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EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL



OPERATIONAL SUPPORT

Guide for designing and conducting risk prioritisation exercises to rank infectious disease threats



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Acknowledgements
The authors express their gratitude to John Kinsman, Angeliki Melidou, Ajibola Omokanye, Anastasia Pharris, Diamantis Plachouras and Linda Trönnberg at ECDC for providing input on the criteria and disease selection, as well as to Maria Moreno and Maryoli Veloso Fraigola for their work on revising the criteria.

ECDC greatly acknowledges our colleagues at Africa CDC and the Public Health Agency of Canada for sharing experiences on risk prioritisation.

ECDC extends its sincere appreciation to all national focal points for preparedness and response for their significant contributions to developing this prioritisation tool, and to the experts who actively participated in ECDC consultations on this subject.

Suggested citation: Guide for designing and conducting risk prioritisation exercises to rank infectious disease threats. Stockholm: ECDC; 2026.

Stockholm, November 2026

ISBN 978-92-9498-938-3
doi: 10.2900/2842852
Catalogue number TQ-01-26-083-EN-N

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Risk prioritisation is a structured process used to rank infectious disease threats based on multiple criteria to determine which threats require the most urgent actions. The outcomes of risk prioritisation exercises assist public health authorities and policymakers with allocating resources, developing operational plans, improving surveillance systems and identifying areas of focus for capacity-building exercises, trainings and procurements.

This guide provides public health authorities with practical instructions for conducting risk prioritisation exercises to facilitate a more evidence-informed and effective approach to preparedness and response planning.

How to use this guide

This guide is split into three sections, representing the three phases of activity when conducting a risk prioritisation exercise:

- Preparation
- Risk prioritisation exercise
- Follow-up

The following supporting materials are provided as Annexes to this report and as Microsoft Word templates (see Supplementary materials): Glossary, ECDC risk prioritisation criteria, Example of how a criterion can be presented in the scoring tool. The R code used for risk ranking is also available as a supplement.

Introduction

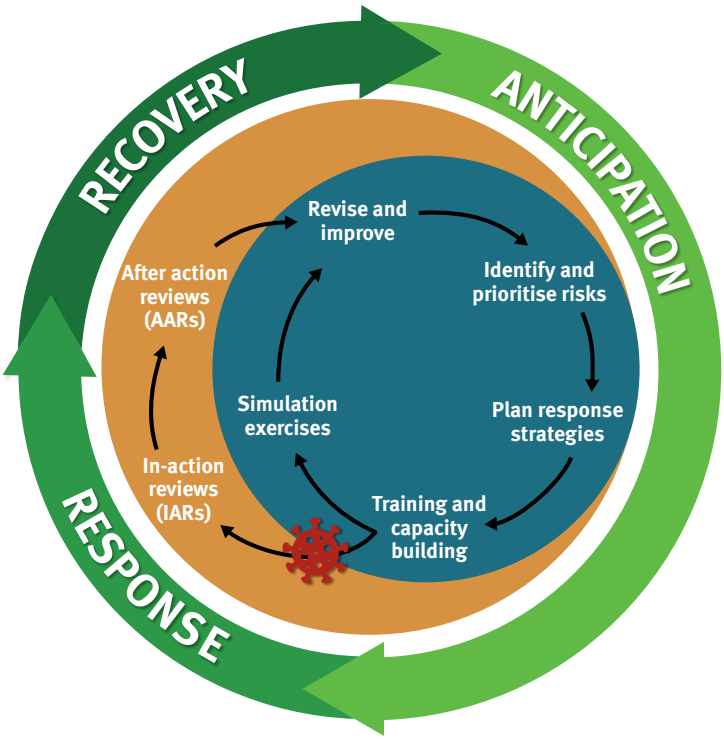
Identifying and prioritising risks is an important step of the emergency preparedness and response cycle (Figure 1). During this step, public health authorities consider the threat spectrum broadly and into the future so that preparedness and response systems can effectively anticipate potential and emerging risks, understand systemic vulnerabilities to these risks, and develop appropriate training, capacity-building, and preparedness and response plans.

As there are often multiple and competing risks, risk prioritisation is essential to identify the threats that require the most immediate attention, which can guide preparedness efforts and resource allocation. Risk prioritisation exercises complement event-based surveillance and early warning systems, which should also be in place to identify imminent threats.

This guide provides European Union and European Economic Area (EU/EEA) countries with an adaptable methodology for conducting risk prioritisation exercises focused on infectious disease threats to facilitate a more evidence-informed and effective approach to preparedness and response planning. All EU/EEA countries should consider regularly conducting this type of exercise, as described under the Regulation (EU) 2022/2371 on serious cross-border threats to health [1]. The Regulation is consistent with the World Health Organization International Health Regulations, which specifically mention health emergency risk profiling mechanisms for serious cross-border threats to health [2]. The methodology can be tailored to national or subnational contexts.

Figure 1. ECDC preparedness and response cycle

Source: ECDC



ECDC methodology for risk prioritisation

The ECDC methodology for risk prioritisation described here is designed to allow public health authorities and policymakers to compare infectious disease threats when varying amounts of information on each disease is available, keeping in mind the threats' short- and medium-term trajectories. As such, the methodology is necessarily qualitative and relies on soliciting multiple expert opinions from different sectors.

While the methodology is flexible and could be applied to a range of purposes, it has been designed to be used with the 'ECDC risk prioritisation criteria' also presented here. These criteria were developed through stakeholder consultations and were designed to lead to results that can inform preparedness and response planning. The criteria account for a wide range of important factors that impact future epidemics and pandemics, in particular:

- Likelihood of transmission
- Disease severity
- Preparedness status
- Availability of control measures, interventions and diagnostics.

Prioritisation of infectious disease threats or hazards is a multi-step process that typically involves three key phases (Figure 2):

1. **Preparation:** planning and preparing for the exercise, including identifying the diseases/pathogens for prioritisation, defining the risk prioritisation criteria and creating the scoring tool;
2. **Risk prioritisation exercise:** conducting the exercise;
3. **Follow-up:** ensuring that the findings are clearly documented and debriefed with the initiating authority, and evaluating the overall process.

Figure 2. Overview of the key phases of designing and conducting a risk prioritisation exercise to rank infectious disease threats

Source: ECDC



ECDC's methodology for conducting a risk prioritisation exercise consists of three key actions (Figure 3):

- **Score** the selected diseases or pathogens against the established criteria;
- **Analyse** the scoring and develop an initial ranking of the diseases or pathogens;
- **Finalise** the risk ranking.

These phases and actions are described in detail in the following sections. Additional steps can be incorporated, depending on the objectives and the context of the exercise.

Figure 3. Overview of the key actions in the ECDC methodology for conducting a risk prioritisation exercise

Source: ECDC



Applications of risk prioritisation outcomes

The outcomes of a risk prioritisation exercise can assist public health authorities and policymakers to strengthen and focus preparedness planning against infectious diseases. In particular, results can be used to determine priorities for preparedness activities, such as:

- **Guiding resource allocation** – both budgetary and human resources – toward the most significant threats for the particular region, country, etc.
- **Developing operational plans** that should ideally be reflected at all administrative levels (national, regional), as well as in hospital preparedness plans and simulation exercise scenarios, as appropriate for the needs of the region or country.
- **Strengthening or improving surveillance systems**, and improving early detection and diagnostic capabilities.
- **Identifying where to focus capacity-building efforts**, such as exercises and trainings to improve response capabilities.
- **Steering procurement and stockpiling** for diagnostics and medical countermeasures.

Priority diseases should also be considered candidates for more in-depth analysis or research, such as modelling studies to predict trends.

Methods

This guide was developed by ECDC experts as an update to a previous ECDC tool for the prioritisation of infectious disease threats. The earlier tool was developed together with the Centre for Infectious Disease Control at the Dutch National Institute for Public Health and the Environment (RIVM) [3].

To produce this document, the previous tool was used as a starting point and updates were made to make it more user-friendly as a practical operational tool that can be used to support international, national and subnational activities aimed at prioritising diseases or pathogens for preparedness purposes.

This update is based on several years of ECDC experience on this topic, including:

- An analysis of best practice for ranking infectious disease threats [4,5];
- Seven prioritisation exercises that were designed and implemented in collaboration with Africa CDC at the African continental [6] and regional levels [7-9];
- Two ECDC expert consultations on this topic (Stakeholder Consultation on prioritisation of infectious disease threats in the EU/EEA, 14–15 May 2024 and Stakeholder Meeting on prioritisation of infectious disease threats in the EU/EEA, 3–4 June 2025).

ECDC experts reviewed numerous approaches to risk profiling and prioritisation during the development of this work, including:

- The World Health Organization (WHO) tool for Strategic Assessment of Risks (STAR) [10], which enables an all-hazard approach, in contrast to the methodology presented here, which is focused on infectious diseases.
- The WHO Research and Development (R&D) Blueprint for Epidemics, which has the primary goal to accelerate the development of medical countermeasures [11].
- The Coalition for Epidemic Preparedness Innovations (CEPI), which maintains a list of priority pathogens that informs its work on supporting the development of vaccines [12].
- Numerous national-level initiatives, such as one recent example from France, in which multi-criteria decision analysis was used to establish a list of priority infectious diseases for public health, surveillance and research [13].

Discussions were also held with other international experts undertaking similar initiatives, such as the Public Health Agency of Canada.

Preparation

Main actions to take

- **Action 1:** Plan the core elements of the risk prioritisation exercise
- **Action 2:** Select diseases or pathogens for prioritisation
- **Action 3:** Define risk prioritisation criteria and develop scoring tool

Action 1: Plan the core elements of the risk prioritisation exercise

As the process of conducting a risk prioritisation exercise can be time-consuming, the initiating health authority should have a clear mandate for this activity to facilitate a smooth and efficient process. Sufficient resources should be allocated and a project plan that outlines all of the core elements described below, the timeline with key milestones, and the results of Actions 2 and 3 should be developed.

Assign the project team

The initiating authority assigns a project team to prepare for and facilitate the exercise. It should include at least one or two dedicated staff members who will be responsible for completing the exercise within the agreed time-line, as well as a few additional staff members to assist with the analysis of the exercise results. At least one staff member should be senior enough to be able to take decisions about the project.

Determine the scope and objectives

The project team clearly formulates the scope and objectives of the risk prioritisation exercise at the outset.

Tips

To refine the scope and objectives of the exercise, first address the questions in the Box.

Box. Questions to help formulate the scope and objectives of the risk prioritisation exercise

Why is the risk prioritisation exercise being undertaken?
Potential answers include:
- To identify priorities for preparedness planning (i.e. which operational plans should be prioritised?);
- To identify pathogens that should be the subjects of simulation exercises (SimEx), research or development activities.

What exactly is being prioritised?
Potential answers include:
- A selected set of diseases or pathogens;
- A specific group of diseases or pathogens (e.g. vector-borne diseases, vaccine-preventable diseases, epidemic-prone diseaseas, zoonotic diseases, or diseases that are dependent on, driven by or sensitive to climate change).

Who are the results for?
Potential answers include:
- Policymakers, public health administrators, civil protection personnel or even hospital administrators, for planning purposes;
- Researchers.

What is the geographical scope of the exercise?
Potential answers include:
- Subnational;
- National;
- Continental;
- Global.

What time frame does the exercise cover (e.g. how far into the future)?

How often should this process be undertaken and the results updated?

Addressing the questions in the Box from the start supports the development of a clearly defined project plan. The answers also provide a foundation for the next steps, including choosing the expert panel and other key stakeholders to participate in the exercise, as well as identifying the risk prioritisation criteria to be used, adapted or developed.

Identify and invite participants for the risk prioritisation exercise

Participants can be identified from multiple sectors: public health (epidemiologists, veterinary public health professionals, preparedness experts, health economists, etc.), healthcare (infectious disease, internal medicine and critical care clinicians, hospital administrators, etc.), health policymakers, and behaviour and social scientists with experience in public health.

As this type of exercise relies on 'expert opinion', it is good practice to ensure that the panel of participants includes individuals from all of the disciplines that are relevant to your scope and objectives [4]. Multidisciplinary input based on expertise and experience is particularly valuable when standard data are not available, such as with emerging disease threats or events with limited evidence or significant uncertainty.

Agree on the format and logistics for the risk prioritisation exercise

The project team agrees on the format for the risk prioritisation exercise and sets up the logistics. The core risk prioritisation exercise is comprised of three key steps:

1. **Initial scoring** – The expert panel conducts the initial scoring of the diseases or pathogens against the agreed criteria (Action 4).
2. **Analysis and initial ranking** – The project team analyses the scoring results and generates an initial ranking (Action 5).
3. **Final ranking** – The expert panel gathers for a final meeting to agree on the final ranking of the diseases or pathogens (Action 6).

The exercise can be conducted as a multi-day workshop (in person, online or hybrid) where, for example, a meeting to conduct the scoring (Action 4) takes place on the first day and a meeting to determine the final ranking (Action 6) takes place on the second day. The project team can conduct the analysis (Action 5) in between the two meetings.

Depending on whether an in-person, online or hybrid approach is selected, details to agree on and plan at this stage can include:

- Identifying and securing any digital tools that will be needed to conduct meetings;
- Securing a venue and coordinating on-site logistics;
- Organising transportation for experts or key stakeholders, possibly including securing funding.

Note that it is also possible for the initial scoring to be performed remotely and independently, using digital tools. If that is the case, digital tools to conduct the scoring can be identified and secured at this stage.

Tips

A glossary of common terms used in this context is provided in Annex 1 and as an editable Microsoft Word template in the Supplementary materials.

Identify any necessary pre-exercise material or training

The project team identifies any necessary pre-exercise material that should be distributed to participants and plans how to address any training needs. For example, as multidisciplinary expert panels may not all be familiar with the terminology that is useful in this context, a glossary could be useful to participants. It can also be beneficial to train participants in the Delphi process so that this can be used in the final ranking discussion. Ensuring that any needs are considered and addressed before the exercise will support an effective and efficient exercise.

Any pre-exercise materials should be from reliable sources, such as national and international health organisations (e.g. ECDC, WHO, etc.) or international non-governmental organisations (e.g. Médecins Sans Frontières). While sharing such information could be perceived as steering responses, it can also reduce subjectivity, reduce bias (individual or professional), correct misconceptions and ensure that decisions are based on reliable, up-to-date information that is relevant to the purpose of the exercise.

Create an output plan

The project team creates an output plan for the exercise's final report. The final report should document how the exercise was prepared and conducted, the results, and an evaluation of the process and any materials used. What exactly the report will contain, how it will be produced and disseminated – and to whom – should be agreed in advance with the initiating authority. The participants should also be informed of the output plan when they are invited and at any workshops or meetings.



Action 2: Select diseases or pathogens for prioritisation

The project team facilitates a process to select the diseases or pathogens for prioritisation according to the agreed scope and purpose of the risk prioritisation exercise. The selection of a list of diseases versus a list of pathogens should be decided according to the objectives of the exercise. While a list of diseases is recommended for a general assessment, a list of pathogens may be selected, for instance, to assess microbiology aspects.

To begin the process, the project team should collate an initial list of diseases or pathogens for consideration using clear criteria and guiding questions (note that these are different from the risk prioritisation criteria). As the initial list of diseases/pathogens is often long, the project team – possibly in consultation with relevant experts – will have to reduce the number of diseases/pathogens to be prioritised, as each one will have to be assessed against a substantial number of criteria. This process should be transparent and based upon common criteria, and decisions should be made taking into account the scope of the planned exercise.

Tips

If conducting a literature review to compile the initial list of diseases, define a methodology that is as systematic as possible and use reliable sources.

Suggested sources for generating this initial list can include:

- Previous risk prioritisation exercises performed in the same country or other countries (e.g. UK Health Security Agency priority pathogen families research and development tool [14]).
- International risk prioritisation exercises (e.g. WHO Blueprint [15], which also includes an assessment on the possibility of each pathogen to cause a Public Health Event of International Concern (PHEIC)).
- Lists of diseases of interest used by other public health-related organisations (e.g. the Coalition for Epidemic Preparedness Innovations (CEPI) [12], Medecines Sans Frontieres (MSF) [16] or the Vaccine Alliance (GAVI) [17]).
- Diseases under surveillance in the country and/or at the EU level [18].

Conduct an expert consultation to refine the initial list

If experts are involved in refining the initial list, ensure that you have a multidisciplinary panel. If possible, the experts consulted for this step should be different from those participating in the exercise, to minimise bias.

An expert consultation for narrowing down the number of diseases/pathogens could be a two-step process. For example, a survey followed by group discussion to reach a consensus. The survey can be simple, using a Likert scale to assess the likelihood of the particular pathogen/disease to cause a public health emergency in the selected time frame (e.g. in the next 5 years, next 10 years, etc.). A five-point scale, including the option 'Do not know/can not assess' would be sufficient.

For the analysis of the survey results, 'Likely' and 'Very likely' can be merged, as well as 'Unlikely' and 'Very unlikely'. Together with the neutral position ('Do not know/can not assess') this will result in three groups of diseases/pathogens. Those that reach the threshold of at least 50% of respondents selecting 'Likely/Very Likely' can move forward and be included in the exercise.

Conduct an expert consultation to finalise the list

The final list for prioritisation should be cross-checked by a limited number of experts to make sure it is not missing important pathogens/diseases. The Delphi technique or a workshop can be used to help multiple experts come to consensus on the completeness of the list [19].

Document the process

The project team should document the process that was undertaken for disease/pathogen identification and selection, including the rationale for the final selection. These details should be included in the final report. This ensures transparency and contributes to the validity of the results.

Action 3: Define risk prioritisation criteria and develop scoring tool

The project team defines the risk prioritisation criteria to be used during the exercise. These criteria can be developed based on the 'ECDC risk prioritisation criteria' presented in in Annex 2. The ECDC criteria build on the Centre's previous tool [3] and the revised criteria used in Africa CDC exercises [7,8], which were also based on the earlier ECDC tool.

In producing this latest version of ECDC criteria for risk prioritisation, the number of criteria was reduced and limited to those that provide a meaningful differentiation between diseases or pathogens. The formulation of the criteria was further informed by examples from the literature [13,20-23] and reviewed by a multidisciplinary group of experts at ECDC. At the 2025 consultation with EU/EEA countries, national experts provided additional feedback that was incorporated to refine and finalise the criteria.

Following previous ECDC guidance [3,4], these criteria were chosen according to good practice guidelines, as follows:

- Ensure criteria are independent of one another.
- Formulate each criterion clearly, with no ambiguities.
- Use as few criteria as possible.
- Apply methods systematically and document all decisions, as appropriate.
- Pilot ranking criteria to assess:
  - The wording of each criterion;
  - The scoring levels associated with each criterion;
  - The accuracy for different diseases and pathogens.

Create the scoring tool

The project team develops a scoring tool to be used during the risk prioritisation exercise, based on the agreed criteria. Importantly, diseases should be assessed relative to one another, as this is a comparative evaluation and the resulting scores do not hold absolute value.

As this type of prioritisation exercise is based primarily on the expert opinion of a multidisciplinary panel of experts, it is important to ensure that all participants are able to make informed decisions; for example, the scoring tool can use qualitative scales with descriptive examples to help participants interpret otherwise abstract scoring levels [4].

The scoring tool can be created using an online survey tool (such as the EUSurvey tool or KoboToolbox [6-8,24]), specialised software (like M-macbeth in Cox et al. [21]), or even Microsoft Excel or Word.

The scoring tool should be piloted among a group of experts that are not part of the project team. Statistical methods can then be used to measure the variation in responses, and appropriate adjustments can be made if the variation is considered too high.

If uncertainty is high for some diseases/pathogens, it would be useful to incorporate a way for participants to express uncertainty in the scoring tool so that this can be assessed. For example, Cardoen allowed participants to respond with a '?' where evidence was not available or they did not agree with the available evidence, which could also be used to identify areas for further research [25].



Tips

An editable Microsoft Word template of the ECDC risk prioritisation criteria is provided in the Supplementary materials so the project team can adapt these criteria to their context and the scope and purpose of their exercise.



Tips

A proposed template of how each criterion can be presented in the scoring tool is provided in Annex 3 (an editable Microsoft Word template is also available in the Supplementary materials).

Implement measures to reduce subjectivity and bias

Expert input is crucial when quantitative metrics are lacking or not easily comparable. However, this can introduce potential subjectivity and bias – especially across different professional groups. Therefore, the project team should put in place measures to minimise this risk, such as clear instructions, clear explanations of criteria, definitions of scores and inter-disciplinary discussion of scores to reduce inter-rater variation.

Document the process

The project team should document the process undertaken to establish the risk prioritisation criteria for the exercise to ensure transparency and bolster the validity of the findings.



Risk prioritisation exercise

Main actions to take

- » **Action 4:** Score diseases or pathogens against criteria
- » **Action 5:** Analyse scoring and develop initial ranking of diseases or pathogens
- » **Action 6:** Finalise ranking
- » **Action 7:** Evaluate the process

Example

Africa CDC, with the support of ECDC through the Africa CDC–ECDC partnership project, conducted seven risk prioritisation exercises: one online and six in person. The in-person regional and continental meetings gathered experts from various countries for two- or three-day workshops to score and rank diseases.

These face-to-face sessions facilitated not only discussion and exchange of perspectives but also helped reduce interpretation bias by ensuring that all participants received consistent guidance and information throughout the process [7,8].

Action 4: Score the selected diseases or pathogens against the established criteria

To begin the risk prioritisation exercise, the participating experts score each disease/pathogen against the criteria developed during the preparation phase, using the associated scoring tool. Scores can be determined either by group consensus or individually:

- **Group consensus:** all participants discuss and come to consensus on one score for each disease;
- **Individually:** Each participant assigns their own score for each disease.

The choice of how to conduct the scoring portion of the exercise should be guided by the availability of resources, time constraints and logistics.

A typical forum to score diseases by **group consensus** is a workshop [26]. If resources permit and logistics are feasible, an in-person, online or hybrid workshop can be convened, bringing experts together to score diseases and discuss rankings collectively. For this method of scoring, there should only be one final score per criterion per disease, as the experts need to take a group decision on each item of the survey.

Individual scoring can be conducted independently and remotely, or during an in-person or online workshop. Conducting individual scoring independently and remotely may be more suitable if resources and time are limited. For this method of scoring, measures of central tendency (median, mean) and dispersion (interquartile range, standard deviation) should be taken during the analysis step to calculate aggregated scores (see Action 5).

Scoring should be based on each participant's expertise and judgement. They may also refer to the provided pre-exercise materials (such as a glossary or other factsheets). All diseases/pathogens should be assessed by all experts.

Action 5. Analyse the scoring and develop an initial ranking of the diseases or pathogens

The project team analyses the information collected from scoring the diseases/pathogens to obtain an initial ranking.

The analysis consists of three steps (the first two steps are only needed if scoring was done individually, not if scores were obtained via group consensus):

i) **Compute the risk scores and the preparedness and countermeasures scores** – These two scores enable the comparison of the diseases/pathogens.

ii) **Obtain agreement intervals via bootstrapping** – Agreement intervals indicate the extent to which the participating experts agreed or disagreed in how they scored the diseases/pathogens, which is useful context for the expert panel when they discuss the final rankings.

iii) **Interpret the risk scores to develop an initial ranking** – The interpretation of the risk scores and initial ranking provide the expert panel with insights that can support them in agreeing on a final ranking at the final meeting.

Tips

This step should only be taken if the initial scoring was conducted individually.

i) Compute the risk scores and preparedness and countermeasures scores

To compute the risk scores, the project team denotes the number of survey respondents by N and the number of diseases covered by the survey by M.

First, obtain the following five scores (for each survey respondent $i = 1, \ldots, N$ and each disease $j = 1, \ldots, \mathrm{M}$):

- The **composite score for the likelihood of transmission** $s_{\mathrm{LOT},ij}$ is obtained as the arithmetic mean of the replies of respondent i to the corresponding four risk prioritisation criteria 1–4 for disease j.
- The **composite score for the disease severity** $s_{\mathrm{DS},ij}$ is obtained as the arithmetic mean of the replies of respondent i to the corresponding five risk prioritisation criteria 5–9 for disease j.
- The **composite score for preparedness and countermeasures** $s_{\mathrm{PC},ij}$ is obtained as the arithmetic mean of the replies of respondent i to the corresponding five risk prioritisation criteria 10–14 for disease j. A higher score indicates a greater lack of preparedness and countermeasures.
- The **risk score** r_{ij} is obtained as the geometric mean $\mathrm{r}_{ij} = \sqrt{s_{\mathrm{LOT},ij} s_{\mathrm{DS},ij}}$ of the likelihood of transmission and the disease severity. We take the geometric mean instead of the arithmetic mean, because the score $s_{\mathrm{LOT},ij}$ is a measure of the (expected) number of infections and the score $s_{\mathrm{DS},ij}$ is a measure of the (expected) number of severe outcomes given an infection. Hence, the product $s_{\mathrm{LOT},ij} s_{\mathrm{DS},ij}$ captures the expected number of severe outcomes, and taking the square root results in a normalisation of the risk r_{ij} to be on the same scale (between 1 and 4) as the risk prioritisation criteria and the other composite scores.
- The **risk score plus preparedness and countermeasures score** follows as $\tilde{\mathrm{r}}_{ij} = \left(\mathrm{r}_{ij} + s_{\mathrm{PC},ij}\right)/2$. Note that high values for both the risk score r_{ij} and the preparedness and countermeasures score $s_{\mathrm{PC},ij}$ indicate a poor outcome (i.e. a more concerning situation for disease j).

Next, average the scores over the respondents i for each disease j. For instance, the risk score for disease j equals

$$\mathrm{r_j} = \frac{1}{\mathrm{N}} \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{r_{ij}}.$$

The scores $s_{\mathrm{LOT},j}$, $s_{\mathrm{DS},j}$, $s_{\mathrm{PC},j}$, and $\tilde{\mathrm{r}}_j$ are defined analogously for each disease j.

If a single, aggregate metric is preferred, then the diseases can be ranked according to the score $\tilde{\mathrm{r}}_j$ that combines the risk score $\tilde{\mathrm{r}}_j$ and the preparedness and countermeasures scores $s_{\mathrm{PC},j}$. However, a clear interpretation of the risk of disease j based solely on the score $\tilde{\mathrm{r}}_j$ may be difficult, as a high value of $\tilde{\mathrm{r}}_j$ may be due to a high risk score $\tilde{\mathrm{r}}_j$ (i.e. due to a high severity $s_{\mathrm{DS},j}$ and a high likelihood of transmission $s_{\mathrm{LOT},j}$ of disease j). In this case, even if the preparedness and countermeasures score $s_{\mathrm{PC},j}$ is low (indicating stronger preparedness and countermeasures), the aggregate score $\tilde{\mathrm{r}}_j$ is high due to the inherent severity and transmissibility of disease j. This limits the options for substantially decreasing the risk with more preparedness and countermeasures. However, a high value of $\tilde{\mathrm{r}}_j$ may also be due to a high $s_{\mathrm{PC},j}$ score (i.e. lack of preparedness and countermeasures). In this case, the risk of disease j can be mitigated by increasing the preparedness and countermeasures. Thus, we recommend presenting the two scores $\tilde{\mathrm{r}}_j$ and $s_{\mathrm{PC},j}$ individually, rather than as the single score $\tilde{\mathrm{r}}_j$ (as presented in Figure 4).

Tips

This step should only be taken if the initial scoring was conducted individually.

ii) Obtain agreement intervals via bootstrapping

In order to reflect the variation in responses – which will indicate the agreement or disagreement across the experts' individual scoring – the project team calculates the agreement intervals associated with the disease scores by performing bootstrapping. These agreement intervals can support interpretation of the disease/pathogen scores by indicating how strong or weak consensus was for each score.

To do this, sample from the set of respondents $\{1, \ldots, \mathrm{N}\}$ uniformly at random with replacement. One bootstrap draw consists of N respondents and their answers from the original group of experts $\{1, \ldots, \mathrm{N}\}$. For this bootstrap draw, calculate the likelihood of transmission score and disease severity score, then the risk score for each disease j.

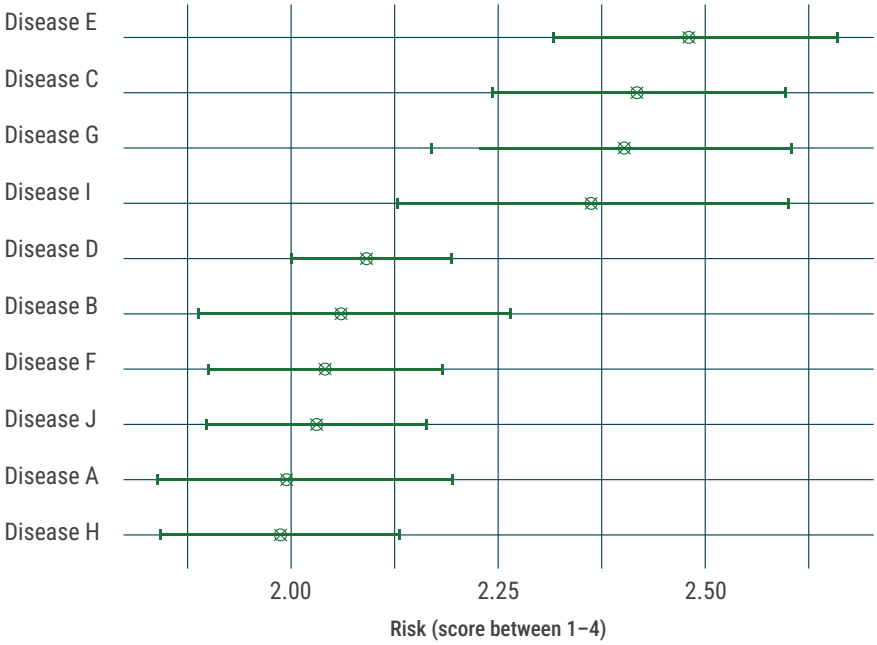
Repeat all the calculations $\mathrm{n}_{bt} = 1\,000$ times (i.e. 1 000 bootstrap draws). Then, the 95% agreement intervals of the disease scores are the 2.5% quantile and 97.5% quantile of the obtained disease scores of the n_{bt} bootstrap draws.

The width of the agreement interval quantifies the extent that respondents agreed on the respective score. For example, if all survey respondents were to give a disease the exact same risk score, then the associated interval would have a width of zero. To do this, you can use the bootstrapping implementation of the R package, called 'boot' [27,28].

Figure 4 presents an example output of the risk score $\tilde{\mathrm{r}}_j$ for different diseases j, including both the mean and the 95% agreement intervals obtained via bootstrapping.

Figure 4. Illustrative example of an output presenting the risk score $\tilde{\mathrm{r}}_\mathrm{j}$ and the associated agreement intervals, based on randomly generated test data

Source: ECDC



Tips

This step should be taken whether scoring was conducted individually or by group consensus.

iii) Interpret the risk scores

The project team interprets the risk scores and prepares an initial ranking to share with the expert panel, to support them in agreeing on a final ranking. Two important composite metrics are presented to assess each disease j: the risk score $\tilde{r}_j$ and the preparedness and countermeasures score $s_{PC,j}$.

The risk score $\tilde{r}_j$ is derived from the likelihood of transmission and the disease severity. Hence, the risk score $\tilde{r}_j$ aims to capture characteristics that are inherent to the disease (i.e. factors that are independent of the region and the time period).

In contrast, the **preparedness and countermeasures score** $s_{PC,j}$ varies greatly depending on the region and the time period. Importantly, if there is a lack of preparedness and countermeasures (i.e. a high score), this can be mitigated through public health measures.

As the results represent a collection of opinions and knowledge from a subjectively chosen group of experts, they should be interpreted with caution and should not be assigned any statistical values, such as representativeness or significant differences. For this reason, the project team should only present summaries of the results (Figure 5).

Example

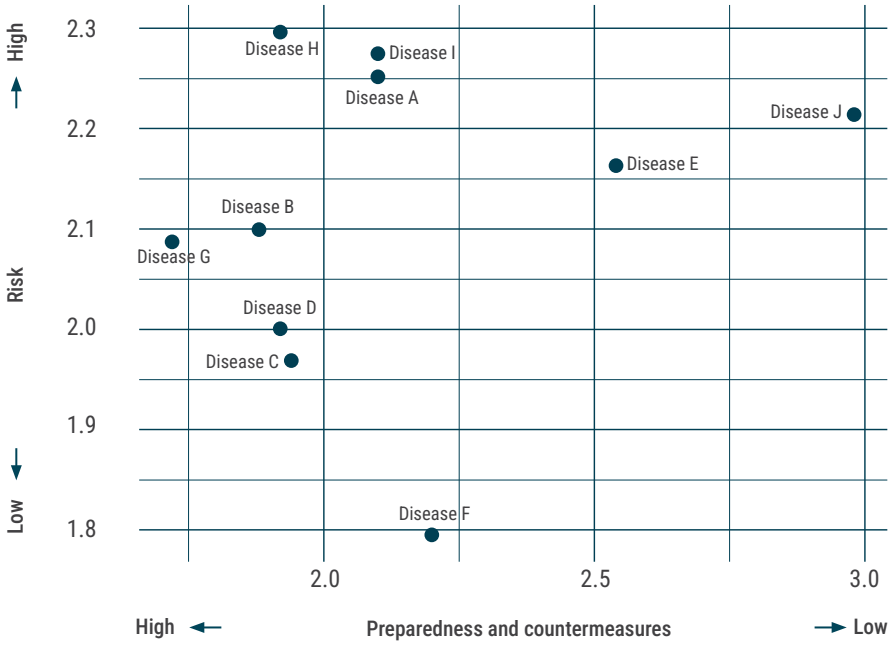
A real-world example of an output presenting the results of a risk prioritisation exercise in Northern Africa conducted by Africa CDC in collaboration with ECDC [7] is presented in Annex 4.

Figure 5 summarises the risk score and the preparedness and countermeasures score for 10 diseases, based on random test data. In general:

- The vertical (y-axis) position of diseases captures the likelihood of transmission and severity of the respective disease, while the horizontal (x-axis) position captures country- and time-specific preparedness and countermeasures.
- The more to the right and the more to the top the scores are, the more concerning the disease is in terms of both risk and lack of preparedness and countermeasures.

Figure 5. Illustrative example of an output summarising the risk score versus the preparedness and countermeasures score, based on randomly generated test data

Source: ECDC



It is plausible to expect that the vertical position may be similar for different regions or countries, as the likelihood of transmission and severity will depend on the disease and, to a lesser degree, on the population or timing. The horizontal position showing the lack of preparedness and countermeasures, however, will probably vary across regions and countries. Improving preparedness and countermeasures moves the respective diseases to the left.

These initial ranking results can be presented in multiple formats (Figures 3 and 4). However, they should be interpreted with caution, as the rankings are only an indication of the relative importance of diseases against one another. The results do not represent absolute values.

Action 6: Finalise ranking

Participants gather at a final meeting to review and assess the initial ranking results, to reflect on the interpretation and analysis, and to reach consensus on the final ranking.

The final ranking represents the final priority order of the diseases/pathogens. It may differ from the initial ranking results presented at the outset of the meeting. For example, the experts may choose to prioritise diseases/pathogens that have relatively high risk scores but are not necessarily at the very top of the ranking, especially if their preparedness levels are comparatively low.

This step can be conducted as an in-person, online or hybrid meeting, as described in the Preparation section. In general, the meeting can be structured as follows:

- The project team presents the results of the scoring exercise, analysis and interpretation;
- The participants discuss the findings;
- The participants come to consensus on the final ranking, possibly using the Delphi process.

Document the process and results

The project team should document the discussion and decision-making process that take place during the meeting, for inclusion in the final report. This ensures transparency and contributes to the validity of the results. A concise output summarising the results may also be created, and this can feed into the evaluation and final report stages (a real-world example of an output presenting the results of a risk prioritisation exercise is provided in Annex 4).

Action 7: Evaluate the process

If time allows, it is ideal to include time at the end of the exercise for participating experts to evaluate the process and any materials or tools used. Feedback on the risk prioritisation process supports continuous improvement to the process and future exercises.

Example

Disease prioritisation exercises undertaken by Africa CDC and ECDC staff included a dedicated hot debrief session at the end of the activities to review both the process and the tool, as well as an online survey to collect feedback on the process and workshop.

Follow-up

Main actions to take

- **Action 8:** Prepare the final report
- **Action 9:** Debrief with the initiating health authority

Example

Krause et. al describes how insights from a risk-ranking exercise informed future iterations and how methodologies were adapted based on previous experiences [29].

Action 8: Prepare the final report

The project team should prepare the final report, as agreed during Action 1 in the Preparation phase. The final report should contain the final ranking results from the risk prioritisation exercise, as well as documentation of each of the previous steps, to ensure transparency and increase the validity of the findings. The final report should also be disseminated as agreed in the output plan.

Action 9: Debrief with the initiating health authority

The project team should debrief with the initiating health authority to evaluate the risk prioritisation process and outcomes, ideally within one to two months after the exercise. Following the debrief, the project team should also update the institution's risk prioritisation methodology based on any lessons learned.

This can also be a good time to ensure that risk-ranking exercises are embedded within the preparedness cycle continuum and that they are repeated at regular intervals (e.g. every three to five years). How often and when the exercises are conducted can depend on the degree of change in disease drivers. Unanticipated events, such as evidence of emerging threats, could also trigger an unscheduled re-ranking of diseases.

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Annex 1. Glossary

Absenteeism	Workforce or school absence due to illness, quarantine or caregiving responsibilities during a health emergency, affecting productivity and service delivery.
After-action review	A structured methodology for reviewing the response to a public health event and improving preparedness planning [1]. It should be conducted after the event has ended, preferably within three months after it ends.
All-hazard	An integrated emergency preparedness approach that focuses on building core capacities and capabilities applicable to a wide spectrum of emergencies or disasters – both natural and man-made – rather than developing separate plans for each individual threat.
Case fatality ratio	The proportion of people with a particular condition who die from that condition. The denominator is the number of people with the condition; the numerator is the number of cause-specific deaths among these people.
Delphi process	A structured decision-making process where anonymous questionnaires are repeatedly circulated to a panel of experts to gather their responses and progressively come to a consensus; it is preferable that participants' identities are not revealed to each other. The method was developed by the RAND Corporation.
Disability	A temporary or long-term physical or mental impairment that has a negative effect on a person's ability to do typical daily activities.
Economic activities	Production, trade and services that sustain economic systems.
Effectiveness	The ability of an intervention or programme to produce the intended or expected results in the field.
Endemic	The constant presence of a disease, disorder or noxious infectious agent in a geographical area or population group; it may also refer to the chronic high prevalence of a disease in the area or group.
Estimated basic reproduction number (R_0) or effective reproduction number (R_e)	R_0 (pronounced 'R naught') gives the estimated average number of secondary infections that would be produced by one case of infection being introduced into a fully susceptible population. Alternatively, R_e is used to give the estimate in a real-world population, where not every person may be susceptible to the infection.
Excess costs	Additional costs incurred beyond typical healthcare expenditure due to an outbreak or emergency, including treatment, logistics and mitigation measures.
Fatal	Resulting in death.

General population	The entire group of people living in a specific area or country, regardless of age, health status or other characteristics.
Health system	A health system is defined as the collective organisations, institutions, resources and personnel responsible for providing health services. It serves to improve health determinants through quality care, preventive measures and rehabilitative interventions. It requires a workforce, funding, information networks and overall guidance to function effectively [2].
Healthcare	Services performed by health professionals or by others under their direction for the purpose of promoting, maintaining or restoring health. In addition to individual care, healthcare services include measures for health protection, health promotion and disease prevention.
Healthcare mitigation costs	Expenses related to measures aimed at reducing the impact of a health threat on healthcare provision, such as infection control, protective equipment and surge capacity.
Hospitalisation	Admission to a hospital for medical care, usually due to the severity of an illness or injury.
Human-to-human transmission	The spread of a pathogen from one person to another. Includes transmission through air, as well as direct or indirect contact.
Importation	The introduction of a disease or pathogen into a new geographical area or population from an external source.
Incidence	The number of new cases of a disease or condition that occur in a specific population during a defined time period (i.e. cases per year). It is typically expressed as a rate (e.g. number of cases per 100 000 population per year) and is frequently used as a measure of the likelihood of exposure to a disease.
Long-lasting effects	Health impacts or symptoms that persist over an extended period, even after the initial illness or exposure has resolved. These effects may be physical, mental or functional and can influence quality of life.
Media attention/coverage	The extent and nature of reporting on health emergencies, which shapes public awareness and behaviour.
Medical intervention	Any action taken by healthcare professionals to prevent, diagnose, treat or manage illness, injury or a worsening condition.
Mental health effects	Changes or disturbances in emotional, psychological or social well-being caused by illness, trauma or stressful events; for example, anxiety, depression or stress.
Misinformation	False or misleading information.
Outbreak management	Coordinated actions to detect, investigate, control and prevent further spread of a pathogen during an outbreak.

Passive early detection/ surveillance system	A surveillance approach that relies on routine reporting of cases by healthcare providers, without active case finding.
Point-of-care diagnostics	Diagnostic tests performed at or near where the patient is receiving care, providing rapid results to guide immediate clinical decisions.
Polarisation	Division of public opinion on certain issues into two very opposite groups, often amplified by political or social factors.
Policy pressure	The demand on policymakers to act quickly and effectively.
Political agenda	The prioritisation of issues within political decision-making.
Post-exposure prophylaxis	A preventive medical treatment administered after exposure to a pathogen that aims to reduce the likelihood of infection. It must be initiated within a specific time window after exposure to be effective. It includes vaccines or other pharmaceutical interventions.
Pre-exposure prophylaxis	A preventive medical treatment administered before exposure to a pathogen that aims to reduce the likelihood of infection. It includes vaccines or other pharmaceutical interventions.
Preparedness/operational/ disease-specific plan	A structured plan detailing the actions, resources and responsibilities for responding to specific health threats.
Priority/key population	The specific group that an intervention is intended for.
Probability	The likelihood or chance that a specific event will occur.
Public anxiety	Heightened fear and stress among the population.
Public debate	Discussion among stakeholders and the public about health measures and policies.
Public health and social measures (PHSMs)	Non-pharmaceutical interventions such as physical distancing, mask use, and hygiene practices aimed at reducing disease transmission.
Public health emergency	A situation that poses a serious threat to the health of a population, requiring immediate and coordinated action. It often demands the rapid mobilisation of resources and implementation of emergency measures, and may trigger national or international response mechanisms.
Public health risk	An event, organism or substance that may adversely affect the health of human populations or may present a serious and direct danger to human health or well-being.
Public risk perception	How the public interprets and responds to health risks, which can be influenced by communication, trust and cultural factors.
Public trust	Confidence in authorities and institutions.

Reservoir	The habitat where an infectious agent normally lives, grows and multiplies. Humans, animals or environments (e.g. water, soil) can serve as reservoirs.
Response and mitigation measures	Actions taken to reduce the severity and spread of a health threat, including public health interventions, communications activities or resource mobilisation.
Risk prioritisation	A structured process used to rank infectious disease threats based on multiple criteria so that public health authorities can determine which threats require the most urgent actions.
Sentinel surveillance	A surveillance approach that relies on routine reporting of cases by a selected number of healthcare providers (based on population representation), without active case finding.
Social cohesion	The degree of solidarity and cooperation within a society, which can be strained during crises.
Social unrest	Public and sometimes violent protests against the government or fighting between different groups of people [3].
Societal impact	The overall effect of a health emergency on social structures such as health systems, the economy and education systems, as well as community well-being.
Societal services	Essential services that support the function of modern societies, such as healthcare services, education, transportation and utilities.
Sporadic	Occurring irregularly, haphazardly, from time to time or generally infrequently (e.g. cases of certain infectious diseases only occur sporadically).
Susceptibility	The degree to which an individual, population or species is vulnerable to infection or disease when exposed to a pathogen. It can be influenced by factors such as age, immune status, genetic predisposition, vaccination coverage or underlying health conditions.
Sustained transmission	The continuous spread of a pathogen within a population over time; when there is already sustained transmission, there is no concern of reintroduction from external sources.
Syndromic surveillance	Collection and analysis of health-related data (e.g. symptoms) from patients seeking care before definitive diagnosis to detect potential outbreaks early.
Treatment opportunity loss	The missed chance to provide timely treatment due to resource constraints or system overload during emergencies, leading to worse health outcomes.
Vector	A living organism (usually an insect, e.g. a tick, mosquito, flea, etc.) that can transmit a pathogen between humans or from animals to humans.
Vulnerability assessment	An examination of the gaps, weaknesses and capacities within national public health systems that influence their vulnerability to health threats.

Annex 2. ECDC risk prioritisation criteria

Likelihood of transmission				Score
1	**Probability that the disease/ pathogen is present among humans in the EU/ EEA in the next five years**	Estimated probability that the disease/pathogen is present in the country in the next five years, either through imported human cases or importation of products, animals or vectors that can transmit the pathogen.	**The disease/pathogen is not present in humans in the country, and there is a very low probability that it could be introduced in the next five years** Examples: • Only sporadic cases or sporadic local transmission are expected to occur; • There is no animal reservoir, no vectors are present in the country, and there are no other factors that could contribute to the spread of the pathogen responsible for the disease (e.g. significant migration from an affected area, importation of relevant products, etc.); • The pathogen cannot survive and spread in the country's environmental and/or climatic conditions.	1
			The disease/pathogen is not present in humans in the country, and there is a low probability that it could be introduced in the next five years Examples: • Local transmission could occur in humans; • There are limited animal reservoirs, vectors or other factors that could contribute to the spread of the pathogen responsible for the disease; • The country's environmental and/or climatic conditions are favourable for the introduction and establishment of the pathogen.	2
			The disease/pathogen might be present in humans in the country, but might not be under surveillance, and/or there is a moderate probability that the disease could be introduced and become established in the next five years Examples: • Sustained transmission could occur in humans; • There are well-established animal reservoirs or vectors in the country, with sporadic detections of the pathogen, or other factors that could contribute to the spread of the pathogen responsible for the disease or cause outbreaks in humans; • The pathogen shows some adaptation to the country's environmental and/or climatic conditions, making introduction and establishment of the pathogen moderately probable.	3

Likelihood of transmission				**Score**
			The disease/pathogen is already established in the country or there is a high probability that it could be introduced and become established in the next five years Examples: • Sustained transmission is already occurring or is likely to occur in humans; • There are well-established animal reservoirs or vectors in the country, with regular detections of the pathogen, or other factors that could contribute to enough sustained transmission in humans that the disease becomes endemic. • The country's environmental and/or climatic conditions are favourable for the spread of the pathogen.	**4**
2	**Probability of a public health emergency related to this disease/pathogen occurring in the next five years**		**Very low**	**1**
			Low	**2**
			Moderate	**3**
			High	**4**
3	**Average annual national incidence over the past five years**		**Very low** (No reported cases per 100 000 population per year)	**1**
			Low (1–5 reported cases per 100 000 population per year)	**2**
			Moderate (6–20 reported cases per 100 000 population per year)	**3**
			High (>20 reported cases per 100 000 population per year)	**4**
4	**Transmissibility of the disease/ pathogen in the country** (according to the known transmission route(s))	To assess a disease/ pathogen against this criterion, it is assumed that the population has no immunity (from vaccination or natural infection).	**Very low transmissibility** Examples: • The known or estimated basic reproduction number (R_0) or effective reproduction number (R_e) is around zero. • The pathogen has very low human-to-human transmission effectiveness, e.g. vector-borne or zoonotic pathogens, where the vector/reservoir is not present in the country. • Very few human cases have been reported, if any.	**1**

Likelihood of transmission				**Score**
		'**Basic or effective reproduction number**' refers to the number of new infections expected to be caused by a single infection in the population. '**Human-to-human transmission**' includes transmission through skin-to-skin contact, air, sexual activity or substances of human origin (SoHO). It can also include mother-to-child transmission (also known as vertical transmission), which occurs in the womb, as well as during birth or breastfeeding.	**Low transmissibility** Examples: • The known or estimated basic reproduction number (R_0) or effective reproduction number (R_e) is above zero but less than one. • The pathogen has low human-to-human transmission effectiveness, e.g.: » Food- and/or waterborne pathogens with low transmission effectiveness (i.e. transmission through food and/or water ingestion only); » Vector-borne or zoonotic pathogens where the vector/reservoir is present in limited areas of the country and the pathogen is not frequently detected in the vector/reservoir. • Only sporadic human cases have been observed, if any.	**2**
			Moderate transmissibility Examples: • The estimated basic reproduction number (R_0) or effective reproduction number (R_e) is between one and five. • The pathogen has moderate human-to-human transmission effectiveness, e.g.: » Food- and/or waterborne pathogens with moderate transmission effectiveness (i.e. through oral-faecal transmission); » Vector-borne or zoonotic pathogens where the vector/reservoir is present in the country and the pathogen has been frequently detected in the vector/reservoir; • Respiratory pathogens transmitted through air (e.g. influenza, COVID-19). • Sporadic human cases have been observed.	**3**
			High transmissibility Examples: • The estimated basic reproduction number (R_0) or effective reproduction number (R_e) is greater than five; • The pathogen has high human-to-human transmission effectiveness, e.g.: » Food- and/or waterborne pathogens with high transmission effectiveness (i.e. in a widely distributed source or through oral-faecal transmission); » Some vaccine-preventable diseases (e.g. varicella and measles). • High transmission among humans has been observed or is expected and there is evidence of transmission from asymptomatic cases. • The disease can be transmitted through air (i.e. respiratory droplets or aerosols).	**4**

Disease severity				**Score**
5	**Case fatality ratio (CFR)**	CFR estimations should be based on cases managed in the country in the last five years or estimated CFR from the medical literature (for diseases/pathogens not yet present in the country). '**Treated**' includes receiving supportive care or post-exposure prophylaxis. Immunisation is usually considered a preventive measure, rather than 'treatment'; however, in specific cases it may be delivered post-exposure to decrease the severity of the disease (e.g. mpox).	**Very low** CFR <0.01%, if untreated	**1**
			Low CFR 0.01–1%, if untreated and/or <0.01%, if treated	**2**
			Moderate CFR >1%, if untreated and/or 0.01–1%, if treated	**3**
			High CFR>1% whether untreated or treated	**4**
6	**Morbidity**	'**Morbidity**' is considered any departure, subjective or objective, from a state of physiological or psychological health and well-being.	**Very Low morbidity** Examples: • Medical intervention or hospitalisation usually not required; • Symptoms are transient or health effects are short (e.g. between 1 week and <1 month); • Sequelae do not affect daily activities; • Little to mild mental health effects.	**1**

Disease severity				Score
			Low morbidity Examples: • Medical intervention is often required; • Hospitalisation is occasionally required; • Intensive care is not usually required; • Symptoms or sequelae persist (e.g. between one and six months). • Sequelae limit daily activities; • Moderate mental health effects.	**2**
			Moderate morbidity Examples: • Medical intervention is very likely to be required; • Hospitalisation is frequently required; • Intensive care is often required; • Long-term health effects are common (including disability) and usually last for more than six months; • Sequelae lead to permanent disability but not full dependence on others or sequelae do not lead to permanent total disability; • Severe mental health effects; • Fatal if left untreated.	**3**
			High morbidity Examples: • Intensive care is very likely to be required; • Very severe sequelae that often lead to permanent disability and full dependence on others or permanent total disability. • Often fatal, even if treated.	**4**

Disease severity				Score
7	**Impact on the health system if a public health emergency occurs**	Expected '**impact on the health system**' includes increases in the number of visits to primary care/ emergency departments, hospitalisations, deaths, excess costs (including outbreak management and healthcare mitigation costs), and treatment opportunity losses for other diseases when healthcare services are disrupted.	**No impact on the health system is expected** Example: • The disease/pathogen causes a negligible proportion of health system utilisation.	1
			Low impact on the health system is expected Example: • The disease/pathogen causes a small proportion of health system utilisation.	2
			A moderate impact on the health system is expected Example: • The disease/pathogen causes a moderate proportion of health system utilisation.	3
			A high impact on the health system is expected Example: • The disease/pathogen causes a large proportion of health system utilisation.	4
8	**Societal and economic impact if a public health emergency occurs**	Expected '**societal and economic impact**' includes school and work absenteeism or closures, as well as response and mitigation measures in sectors other than public health. It excludes health system costs.	**Minimal societal and economic impact expected** Examples: • Little to no absenteeism or closure of venues; • No significant disruption to services or productivity.	1
			Low societal and economic impact expected Examples: • Localised absenteeism or closure of venues; • Limited associated costs; • Minor disruptions to services or productivity.	2
			Moderate societal and economic impact expected Examples: • Significant absenteeism or closure of venues across multiple sectors; • Moderate or sustained increases in direct and indirect costs; • Some disruption to services or productivity.	3

Disease severity				**Score**
			High societal and economic impact expected Examples: • Extensive absenteeism or closure of venues across several sectors; • High or sustained increases in direct and indirect costs, including for mitigation and response in sectors outside of public health; • Major disruptions to services and productivity.	**4**
9	**Impact of social, behavioural and informational aspects on public health emergency response**	There are a range of '**social, behavioural and informational aspects**' that can affect the population's response to a public health emergency. This criterion focuses on negative aspects that may hamper the response. This question focuses on such response measures as: case detection, treatment, contact tracing, isolation, vaccination, or public health and social measures (PHSMs).	**Social, behavioural and informational aspects are expected to have a low negative impact on public health emergency response** Examples: • Low spread of mis- and disinformation; • Negligible media coverage; • No impact on political agenda or public trust; • No impact on adherence to preventive and response measures; • No impact on social cohesion.	**1**
			Social, behavioural and informational aspects are expected to have a moderate negative impact on public health emergency response Examples: • Moderate spread of mis- and disinformation; • Moderate or localised media coverage; • Minor influence on political agenda or public trust; • Minor impact on adherence to preventive and response measures; • Minor impact on social cohesion.	**2**
			Social, behavioural and informational aspects are expected to have a high negative impact on public health emergency response Examples: • High spread of mis- and disinformation; • Politicisation of the event and sustained policy pressure; • Public anxiety and distrust; • High impact on adherence to preventive and response measures; • High impact on social cohesion.	**3**

Disease severity				**Score**
			Social, behavioural and informational aspects are expected to have a very high negative impact on public health emergency response Examples: • Extensive spread of mis- and disinformation; • Substantial political implications; • Extensive impact on adherence to preventive and response measures; • Widespread social unrest and disruption.	**4**
Preparedness and countermeasures				**Score**
10	**Previous experience responding to an outbreak of the pathogen, and level of public health preparedness to respond to it**	Having previous experience preparing for and/or responding to outbreaks of this disease/ pathogen or group of pathogens with similar transmission modalities may be indicative of greater capability for managing an outbreak of this or similar pathogens.	**Very low previous experience and preparedness** There is no previous experience at the national level; AND no specific preparedness and response plan addressing it.	**4**
			Low or minimal previous experience and preparedness There is low or minimal previous experience at the national level; OR a specific preparedness and response plan addressing it is in development, but not yet implemented.	**3**
			Moderate previous experience and preparedness There is some previous experience at the national level; OR a specific preparedness and response plan is in place.	**2**
			Extensive previous experience and preparedness There is extensive previous experience at the national level **and** after-action reviews or other reflections following these events have been conducted; OR a specific preparedness and response plan is in place, is regularly revised **and** simulation exercises have been conducted in the last three years.	**1**

Preparedness and countermeasures				**Score**
11	**Availability of early detection and diagnostics**	This criterion assesses the extent to which early detection systems and diagnostics relevant to the disease/pathogen are available to enable a timely and effective response.	**Very low availability of early detection and diagnostics** There is no dedicated system in place to detect early signals of potential threats specifically related to this disease/pathogen; AND/OR no diagnostics exist; OR no standard diagnostics are available in the country.	**4**
			Low availability of early detection and diagnostics A passive surveillance system is in place to detect early signals of potential threats specifically related to this disease/pathogen; AND/OR diagnostics exist but are not available all over the country; AND/OR the effectiveness of existing diagnostics methods is limited.	**3**
			Moderate availability of early detection and diagnostics A structured surveillance system is in place to detect early signals of potential threats specifically related to this disease/pathogen (e.g. sentinel surveillance, syndromic surveillance); AND effective diagnostics are widely available in the country and allow for timely detection and response.	**2**
			High availability of early detection and diagnostics A comprehensive surveillance system is in place to detect early signals of potential threats specifically related to this disease/pathogen; AND effective diagnostics exist and are widely available in the country, including point-of-care diagnostics, allowing for timely detection and response.	**1**

Preparedness and countermeasures				**Score**
12	**Availability and effectiveness of vaccines**	This criterion assesses how available vaccines against this disease/ pathogen are in the country, as well as how effective the vaccines are against the disease/ pathogen. In particular, the context includes administering vaccines to priority populations during a public health emergency response. Priority populations should be considered according to the country's modelling of this event. '**Availability**' includes: vaccines are licensed for use in the country (even if under emergency procedures), can be accessed in a timely manner and are available in sufficient amounts to cover the priority populations.	**No vaccine is available or vaccine effectiveness has not been established** No vaccine is available against the particular disease/pathogen; OR vaccine effectiveness has not yet been established.	**4**
			Low vaccine availability and/or low to moderate vaccine effectiveness Fewer vaccine doses are available in the country than are required to meet the needs of the priority population; AND/OR the available vaccine(s) have low to moderate effectiveness.	**3**
			Moderate vaccine availability and high vaccine effectiveness Some vaccine doses are available in the country, but fewer than are required to meet the needs of the priority population; AND the available vaccines have high effectiveness	**2**

Preparedness and countermeasures				**Score**
		'**Effectiveness'** refers to the results of studies that assess or estimate the vaccines' effectiveness against severe disease or mortality. While effectiveness against onward transmission or sterilising immunity is also highly desirable, this is not explicitly considered in this criterion.	**Sufficient vaccine availability and/or high vaccine effectiveness** A sufficient supply of effective vaccine(s) is available in the country to reach the priority population in a timely manner; AND/OR Immunity has already been achieved in the priority population.	**1**
13	**Availability and effectiveness of other pharmaceutical countermeasures**	This criterion assesses how available '**pharmaceutical countermeasures**' (excluding vaccines) are in the country. These include effective treatments, pre- or post-exposure prophylaxis (PrEP or PEP), or supportive care to reduce infection (in case of PEP), morbidity and/or mortality during a public health emergency.	**No other pharmaceutical countermeasures available** Pharmaceutical countermeasures do not exist OR are not available in the country.	**4**
			Low availability and effectiveness of other pharmaceutical countermeasures Pharmaceutical countermeasures with limited effectiveness exist and are available in the country; OR pharmaceutical countermeasures with moderate to high effectiveness exist, but are not available; OR pharmaceutical countermeasures with moderate to high effectiveness exist but compliance is expected to be low.	**3**
			Moderate availability and effectiveness of other pharmaceutical countermeasures Pharmaceutical countermeasures with moderate effectiveness exist and are highly available in the country or can be made available in a timely manner, if necessary; OR pharmaceutical countermeasures with high effectiveness exist but the timeliness of their availability is moderate; OR pharmaceutical countermeasures with high effectiveness exist but compliance is expected to be moderate.	**2**

Preparedness and countermeasures				**Score**
		'**Availability**' includes that the pharmaceuticals are licensed to be used in the country and that there is enough stock to cover the target population in case of a public health emergency (e.g. if a national stockpile exists).	**High availability and effectiveness of other pharmaceutical countermeasures** Pharmaceutical countermeasures with high effectiveness exist and are highly available in the country or can be made available in a timely manner, if necessary, **and** compliance to the pharmaceutical countermeasures is expected to be high; OR pharmaceutical countermeasures are rarely necessary.	**1**
14	**Availability and feasibility of effective public health and social measures in community settings**	This criterion assesses the availability and effectiveness of '**public health and social measures (PHSMs)**' to contain the transmission of the pathogen. These include, for instance, hand hygiene, the use of face masks, isolation, mosquito nets, physical distancing, respiratory etiquette, travel measures, etc. To facilitate the assessment, only effective PHSMs are considered. PHSMs with very low or unknown effectiveness are excluded.	**No PHSMs available** There are no PHSMs available that are able to control disease transmission among the affected communities.	**4**
			PHSMs available, with low implementation feasibility PHSMs that are able to control disease transmission are available but have a low estimated implementation feasibility for the affected communities.	**3**
			PHSMs available, with moderate implementation feasibility PHSMs that are able to control disease transmission are available, with moderate estimated implementation feasibility for the affected communities.	**2**

Preparedness and countermeasures				Score
		'Feasibility' relies on previous assessment of the ability to implement such measures in the affected communities or subgroups within them, including their possible costs and adherence among members of the affected communities.	**PHSMs available, with high implementation feasibility** PHSMs that are able to control disease transmission are available and implementation feasibility is high for the affected communities.	**1**

Annex 3. Example of how a criterion can be presented in the scoring tool

Criterion 7: Impact on the health system if a public health emergency occurs

Expected '**impact on the health system**' includes increases in the number of visits to primary care/emergency departments, hospitalisations, deaths, excess costs (including outbreak management and healthcare mitigation costs), and treatment opportunity losses for other diseases when healthcare services are disrupted.

	No impact on the health system is expected Example: • The disease/pathogen causes a negligible proportion of health system utilisation.	**Low impact on the health system is expected** Example: • The disease/pathogen causes a small proportion of health system utilisation.	**A moderate impact on the health system is expected** Example: • The disease/pathogen causes a moderate proportion of health system utilisation.	**A high impact on the health system is expected** Example: • The disease/pathogen causes a large proportion of health system utilisation.
Disease A	○	○	○	○
Disease B	○	○	○	○
Disease C	○	○	○	○
Disease D	○	○	○	○
Disease E	○	○	○	○
Disease F	○	○	○	○
Disease G	○	○	○	○
Disease H	○	○	○	○
Disease I	○	○	○	○
Disease J	○	○	○	○

Annex 4. Example of how risk prioritisation exercise results can be presented

In May 2025, the Africa CDC Northern Regional Coordination Centre ran a three-day risk prioritisation workshop for epidemic-prone diseases in Cairo, Egypt, with the support of ECDC [7]. A list of 19 criteria was developed in 2022 and revised in 2024, after consultations with a technical advisory group of experts from Africa CDC, ECDC, United Kingdom Health Security Agency (UKHSA), International AIDS Vaccine Initiative (IAVI), United Nations Children's Fund (UNICEF) and the World Food Program (WFP), resulting in a streamlined set of 17 criteria. Diseases were selected from:

- The Africa CDC Event Management System;
- Priority diseases identified during the Africa CDC Continental Surveillance Workshop (Addis Ababa, Ethiopia, April 2025);
- Diseases identified during the Climate Change Workshop conducted in Sharm El Sheikh in May 2024;
- Outbreak data provided by Northern Africa Member States for 2020–2024;
- Internationally notifiable diseases that could constitute a public health event of international concern (PHEIC) under the International Health Regulations (2005);
- Outbreaks identified through a literature review using Web of Science;
- Expert opinions on epidemic-prone threats in the region.

The exercise had 30 participants, including 20 experts from six countries in the Northern Africa region. The results of this exercise are summarised in the Table and Figure, which offer an example of how risk prioritisation exercise results can be presented.

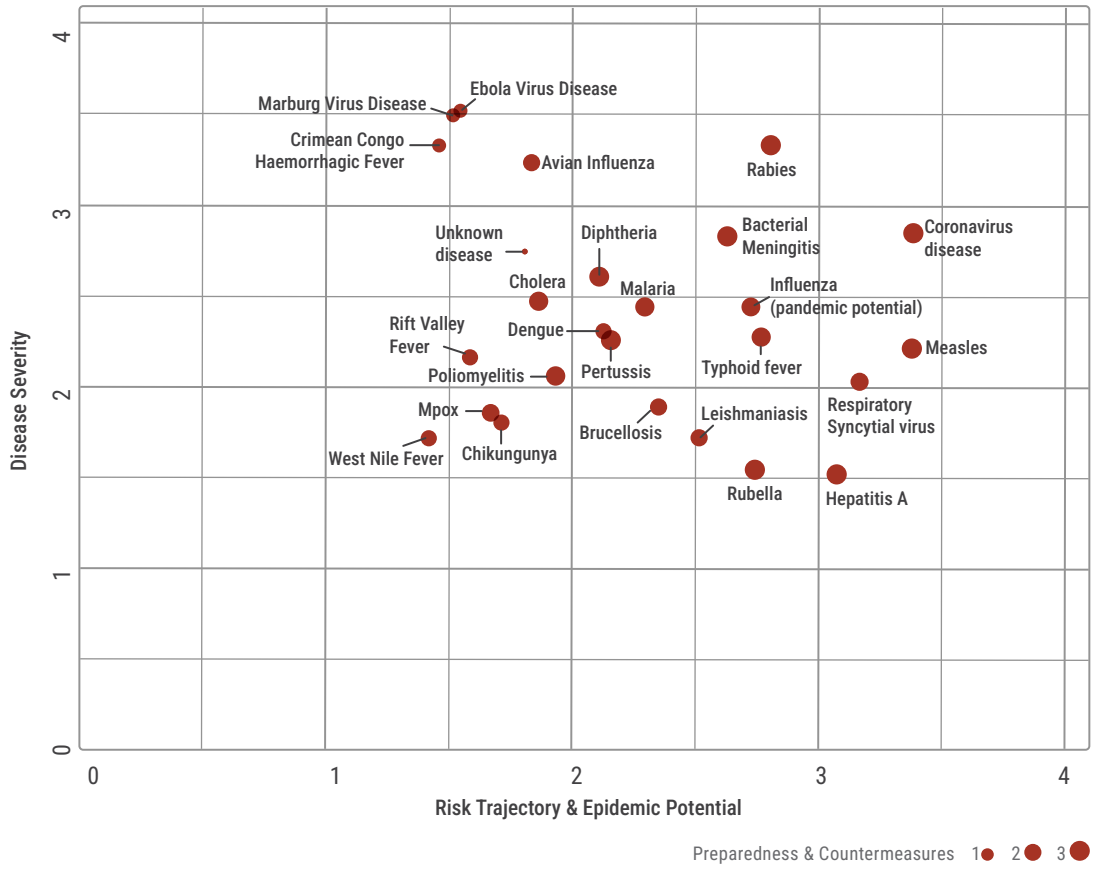
Please note that in this risk prioritisation exercise, a higher preparedness and countermeasures score represented better preparedness, which is the opposite of the method described in this guide (Section 5), where higher scores indicate a greater lack of preparednessand countermeasures.

Table. Risk score of selected diseases, in descending order, and median level of perceived preparedness and countermeasures per disease, as assessed in the Africa CDC Northern Regional Coordination Centre risk prioritisation exercise, 2025

Rank	Disease	Risk score	Preparedness and countermeasures score
1	Coronavirus disease	9.63	2.84
2	Rabies	9.35	2.71
3	Measles	7.47	3.28
4	Bacterial meningitis	7.44	3.19
5	Influenza (pandemic potential)	6.65	2.55
6	Respiratory syncytial virus	6.43	2.37
7	Typhoid fever	6.30	2.67
8	Avian influenza	5.94	1.93
9	Malaria	5.60	2.43
10	Diphtheria	5.50	3.07
11	Ebola virus disease	5.43	1.34
12	Marburg virus disease	5.30	1.24
13	Unknown disease	4.97	0.37
14	Dengue	4.91	1.93
15	Pertussis	4.87	3.16
16	Crimean Congo haemorrhagic fever	4.86	1.40
17	Hepatitis A	4.68	2.94
18	Cholera	4.61	2.79
19	Brucellosis	4.44	2.52
20	Leishmaniasis	4.33	2.23
21	Rubella	4.24	3.41
22	Poliomyelitis	3.98	3.05
23	Rift Valley fever	3.43	1.84
24	Mpox	3.10	2.25
25	Chikungunya	3.09	1.62
26	West Nile fever	2.44	1.77

In contrast with the analysis method described in this guide (Section 5), a higher preparedness and countermeasures score in this exercise indicated better preparedness.

Figure. Bubble scatterplot of disease severity against risk trajectory and epidemic potential, grouped by country, as assessed in the Africa CDC Northern Regional Coordination Centre risk prioritisation exercise, 2025



The size of the bubble is proportional to the level of preparedness and countermeasures; in contrast with the analysis method described in this guide (Section 5), the greater the size of the bubble, the better the preparedness.

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