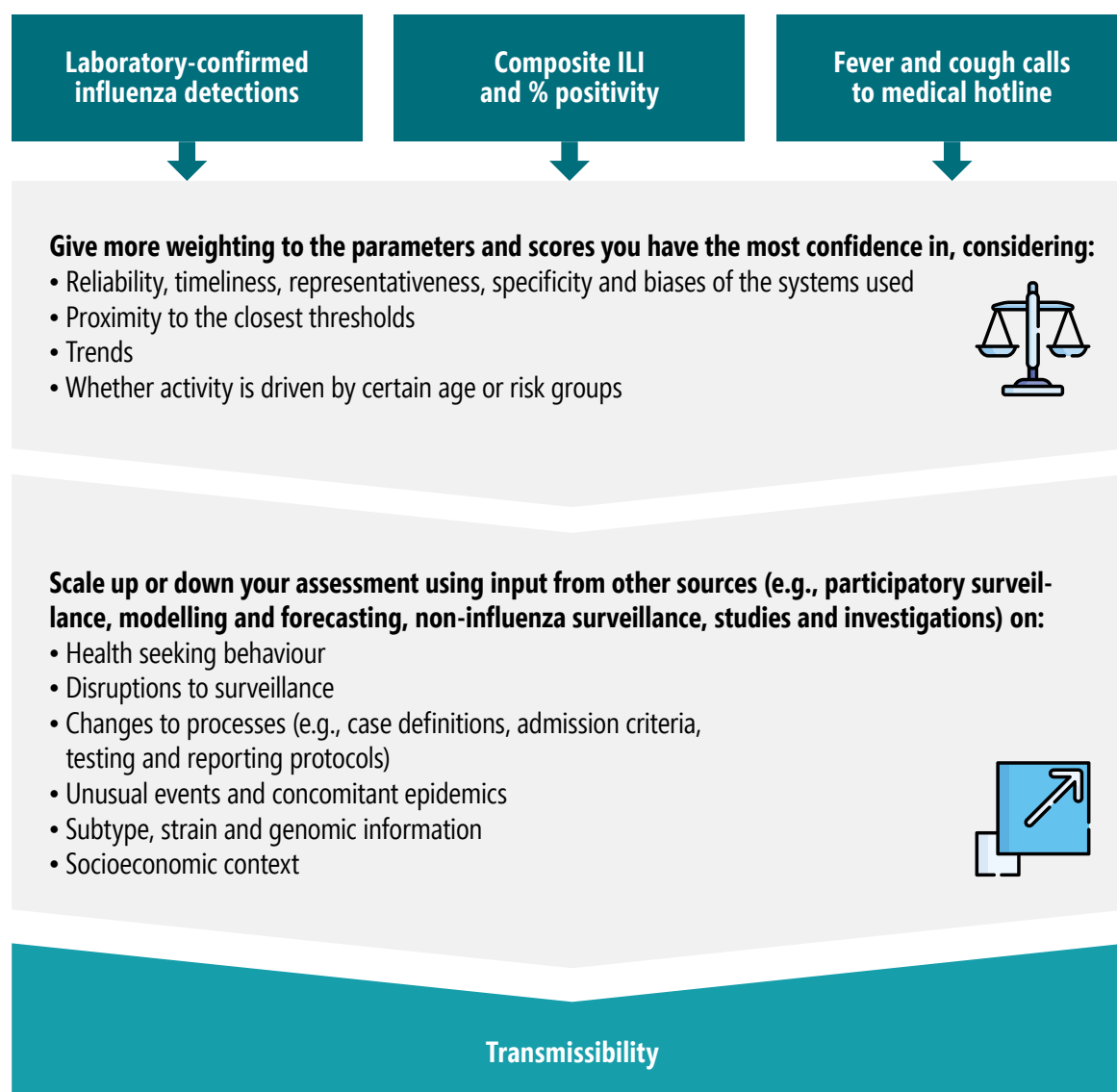


Table 10. Assigning confidence levels for reporting PISA results to WHO

Confidence level	Description
High	Parameters used for the assessment meet the recommended criteria for use in PISA. Surveillance systems are generally stable, and where changes do occur these are well documented. Indicator assessments are likely to be based on more than one parameter, with the different parameters showing similar trends or scoring at the same level.
Medium	Parameters used for the assessment meet some of the recommended criteria but there may be some challenges with the quality of weekly data or the threshold setting approach. Reporting lags may require assessments for the most recent weeks to be estimated based on past data and trends, or using sources of data which may be more timely but less accurate.
Low	The surveillance systems used for assessments are not stable and changes or disruptions are not well documented. The data used for assessments may be incomplete or subject to significant delays. If multiple parameters are used, they may indicate vastly different activity levels or conflicting trends.

Influenza severity assessment: Step 3 – Key points

- Assess transmissibility, morbidity and mortality, and impact on health care capacity on a weekly basis. Assess seriousness of disease using cumulative data up to twice per epidemic or pandemic – once near the peak and again at the end of the epidemic or pandemic.
- Examine data for any differences between age groups or at-risk groups.
- Use the findings from the assessments (including contextual information and confidence levels) to inform the national risk assessment.
- Document the parameters and thresholds used, the parameters that were most reliable and given most weight in the overall assessment, how the interpretation was made, and how information on the different parameters was combined to produce the overall score for each indicator.



4.4 Step 4: Communicate and report the severity assessment findings

National PISA indicator assessments should be used for situational awareness and communications, both within a country and at the regional and global levels. While PISA methods can be applied at a subnational level to identify areas with higher activity, only national assessments are reported to WHO. Subnational assessments may be particularly useful for countries that cover large geographical areas with different seasonal influenza dynamics, or where PISA thresholds will be used to set PHSM at a subnational level. Similarly, while all-age assessments are reported to WHO, age-stratified assessments may be useful for communicating the need for targeted interventions, such as risk communication campaigns in schools.

4.4.1 Communicating PISA results

The following risk communication principles may be useful for ensuring that PISA results are presented effectively:

- Risk communication interventions should be transparent, timely, easy to understand, acknowledge uncertainty, address affected populations, and be disseminated using multiple platforms, methods and channels.
- Communicating PISA results during influenza seasons will help familiarize

people with the methods and may make communicating during a pandemic easier.

- Communicate both what is known and what is not known from the severity assessments. PISA has its limitations, and it is important that these are acknowledged and communicated to target audiences to build trust:
 - The severity assessments provide a judgement on the magnitude of the current season's activity compared to previous seasons, and on the seriousness of disease in infected people. The assessments may provide clarity on which population groups experience the most activity and are most affected by serious disease. They can also guide what actions to take and why. For example, a more severe influenza pandemic may require more urgent and intense response measures (such as increasing hospital bed capacity, providing antivirals or cancelling mass gatherings) compared to the measures needed in a less severe influenza pandemic. By collecting data from different sources and using age stratification, PISA can inform how PHSM might be targeted to reach the

settings and populations experiencing the highest levels of activity, such as schoolchildren, health care workers or residents in long-term care facilities.

- Severity assessments are dependent on the data available. The accuracy of the assessment will improve with time and more data. Under-reporting and changes in testing practices or health care seeking behaviours may affect public health surveillance data. Severity varies within and between populations and will change over time, requiring reassessment. Surveillance systems differ widely from one country to another. A severity assessment is not a risk assessment but can be part of the risk assessment. PISA cannot predict when, from where or from which virus strain the next influenza pandemic will emerge, or the length or severity of future epidemics or pandemics.
- Communicating PISA results can enable individuals to make choices and take actions to protect themselves, their families and communities from seasonal or pandemic influenza, and can enable decision-makers and public health officials to act rapidly with appropriate response measures for community engagement. PHSM recommended for epidemics and pandemics of any severity include hand hygiene, respiratory etiquette, enhanced cleaning and ventilation, travel advice, and face masks for (and isolation of) sick individuals. Additional measures and pharmaceutical interventions (vaccination and medications) could also be implemented depending on assessed severity, target audience and setting.
- Develop a strategic plan for communicating influenza severity in order to clearly and consistently convey the concept and importance of PISA to target audiences during seasonal influenza epidemics and pandemics. Identify people that the community trust and build relationships with them. Involve them in decision-making to ensure that interventions are

collaborative, contextually appropriate and that communication is community owned. Target audiences, key messages, and appropriate channels and approaches to monitoring and evaluation should be outlined and integrated into existing health response plans.

- For more information, please see: <https://www.who.int/emergencies/risk-communications>

4.4.2 Reporting PISA results to WHO

Routine national level estimates also contribute to regional and global severity estimates, which allowing WHO to provide timely information, back to countries to inform their own national risk assessments, preparedness and response planning. The reporting of national PISA estimates to WHO is considered to be voluntary routine data reporting outside of an emergency situation. The terms applicable to the provision of data to WHO by countries are provided below in Annex 1 (Data collection agreement). By reporting PISA data to WHO (either by sending an Excel file or uploading directly to RespiMart (<https://www.who.int/tools/RespiMart>) or via regional platforms), the country is agreeing to the terms set out in Annex 1.

When and what to report to WHO

The qualitative assessment by countries for each indicator (except seriousness of disease), together with associated confidence levels, the parameters used in the assessment and any indicator-specific comments, should be reported to WHO, ideally on a weekly basis. Year-round reporting is encouraged to ensure that periods of high activity with unusual timing are captured. The seriousness of disease indicator should be reported up to twice a year – near the midpoint and at the end of the epidemic. Assessments can be reported retrospectively and can be updated if new data become available.

Indicator level:

- Where there are differences in the estimates by age group or for groups with underlying conditions, the final assessment should be based on the aggregated data for all groups.

However, if the estimate for a specific age group or risk group is in a higher category, this should be flagged in the comment field.

Indicator confidence level:

- The confidence level qualitatively reflects how sure the investigator is of the final assessment score for the indicator. This will depend on the breadth and quality of data and the methods used to assess the indicator. Confidence levels may vary from week to week if there are short-term challenges in data collection or where parameters for the same indicator give vastly different scores. Specified criteria may be developed by countries when assessing confidence levels to ensure consistent reporting (see Table 10).

Parameters used in the assessment:

- To facilitate interpretation of national assessments at the global level, the parameters used in the assessment should be reported. This can be done once at the beginning of the season.

Comments:

- Information should be included on any factors which may have influenced the assessment (for example, changes in health care seeking behaviour, testing practices and capacities and so on), and any differences in activity in certain age groups, at-risk groups or regions highlighted. In the following example, the report for week 10 would be “Moderate” but the comment field could include the text: “High in 15–64 year-olds”.

		Week										
		1	2	3	4	5	6	7	8	9	10	11
Age groups	All	34.29	38.50	40.32	37.36	36.12	39.13	40.52	41.16	43.37	33.84	43.28
	>15yrs	13.35	17.65	21.74	16.67	17.65	20.63	26.92	26.83	28.13	28.00	27.93
	15-64yrs	64.29	65.00	68.00	65.63	58.00	59.72	58.24	55.17	57.45	58.75	44.74
	65+yrs	16.67	20.00	21.45	30.43	32.36	32.65	31.75	35.44	37.89	39.81	38.26

Influenza severity assessment: Step 4 – Key points

- Develop a plan to communicate the assessments to the public and decision-makers to ensure they are interpreted appropriately.
- Report the assessment for each indicator through RespiMart at <https://www.who.int/tools/RespiMart> and include the following:
 - weekly qualitative assessments for the transmissibility, morbidity and mortality, and impact on health care capacity indicators;
 - at the peak of the season and at the end of the season, a qualitative assessment for the seriousness of disease indicator;
 - confidence level in the assessment of each indicator;
 - the parameters used to assess each indicator; and
 - any comments (for example, whether certain age groups are more affected or whether a high proportion of cases did not have underlying chronic conditions that would put them at risk for serious disease).



5 Presentation and use of severity assessments at the global level

The country PISA severity assessments reported to WHO are stored in the WHO RespiMart data platform. The platform facilitates the exchange, harmonization, consolidation, and storage of disease-specific and syndromic respiratory disease data.

The WHO Global Influenza Programme compiles and examines the reported national severity estimates, confidence levels and comments, and incorporates this information into its routine surveillance and monitoring activities for seasonal influenza – the outcome products of which include, but are not limited to, weekly seasonal influenza updates, seasonal reviews, meeting presentations and internal communications.

Reported PISA data will be made publicly available unless data providers inform WHO that they wish to opt out of public reporting (Table 11). The public sharing of information reported by countries aligns with the WHO policy on the use and sharing of data collected by WHO in Member States outside the context of public health emergencies (<https://www.who.int/about/policies/publishing/data-policy>), which was introduced in January 2018. The terms applicable to the use of the data by WHO are provided below in Annex 1.

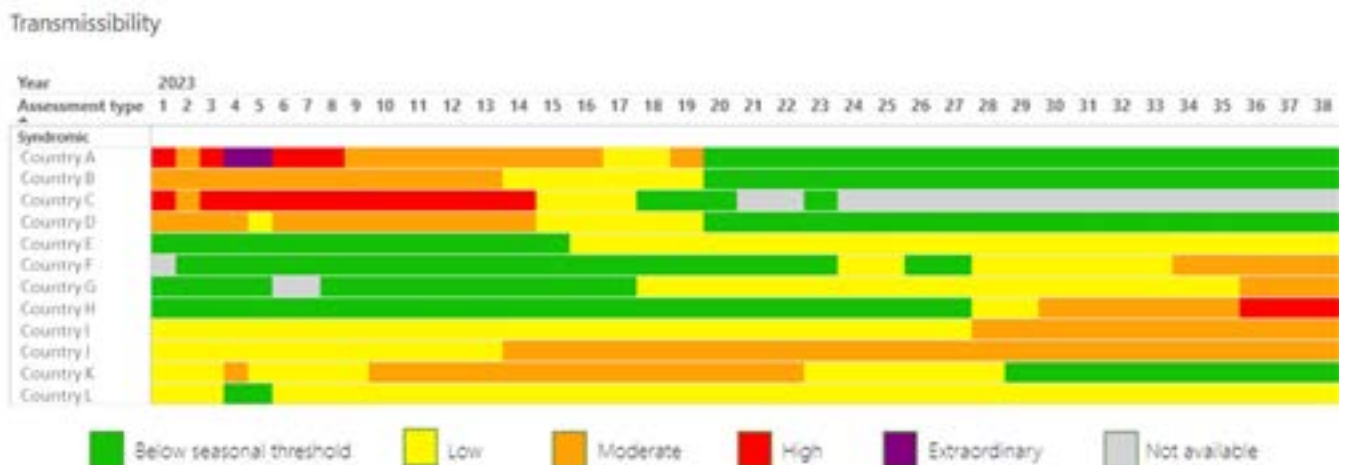
The data visualized on the public WHO website are qualitative assessments and contain no personal identifying information. Outputs will include heat charts (Fig. 3) for each indicator by week and by country. Maps showing results for each indicator will also be produced, showing assessments by country at a certain time point. Explanatory information on the methods used and their inherent uncertainty provides context for the severity estimates. Disclaimers accompany the data and indicate that estimates, confidence levels and comments may be revised over time. The terms and conditions of use by others of the data shared by WHO can be found on the WHO website (<https://www.who.int/about/policies/publishing/data-policy/terms-and-conditions>).

By reporting PISA data to WHO (either by sending an Excel file or uploading directly to RespiMart or regional platforms), the country is agreeing to the terms of data use by WHO set out in Annex 1. The benefits of making national PISA estimates publicly available include, but are not limited to, improving data accessibility and enhancing the transparency of national and global decision-making. The information published can support decision-making and allow countries to be better informed on pandemic preparedness actions to be taken. The sharing of information during seasonal epidemics also lays the foundation for data sharing and access during a pandemic or other public health emergency.

Table 11. Data sharing options

Has never reported PISA results to WHO	Wishes to share data and make assessments publicly available	Agree to terms on RespiMart
	Wishes to share data with WHO but not make assessments publicly available	Consult WHO in writing before reporting
Has previously reported PISA results to WHO	Wishes to continue sharing data and make all assessments (past and future) publicly available	Agree to terms on RespiMart
	Wishes to continue sharing data but only make assessments after a specific date publicly available	Consult WHO in writing before reporting
	Wishes to continue sharing data with WHO but not make assessments publicly available	Consult WHO in writing before reporting
	Does not wish to continue sharing data or make past assessments publicly available	Consult the process for opting out of sharing data at https://www.who.int/about/policies/publishing/data-policy – once notification is received and acknowledged, past PISA assessments will be removed from the publicly available platform

Figure 3. Heat chart for transmissibility indicator



6 References

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Annex. Data collection agreement

Data are the basis for all sound public health actions and the benefits of data sharing are widely recognized, including scientific and public health benefits. Whenever possible, the World Health Organization (WHO) wishes to promote the sharing of health data, including but not restricted to surveillance and epidemiological data.

As used in this data collection tool, the term “Data provider” means a duly authorized representative of the governmental body with authority to release health data of the country to WHO (i.e. the Ministry of Health or other responsible governmental authority). The recipient of this data collection tool is responsible for ensuring that he/she is the Data provider, or for providing this data collection tool to the Data provider.

In this connection, and without prejudice to information sharing and publication pursuant to legally binding instruments, by providing data to WHO, the Data provider:

- confirms that all data to be supplied to WHO (including but not limited to the types listed in Table 1) hereunder have been collected in accordance with applicable national laws, including data protection laws aimed at protecting the confidentiality of identifiable persons;
- agrees that WHO shall be entitled, subject always to measures to ensure the ethical and secure use of the data, and subject always to an appropriate acknowledgement of the country:
 - i. to publish the data, stripped of any personal identifiers (such data without personal identifiers being hereinafter referred to as “the Data”) and make the Data available to any interested party on request (to the extent they have not, or not yet, been published by WHO) on terms that allow non-commercial, not-for-profit use of the Data for public health purposes (provided always that publication of the Data shall remain under the control of WHO);
 - ii. to use, compile, aggregate, evaluate and analyse the Data and publish and disseminate the results thereof in conjunction with WHO’s work and in accordance with the Organization’s policies and practices.

Except where data sharing and publication are required under legally binding instruments (International Health Regulations (2005), WHO Nomenclature Regulations 1967, etc.), the Data provider may in respect of certain data opt out of (any part of) the above, by notifying WHO thereof in writing at the following address, provided that any such notification shall clearly identify the data in question and clearly indicate the scope of the opt-out (in reference to the above), and provided that specific reasons shall be given for the opt-out.

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Table 1. List types of data provided to WHO (non-exhaustive)

Data types	Examples
WHO-supported household surveys	WHO Strategic Advisory Group of Experts (SAGE) on Immunization, WHO STEPwise approach to surveillance (STEPS), World Health Survey
Unit record mortality data	(Not currently collected by WHO headquarters, but by the WHO Regional Office for the Americas/Pan American Health Organization)
Aggregated mortality data	WHO Mortality Database
Aggregated health facility data	DHIS 2.0 data (not currently collected by WHO headquarters, but hospital data are collected by the WHO Regional Office for Europe)
Case-based health facility data	WHO Global Burn Registry data ^a
Health expenditure data	WHO Global Health Expenditure Database (National Health Account indicators)
Health facility surveys	Availability of medicines and diagnostics
Health research data (other than clinical trials) ^{b,c}	Case-control investigations, prospective cohort studies
Key informant surveys	Existence of national road traffic laws
National survey reports	Prevalence of hypertension or tobacco use
Disease surveillance data	HIV prevalence in pregnant women or tuberculosis treatment outcomes
Surveillance of notifiable diseases	Total number of cases of plague

^a Note: Case-based health facility data collection such as that in the WHO Global Burn Registry does not require WHO Member State approval.

^b The world health report 2013. Research for universal health coverage. Geneva: World Health Organization; 2013 (<https://iris.who.int/handle/10665/85761>, accessed 6 December 2023).

^c WHO statement on public disclosure of clinical trial results: Geneva: World Health Organization; 2015 (<https://www.who.int/clinical-trials-registry-platform/reporting-on-findings>, accessed 6 December 2023).

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