November 2020 | Report

Strategic and performance analysis of ECDC response to the COVID-19 pandemic

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Executive summary

Key messages

ECDC's response activities to COVID-19 since the beginning of the year were relevant and created significant value for most of its stakeholders. ECDC provides high-quality surveillance data that is widely relied upon, and stakeholders recognise the high scientific quality of ECDC's technical guidance and reports. ECDC's guidance is a critical input for decision makers, especially for Member States that are smaller or have a limited public health infrastructure on the national level.

At the same time, there is a clear potential for ECDC, in line with its commitment to continuous improvement, to support crisis response in Europe more effectively. Based on stakeholder feedback ECDC could consider to:

- Better adapt its outputs to the needs of decision makers by placing a larger emphasis on the practicality of recommendations for specific contexts. More timely outputs are helpful given the need for fast decision making based on the best available evidence at any given point. More tailored communication to different audiences better supports decision makers without much scientific expertise.
- Play a larger role in shaping the European crisis response agenda by providing a more forward-looking perspective. This includes early modelling of potential scenarios and consequences, and early identification of issues that need to be addressed going forward. Such a proactive and strategic approach can also help ECDC to prioritise incoming requests from its stakeholders, and to effectively direct resources to where they add the most value.
- More systematically support learning and exchanges of experiences between Member States, including during the earlier phases of the response. ECDC has a unique and appreciated role as a convenor of European expert networks. Building on this, ECDC can further deepen its understanding of the local context of Member States to support learning across geographies.

A number of internal organisational measures can help enabling these improvements. This includes the establishment of a senior Strategic Lead function with the responsibility to shape ECDC's strategic agenda, in dialogue with the Commission. Such an agenda can inform criteria and processes to prioritize activities and incoming requests, and to allocate staff and resources. Internal processes for producing technical outputs could be more differentiated based on the nature and needs of the requestors, and expert networks could more often be involved in solving issues of common interest.

To play a more effective role in the response ECDC also needs to enhance its capabilities.

ECDC is recognised for the depth of its expertise within its core domain of infectious diseases. There is clear potential to strengthen in-house modelling and forecasting capabilities. To further increase the effectiveness of its analysis and recommendations, access to a broader set of capabilities is helpful, including behavioural sciences, health economics, political science and other research areas related to the broader social context of public health interventions.

In the longer term, there are important questions about the target role ECDC should play in the larger European public health security landscape. What is the appropriate degree of European coordination of public health policies and health data? What should the relative roles of ECDC and WHO Europe be, what are the areas for synergies and collaboration? How large should ECDC's role be in supporting health systems and preparedness in each individual Member State? Should ECDC exclusively focus infectious diseases or also have a role related to non-communicable diseases? Some of these questions are currently addressed by the European Commission in its review of ECDC's role and responsibilities (the Commission's proposal had not been presented as this analysis was performed), and ECDC can play a role in addressing them in collaboration with the European institutions and Member States also going forward.

The report in brief

The COVID-19 pandemic is the largest, most grave and most prolonged public health event (PHE) to hit Europe and the world, in over a century. It has impacted all parts of society and put nearly unprecedented pressure on healthcare and public health systems in every country. For ECDC, COVID-19 is the most serious PHE it has had to respond to since the agency's establishment in 2004, when it was established with the very purpose to support an effective European response to public health threats. In 2020, COVID-19 response has become the most dominant activity of ECDC, consuming a majority of the agency's time and resources.

ECDC's response has mainly consisted of four groups of activities: first, they have continuously published data and surveillance outputs. This includes a broad set of epidemic surveillance data on the development of the disease and its spread, hospitalisation, ICU occupancy and other response measures in all Member States and beyond. It further includes rapid risk assessments, twelve of which were published during the outbreak, up until September, and Weekly Threat Reports. Second, ECDC has produced scientific guidance to support public health decision making at all levels, on a wide range of issues related to the effective response to the pandemic, including, for example, on the use of face masks or on transmission in schools. Third, ECDC has published information on the disease and response measures directly to healthcare practitioners and the general public, for example, on the proper use of face masks or social distancing guidance in care homes. Fourth and finally, ECDC has responded to a large number of ad- hoc requests from European institutions and agencies, Member States and other stakeholders, not resulting in publications.

The present report, and the findings in it, cover these response activities so far, in the period from the onset of the of COVID-19 pandemic up until September 2020, when most of the analysis took place. It is hence not a general assessment of ECDC or it's functioning and organisation in peacetime, but focuses on ECDC's response to the COVID-19 pandemic. The perspective is both internal and external: it covers the relevance, quality, timeliness and effectiveness of outputs and

external support activities during the crisis, as well as the organisation and processes that lead to these outcomes. The purpose of the strategic analysis is to identify strengths and areas of improvements, and to make concrete recommendations on these that can be applied by ECDC in its continued work with the COVID-19 pandemic. The analysis also has a longer-term perspective, and its conclusions should serve to improve ECDC's response to any large-scale PHE in the future, and aspects of its crisis preparedness work in peacetime.

The strategic analysis builds on desk research analysis of documentation provided by ECDC, as well as external documents; an external consultation of 59 senior stakeholders in 19 Member States, EU institutions, EU agencies and international institutions; interviews with 70 ECDC employees in all roles and functions; an internal and an external survey covering a total of 250 respondents; an analysis of learnings from international peers; and consultations with independent external experts and academics

With regard to the externally oriented response activities, the evaluation finds that most stakeholders appreciate the relevance and scientific quality of ECDC's outputs. The data collected and published by ECDC is extensively used on all levels, and the data sharing and collection process is seen as fit for purpose. Further, especially smaller Member States relied heavily on the guidance of ECDC for public health response decision making. The exchange in the various expert networks convened by ECDC was highlighted as another area where ECDC's role and contribution was highly effective. In general, Member State stakeholders in public health technical and expert functions see ECDC as their main counterpart and are largely positive in their assessment of ECDC's COVID-19 response.

As an important area of improvement, most stakeholders, especially in decision-making functions, called for more timely, more practically applicable guidance on response measures – a clearer link between the scientific evidence and concrete actions. ECDC's outputs were not sufficiently adapted to the needs of the different audiences it caters to. Some Member States (MS), European institutions and international counterparts, thought that ECDC would have benefited from closer links, including a physical presence, in each MS, and that this could have made their response activities more relevant. Relatedly, many would have welcomed earlier and clearer positions taken by ECDC on matters ranging from case definition and data collection guidelines to European-level response measures – a strong, independent European voice. ECDC's assessment and guidance on important topics was seen by many as coming too late. A more proactive approach to defining and guiding the agenda would have helped, as highlighted by some stakeholders.

With regard to the internal organisation of COVID-19 response, stakeholders emphasise the depth of ECDC co-workers' expertise and the commitment, and the organisation's ability to learn and improve as its core strengths. The PHE plan, foreseen to guide the work during crises, was initially seen as helpful but not well adapted to an emergency equivalent to the scale and length of COVID-19; the addition of the Support Group has been helpful and has improved the effectiveness of the response.

The processes for prioritising tasks and effectively allocating resources to where they add the most value are seen as insufficient. Along with clearer guidelines and better follow-ups of resource usage, a proactively defined strategic agenda would help guide such decisions; a strengthening of the strategic analyst role could play an important role in this. Further, an organisational culture placing emphasis on scientific excellence, correct processes and internal alignment – manifested in a large number of internal meetings – are

contributing factors to lower-than-desired efficiency.

While the knowledge and skills of ECDC's staff are seen as extensive and relevant, most stakeholders say more staff would have been needed during the pandemic. The existing processes for hiring or contracting staff, or for procuring services externally, are time-consuming and poorly adapted for a crisis situation with short timelines. In terms of additional skill sets and knowledge areas that would complement and broaden the existing ECDC capabilities both internal and external stakeholders point at the need for modelling and analytics capabilities to better contribute to forward-looking scenario building. , Furthermore, broader behavioural science, economic, political science, and crisis management expertise would better anchor output guidelines in a holistic analysis of PHE's impact on society and the effectiveness of response measures.

Based on these findings in the strategic analysis, recommendations for improvements are put forward, covering multiple aspects of ECDC's organisation and processes.

The recommended actions and initiatives aim to enable a desired end state (here structured by topic), whereby:

PHE response (including Surveillance)

- Outputs are actionable and easy to interpret
- Outputs are timely and adapted to the needs of the requester
- ECDC's activities and outputs are guided by a proactively defined agenda and forward-looking approach
- Internal resources and experts' time are used efficiently, especially in times of urgency and resource shortage
- The decision-making guidelines are clear within the PHE at each level, that is, it is clear which decisions can be made by PHE managers and/or group heads, and which decisions need to go to the management Team
- Country responses are systematically assessed and learnings disseminated
- ECDC provides effective response support to Member States and contributes to cross-country learnings

PHE preparedness, organisation and processes

- ECDC's PHE plans are adapted to effectively handle emergencies of different severities and durations
- There is an appropriate balance between continuity of strategic positions and rotation of the high workload-response roles within the PHE
- ECDC effectively uses peacetime to ensure preparedness of Member States
- ECDC has an effective business continuity plan in place for future PHEs of varying durations
- ECDC's PHE structure includes the necessary horizontal functions (such as administration, communication, digital transformation and international relations) in an efficient manner
- ECDC effectively identifies issues and/or improvement potential within the PHE and ensures follow-through on implementation of remediation measures

Assets and capabilities

- ECDC has best-in-class modelling and forecasting capabilities to better develop potential scenarios and risks for stakeholders in a timely and more detailed manner; also covering medium- and long-term scenarios
- ECDC receives data in a more harmonised and timely manner from Member States ECDC has more personnel to draw upon

during a PHE, in a flexible and timely manner (such as, an emergency response workforce)

- All ECDC staff are PHE trained to transition into the PHE organisation as needed
- ECDC has a broader pool of cross-functional expertise that enables them to build more effective system-level perspectives on public health and PHE responses

Collaboration and coordination with stakeholders

- ECDC's Advisory Forum and expert networks are used as effective tools for ad-hoc problem solving of prioritised issues of common interest
- ECDC is viewed by its stakeholders as a transparent organisation, that makes its information and priorities easily accessible
- ECDC's role within the EU landscape is well defined and its unique purpose understood clearly
- ECDC has strong ties to, and good knowledge of, the health system in each Member State
- ECDC coordinates European collaboration on building a scientific fact base to: 1) enable a more holistic overview of scientific findings and 2) reduce overlaps and the duplication of work in Europe
- ECDC has an independent, strong voice and position, coordinated with the WHO, but not bound or delayed by WHO coordination
- ECDC further strengthens cooperation with global and international partners including in particular the WHO and other CDCs to ensure strong global intelligence on emerging health threats and during global crises

Mandate and scope of ECDC

- There is clarity of ECDC's role in supporting the coordination of national response measures , whereby ECDC's existing mandate enables a more direct and larger role in supporting the Member States, European institutions and agencies

Finally, the strategic analysis has raised a number of larger, systemic questions about how public health prevention, preparedness and PHE response is best organised at the European level, and what role ECDC should play in a better-coordinated response. Whereas it is beyond the immediate scope of this assessment to address these questions, their answers will have important implications on ECDC's mandate, organisation and operating model. It should be a matter of priority that they are addressed by the European institutions and the Member States, in dialogue with ECDC.

List of abbreviations and acronyms

ACDC	Africa Centre For Disease Control
AF	Advisory Forum
BAU	Business as Usual
BCP	Business Continuity Plan
CCB	Coordinating Competent Body
CDC	Centre for Disease Control
EASA	European Union Aviation Safety Agency
EC	European Commission
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EU	European Union
EMA	European Medicines Agency
EPIET	Field Epidemiology Path
EUPHEM	Public Health Microbiology Path
EWRS	Early Warning and Response System of the European Union
ICU	Intensive Care Unit
IHR	International Health Regulations
IPCR	Integrated Political Crisis Response
IT	Information Technology
JRC	Joint Research Centre
KDCA	Korean Disease Control and Prevention Agency
KOICA	Korea International Cooperation Agency
MB	Management Board
MFF	Multi annual Financial Framework
MIS	Management Information System
MS	Member States
NFPs	National Focal Points
NUTS	Nomenclature of Territorial Units for Statistics
OCPs	Operational Contact Points
PHE	Public Health Event
PHEMT	Public Health Event Management
PHEOC	Public Health Emergency Operations Centres
RCCs	Regional Collaborating Centres
RRA	Rapid Risk Assessment
SOP	Standard Operating Procedures
SARI	Severe Acute Respiratory Illness
TESSy	The European Surveillance
US CDC	United States Centers for Disease Control
WHO	World Health Organisation

1. Introduction

1.1. Scope and approach of the study

This report summarises the findings of a strategic and performance analysis of ECDC's response to COVID-19 between August and October 2020. The context and subject of this analysis is ECDC's performance during the COVID-19 outbreak. Hence, the scope of the analysis, and this report, is largely limited to events that took place in the period from the first known cases of COVID-19 in China until the time of this strategic analysis. The analysis focuses on ECDC's activities, organisation and processes that were in place during this period. As a result of this, the analysis and the resulting conclusions and recommendations pertain primarily to ECDC's operations in times of crisis. Although the conclusions may have important implications on ECDC's organisation in peacetime – not least with regard to its work in the area of emergency preparedness – this is not an analysis of ECDC's organisation and processes in general and in a business-as-usual setting. It is the intention of the analysis that its findings and recommendations should not only apply to COVID-19 and the short term, but be relevant to ECDC's response to any future PHE. As such, recommendations and consideration are provided for the short, medium and long term, and some reflections and ideas beyond the immediate short-term control of ECDC are included.

The scope of the assessment is both external and internal: it covers the output and externally oriented response activities of ECDC, and the internal organisation and processes that led to these outcomes.

The evaluation and analysis relies on multiple sources of insight:

- A review of documentation provided by ECDC, including its PHE planning; organisational structures, processes and guidelines; internal evaluations; and a detailed overview of outputs produced during the pandemic
- Structured interviews, individual and in focus groups with approximately 70 employees at ECDC, at all levels and with a wide representation of roles, functions, hierarchies and organisational units
- An on-line survey distributed to all ECDC employees (N = 264) with a response rate of 74 per cent
- Structured interviews, individual and in focus groups, with 59 of ECDC's external stakeholders in the Member States (MS), EU institutions and bodies, and international organisations, including:
  - Members of ECDC's Management Board
  - Members of ECDC's Advisory Forum

  - National Focal Points (NFPs) and Operational Contact Points (OCPs) for relevant subject areas:
    - NFPs for Preparedness and Response
    - NFPs for Influenza
    - NFPs for Threat Detection, Early Warning and Response Systems (EWRS) and International Health Regulations
    - New ECOVID-Net composed by OCPs for Microbiology and OCPs for Surveillance
  - Senior representatives of the European Commission
  - Senior representatives of relevant EU agencies and bodies
  - Senior representatives of the WHO
- An on-line survey distributed to 225 external stakeholders: NFPs and OCPs mentioned above, with a response rate of 24 per cent
- An analysis of learnings from relevant peer organisations internationally, including the US CDC, Africa CDC and Korea CDC
- A database analysis of media coverage of ECDC in five EU Member States
- Structured interviews and document reviews with public health experts external to, and independent in relation to ECDC, including in regular consultations with an Academic Advisory Board

A full documentation of the approach and methodology of this study is found in Appendix 1.

1.2. Structure of this report

The report is structured into five chapters in addition to the introduction. The report opens with an introduction to ECDC and their mandate and areas of responsibilities within and outside a PHE, along with a high-level view of ECDC's resources within a PHE (Chapter 2). The next chapter presents on overview of ECDC's response activities during a PHE, and specifically within the current COVID-19 pandemic, which include both output generation and collaboration and coordination with external stakeholders. Chapter 4 explores ECDC more internally, focusing on the internal organisation, workflows and processes of the PHE and a more in-depth view on the assets and capabilities ECDC has access to there within. Chapters 2 to 4 first present baseline information regarding the aforementioned topics, which are then followed by synthesised findings from internal and external stakeholder consultations on those same topics, and finally a discussion on the insights those findings could be pointing to.

In Chapter 5, potential learnings from international peer organisations (such as, other CDCs) are explored. This is done through both a benchmarking analysis and interviews with experts on those organisations and their activities.

Finally, Chapter 6 presents the key synthesised insights to the topics identified in this strategic and performance analysis. The chapter first explores the key strengths ECDC should maintain and develop. This is followed by clear potential recommendations for improvements that could improve ECDC's effectiveness for future PHEs, along with corresponding recommended actions on how ECDC could potentially realise these improvements. Chapter 6 concludes with a brief presentation of the potential longer-term options (outside ECDC's control) that may improve the European PHE response effectiveness.

2. The baseline: ECDC in a Public Health Emergency

ECDC's activities within a PHE focus most heavily on scientific and surveillance outputs covering matters related to the specific disease itself. ECDC is considered, both internally and externally, to interpret their own mandate in a strict and potentially rather narrow manner. There may well be an opportunity for ECDC to take a bolder stance on their mandate (especially during a PHE), by for example, taking a clearer stance on public health matters of scientific significance and broadening monitoring and analyses beyond narrow disease surveillance. Formal expansion of the mandate may be a longer-term option, which EU and MS need to decide with regards to the desired common European response to PHEs.

ECDC is further the convenor of several European health expert networks, discussed further below.

2.1. Overarching intro to ECDC, mandate and areas of responsibility

The European Centre for Disease Prevention and Control (ECDC) is the EU's agency for strengthening Europe's defences against infectious diseases by identifying, assessing and communicating the current and emerging threats they pose to human health. According to ECDC's founding regulation (851/2004/EC), the agency is committed to 'protect and improve human health by prevention of human disease and ensuring a high level of protection of health of European citizens' and 'serve as a source of independent scientific advice, assistance and expertise from trained medical, scientific and epidemiological staff from its own resources or from those of recognised competent bodies acting on behalf of Member States' authorities responsible for human health'.

To do so, ECDC's core activities include providing scientific support and being a reference point for MS regarding infectious diseases, monitoring European public health through indicator-based, event-based and laboratory surveillance, including molecular typing-related data (collecting, analysing and disseminating surveillance data on 56 communicable diseases and related special health issues from 27 Member States and EEA countries). In addition, ECDC supports MS in their emergency preparedness by coordinating training programmes to assist Member States in having sufficiently trained specialists to control disease outbreaks. This comes in the form of face-to-face training/blended learning/e-learning modules (fellowship programme, continuous professional development and in-country training); forming training networks; collaborating training centres; publishing training documents; collecting and assessing scientific evidence to support preparedness planning; creating preparedness

plans and evaluating their effectiveness; facilitating information exchange between MS; developing and maintaining procedures to coordinate public health emergencies and crisis management. ECDC is the convenor of several European health expert networks, further discussed below.

2.2. ECDC's mandate and responsibilities in a Public Health Event

ECDC's responsibilities during a PHE mirror the organisation's overall responsibilities as set out in their Founding Regulation. In the preamble of the regulation, it is established that 'effective response to disease outbreaks requires a coherent approach among Member States and input from experienced public health experts, coordinated at community level'. Beyond that, the regulation does not differentiate between responsibilities in peacetime and during a PHE.

Hence, ECDC should carry out the same risk assessment activities during an outbreak in the same manner as in peacetime (as described in Chapter 2.1). In practice, this means:

Collecting and publishing surveillance data and Epidemic Intelligence targeted towards public health institutions, including:

- Indicator-based surveillance data, relying on continuous collections of structured information, related to a specific disease
- Epidemic Intelligence reports, relying on unstructured data gathered through public on-line sources
- Epidemiological updates (including, for example, the epidemiological situation in EU/EEA countries and the UK and epidemiological characteristics of cases reported by Member States)

Publishing risk assessments on an ongoing basis (including, for example, various risk profiles based on reported cases, hospitalisations, testing methodologies, test positivity rates) and implemented response measures (such as testing strategies, contact tracing and measures to minimise risks)

Publishing technical assistance and scientific guidance targeted to public health agencies, health professionals and policymakers, such as:

- Testing strategies and objectives
- Guidance on COVID-19 in care homes
- Guidelines for safe travel resumption in Europe during a pandemic
- EU guidance for cruise ship operations
- Guidance on infection prevention control

Publishing information to the broader public, such as:

- Transmission updates in EU/EEA countries
- Videos on how to wear face masks properly
- Effective hand washing

In addition to this, an important responsibility, to which a large share of ECDC's resources are dedicated during a PHE, is responding to incoming requests from the European Commission, European Parliament, MS and other stakeholders within their area of competence. These requests can be of varying nature and span across all four of the above mentioned categories (for example, provide guidance on the public health management of COVID-19 in prison settings and provide EU recommendations for testing strategies).

ECDC's competencies as outlined above lie within risk assessment rather than direct risk management: ECDC does not provide practical response measures or concrete policy-level recommendations on such measures to MS, the public or other stakeholders.

2.3. ECDC's resources in a PHE

2.3.1. ECDC's level of funding, outside and within a PHE

ECDC is primarily funded by the general EU budget. In addition, a small part of its funding stems from subsidies from the EEA. Their 2020 revenues amount to EUR 59 million and expenditures to EUR 60.5 million, split into the three categories; staff, infrastructure and operating expenditure. The EU budget, as well as ECDC's budget, follows the Multi-annual Financial Framework, meaning budgets are set on a 7-year horizon and thus limited in flexibility. The Multi annual Financial Framework, as well as the annual budget, is approved by the European Council and the Parliament based on a proposal from the European Commission. In practice, this means that ECDC must go through the European Commission to get additional funding, including during a PHE. Funding can be reallocated trough reprioritising activities, that is, by effectively putting business-as-usual activities on hold.

2.3.2. ECDC's personnel and competencies

In a PHE, ECDC works with its existing staff to respond to the crisis. This is done through reallocating staff from regular activities to the PHE organisation on an on-demand basis. Hence, the composition of ECDC's staff in peacetime, defines the capabilities the organisation has at its disposal to respond in times of crisis.

The full allowance for personnel covers 280 full-time equivalents, however this number is naturally impacted by the number of vacancies. There are currently 268 full-time equivalents working within the regular organisation, out of which approximately 45 per cent, or about 125 employees, are focused on scientific content creation (that is, experts working in the Disease Programmes, Public Health Functions or Scientific Methods and Standards Units):

- Within the Disease Programmes Unit, 56 experts are mainly focused on analysing and interpreting surveillance data and providing scientific advice and disease-specific country support
- The Public Health Functions Unit has 45 experts responsible for ECDC's delivery of generic surveillance infrastructure, public health training, emergency preparedness and response support for Member States to mitigate disease threats
- The Scientific Methods and Standards Unit, composed of 21 experts, leads processes for strengthening the scientific excellence and dissemination of knowledge internally and to external stakeholders. This includes ensuring quality, relevance and transparency of ECDC's scientific outputs. Within this Unit an independent Eurosurveillance (independent scientific journal hosted by ECDC) Section, consisting of 5 experts, also exists
- In addition, the three units are supported by administrative staff. The rest of ECDC's staff work three governance and support functions in the director's office (34 people), the Digital Transformation Service Unit (32 people) or the Resources Management Service Unit (57 people)

In addition to using the existing in-house staff, ECDC has the possibility to procure services from external service providers which can support the work of the PHE. Interim staff can also be hired on short-term contracts. Further, they can procure external services to deliver pre-defined outputs, such as technical reports including forward-looking modelling scenarios. The procurement process depends on the value of the contract to be awarded (that is, the total value of a type of services procured). When relying on external (interim)

staff and procuring external services, ECDC must choose from already existing contracts. If a new demand of specific service arises which is not covered by any existing contracts, a process for procuring a new contract must be initiated. In case of urgency, ECDC can rely on a simplified procedure based on the EU Financial Regulation.

2.3.3. Expert networks

ECDC is the convenor and coordinator of several public health and disease networks with representatives from the Coordinating Competent Bodies (CCBs) in each of the EU/EEA Member States – just as in peacetime – which is an important asset for emergency response activities. These consist of several subject matter and disease-specific public health, disease and laboratory networks. The public health networks constitute NFPs and OCPs, which are coordinated by ECDC's different sections (namely, communication, microbiology, preparedness and response, public health training, scientific advice coordination, surveillance and threat detection). Furthermore, there are 15 operational disease networks coordinated by ECDC, also with NFPs and OCPs for which regular meetings are organised to create a shared understanding of trends, risks and how data should be reported for specific diseases. In each Member State there is a national coordinator, having the overview of all the national CCB interactions with ECDC and appointing the NFPs and OCPs from that Member State. Strategic advice from a Member State perspective is also provided by the CCB directors in annual meetings with the ECDC director.

The Advisory Forum is one of ECDC's governance bodies and advises the director of the Centre on the quality of the scientific work undertaken by ECDC. It is composed of senior representatives of national public health institutes and agencies, nominated by the Member States on the basis of their scientific competence, and a representative from the European Commission. Beyond this, the Advisory Forum serves as a platform for exchanging information and pooling knowledge and cooperation measures.

2.3.4. ECDC's surveillance and data capabilities

In a PHE, ECDC provides three types of surveillance; indicator-based, event-based and molecular surveillance. The indicator-based surveillance relies on a collection of case-based data and indicators which are provided by Member States on a regular basis. The event-based surveillance, also known as Epidemic Intelligence, is based on unstructured data gathered through screening of various public on-line sources. The molecular surveillance relies on data reported by Member State laboratories, just like indicator-based surveillance. The purpose is to delineate outbreaks and investigate the evolution of the pathogen population over time.

The majority of data is gathered through four main sources; TESSy (The European Surveillance System), EPIS, EWRS (ECDC operates EWRS on behalf of the European Commission, which plays the role of business owner for EWRS) and public on-line sources. As ECDC's emphasis lies on indicator-based surveillance, they rely heavily on the data reported from Member States to TESSy. Member States are requested to upload different levels of detail in case-based data on a regular basis; aggregated on a national level and complemented with sub-regional levels. The reporting cadence depends on the severity and characteristics of the ongoing outbreak. Regional data is collected using the European Nomenclature of Territorial Units for Statistics (NUTS) classification. This is a geographical system, according to which the territory of the EU is divided into hierarchical levels ranging from zero to three (described in further detail in Chapter 4).

ECDC provides Member States with case definitions and predefined variables to be followed when uploading data. However, due to incomplete data sets often being provided, ECDC must regurarly turn to publicly available sources to gather the needed data, such as, national health institutions, social media and other third-party sources. Furthermore, ECDC is unable to collect data from Member States themselves, but relies heavily on Member States providing them with the requested data. ECDC does issue guidelines on data collection, but has no authority to enforce standards in how data should be reported, currently enforced by the database and reporting control, or quality assure the source of surveillance and data reporting within Member States.

2.4. Stakeholders' view on ECDC's mandate and scope in a PHE

Building on the baseline outlined above, this section covers the main feedback and opinions of external and internal stakeholders interviewed on the scope and boundaries of ECDC's responsibilities in a PHE, the interpretation and application of these. On the highest level, it is a political choice for the EU and the Member States what level of coordination and harmonisation there should be to the European response, and whether the current level of cooperation (as primarily laid out in Decision 1082/2013/EU) is appropriate. That choice – and especially a decision towards more coordination – would have important design implications on the role and scope of ECDC. MS stakeholders do not express a change of ECDC's formal responsibilities as a priority. However, also within the current mandate, a broader, more active ECDC with a stronger voice is possible and would be welcomed by many, both internally and externally.

2.4.1. External stakeholders

Many stakeholders, especially public health officials in the MS say:

- ECDC's scope of activities are well defined and its boundaries appropriate: ECDC fulfils an important function as a risk assessor and the balance of responsibilities between different players and levels in the public health landscape is largely appropriate
- ECDC's focus on data collection, aggregation and dissemination is relevant in its current format
- A stronger voice and role of ECDC would be beneficial within its current mandate, for example, by firmly establishing ECDC as the European risk assessor versus international institutions (such as the WHO); and ECDC taking a stance without awaiting full alignment with, for example, the WHO when doing so would delay key outputs
- An expansion of the mandate, beyond risk assessment or a strict focus on infectious diseases, may be helpful but is not a priority of stakeholders

Some international institutions, and a minority of MS, spontaneously say that ECDC's mandate should be formally expanded to concretely guide decision making (risk management and response) at the European level in emergencies.

Some EU institutions and bodies, and international institutions say:

- A better-defined mandate that clarifies the division of responsibilities between different EU institutions, Commission services and agencies is needed, for example, in relation to the Joint Research Centre (JRC) which performs similar tasks
- No mandate will ever be able to outline responsibilities clearly for all potential scenarios; ECDC could collaborate more with other organisations during crises even if

it is not explicitly foreseen in their mandate, if stakeholders express the wish for it

2.4.1.1. Findings from the external survey

The following findings stem from a survey distributed to 225 stakeholders external to ECDC, primarily NFPs and OCPs in the MS. A short version of the same survey was also carried out directly in association with focus groups. The total response rate was 24 per cent.

External survey respondents are divided on whether they would like more involvement or the same involvement as today from ECDC in large-scale PHEs.

- 61 per cent of respondents want ECDC to have more involvement in a future public health emergency compared to today, while 37 per cent want a similar involvement. In addition, 47 per cent of respondents want broader support from ECDC while 39 per cent want the same level of support, and 14 per cent want less support
- 41 per cent of respondents want ECDC to have a similar set of capabilities in terms of expertise in the future, while 47 per cent want them to have a broader set. Only 12 per cent want ECDC to have a narrower set of expertise capabilities in the future

2.4.2. Internal stakeholders at ECDC

Internally, there is a widely held opinion that ECDC's current mandate is limiting its ability to effectively assist stakeholders in managing risks, and that an adjustment or reinterpretation of the mandate would be beneficial.

According to internal stakeholders, three potential areas of mandate expansion could be:

- Not limiting the mandate to communicable diseases, but expanded to non-communicable diseases and the broader public health system, as communicable diseases have broad implications on healthcare systems and sociological impacts, which ECDC currently cannot contextualise into its recommendations
- ECDC's data-gathering mandate should expand according to the point above as it would enable ECDC to provide more detailed and actionable output, and has the additional benefit of creating a centralised repository of disease and public health data for the EU, which could be incorporated into the European Health Data Space that is currently being developed
- Standardisation, and potentially binding recommendations of data reporting, preparedness and planning in Europe are seen as important to ensure a more effective European response to PHEs

2.4.2.1. Findings from the internal survey

Echoing the above findings, respondents in the ECDC internal stakeholder survey also advocate for increased mandate and involvement from ECDC in Public Health Events. More specifically, some respondents want ECDC to take on a stronger leadership role and be able to provide more concrete, potentially binding, recommendations.

- 54 per cent of respondents answered 'Significantly more involvement than today' and 36 per cent answered 'Slightly more than today', when asked what level of involvement they would want to see from ECDC in future PHEs.

2.5. Observations

There is agreement that it would be beneficial if ECDC broadened and sharpened its activities beyond a narrow definition of its current mandate. There is likely room for ECDC to immediately make a bolder interpretation of

its current mandate, to broaden its monitoring activities and to take a clearer stance on matters of scientific debate, especially in the context of the ongoing crisis; for example, by broadening its monitoring and analyses beyond narrow disease surveillance, to include system-level indicators; and making outputs more actionable and concrete for decision makers to act upon.

Formally expanding the mandate and responsibilities of ECDC may be an option in the longer term, but is not a priority for most external stakeholders, especially in the Member States. Expanding the mandate would require increased resources in both funding and personnel, which – if provided – could have the additional benefit of solving the issue of lack of personnel during a PHE expressed by ECDC (both within and outside the PHE).

On the European system level, the EU and MS need to decide on the level of coordination and desired common European response to PHEs. Related to that, there is a choice whether ECDC should focus solely on the scientific fact base, or whether they should concretely guide decision making – in the long term, this choice should guide ECDC's scope of activities (mandate).

3. ECDC's response to COVID-19

ECDC has strong scientific core capabilities that were widely recognised in the COVID-19 pandemic. There is, however, a need for ECDC to more effectively bridge the gap between the scientific and political levels through more practical and timely recommendations by tailoring the content to different audiences through a clear understanding of their needs; and publishing best available evidence at a given point. In addition, stakeholders expect ECDC to take stronger control of the agenda through proactive identification of important areas to cover and for ECDC to systematically facilitate the dissemination of learnings across countries, particularly early in the response. These improvements would require a shift from the currently reactive and cautious approach to a more proactive response based on best available evidence. In addition, ECDC would be helped by a proactively defined strategy to guide the response, and clearer processes for triaging and allocation of resources. Finally, a discussion should be initiated regarding the possible strengthening of capabilities (for example, with a background in behavioural science, policy and crisis management).

3.1. Overview of ECDC's response activities

The COVID-19 pandemic is the largest and most prolonged PHE that ECDC has encountered since its formation in 2005, and the first one to impact Europe at scale. As such, ECDC's response activities, albeit building on their mandate and ordinary responsibilities, have, in many ways, been unique and without precedent.

ECDC's COVID-19 response activities and outputs can be broadly placed into four categories: (1) data outputs and technical reports, (2) scientific guidance to policymakers, (3) information directly to practitioners and the general public and (4) responses to ad-hoc requests from European institutions, agencies and Member States not resulting in publications. In addition, requests coming in from external stakeholders can span across all four categories.

1) Data and surveillance outputs
ECDC has continuously collected, collated and published surveillance outputs, epidemiologic and micro biologic overviews. This type of data has been published in the following types of formats:

- Rapid Risk Assessments (RRAs)
- Weekly Threat Reports
- Geographic distribution of cases worldwide
- National and subnational daily and weekly 14-day notification rates
- Hospital and ICU admission rates and current occupancies
- Surveillance summaries per country
- Situation dashboards per country

During COVID-19, there has been great emphasis on the creation of RRAs. Since the beginning of the outbreak, ECDC has published 14 RRAs, cadence varying between 1 and 4 weeks. These documents aim at supporting countries and the European Commission in their preparedness and response, by providing a timely summary of the ongoing health threat and suggested response measures. Examples of dimensions covered are updates on geographic spread, virus characterisation and test positivity rates. The first RRA was published 17th of January 2020 and described risks related to travelling, spread within the EU, transmission in airplanes, nonsocial transmission, infection prevention, control and risk.

2) Scientific guidance

ECDC has published scientific findings and opinions aimed to target, for example, public health agencies, health professionals and ministry of health representatives in the Member States. The purpose and nature of these outputs are often to provide guidance and recommendations for how to respond to the crisis. For example, ECDC published:

- Their opinion on the effectiveness of wearing face masks, published 8th April
- An assessment of transmission in school settings, published 6th August
- Strategies and objectives for sustainable testing, published 18th September

3) Information directly to practitioners and the general public

Throughout the pandemic, ECDC published videos, info graphics and posters aimed to target the broader public audience. A few examples include videos on how to properly wear face masks and animations showing how physical distancing can curb the spread and guidance on COVID-19 in care homes.

4) Responses to ad-hoc requests from European institutions, agencies and Member States not resulting in publications

Staff working in the PHE Unit have received numerous incoming requests with specific niche questions from external stakeholders, such as the European Commission, Member States and media representatives, throughout the pandemic. Examples of such requests are additional comments to RRAs, more detailed geographical levels in case-based data reporting in China and sharing all RRAs on the EWRS platform.

Interviews with ECDC show that out of the time spent on output creation, approximately 40 per cent is devoted to creating their mandatory and self-generated surveillance outputs, scientific guidance and modelling, whereas roughly 40 per cent is spent on answering requests coming from the European Commission and 20 per cent from MS and other stakeholders. As continuous surveillance activities and request management have demanded most resources during the PHE, little room has been left for ECDC to be proactive in their creation of scientific guidance for policymakers and information for the general public. In fact, there's a large perception within the organisation that most of their time is spent on reactive measures.

In the creation of outputs, ECDC has been collaborating with EU institutions and agencies, Member States and the WHO. As previously mentioned, they have organised meetings to exchange information through, for example, disease networks and the Advisory Forum. During the disease network meetings, expert representatives from Member States meet to exchange knowledge and approaches on critical questions such as case definitions, data outputs and important analyses to be conducted. During COVID-19, additional network meetings have been set up on a weekly basis representing all functions of the Technical Group (including, Epidemic Intelligence, Surveillance, Infection Prevention and Control, Microbiology, Scientific Evidence, Preparedness, Response and Mathematical Modelling) where analyses and outputs are being reviewed and discussed. Furthermore, ECDC shares all received data from Member States with the WHO. Representatives from both organisations discuss, on a weekly basis, operational information, such as what outputs are currently being produced.

3.2. An analysis of ECDC's media presence during the PHE

To gain a better understanding of ECDC's positioning and presence throughout the COVID-19 pandemic, an analysis of ECDC's media presence was conducted. Data regarding the frequency of mentions for both ECDC and national public health institutes throughout 2020 in a selection of countries is gathered and compared. In order to get a representative sample of the EU MS, countries with different size, geographical location and spend levels in the national healthcare systems were selected for the analysis. This analysis yields a proxy for the visibility and presence of ECDC in the EU landscape.

The common theme throughout all countries analysed is that ECDC and the national health institutes saw a spike in frequency of mentions starting in March, when COVID-19 hit Europe. Generally, ECDC is mentioned significantly less than the national health institutes but some differences across countries exist. This is especially notable in Hungary, where the national health institute is only mentioned five times more often than ECDC. Furthermore, Sweden and Germany seem to have stronger presence of their national health institute compared to ECDC in their national media coverage. In most countries analysed, ECDC is mainly referred to as a source of data, e.g. number of reported cases across Europe.

Table 1. Number of press hits per month, country and organisation.

	Articles mentioning the agency									
	France[1]		Germany[2]		Greece[3]		Hunguary[4]		Sweden[5]	
Month	Santé Publique France	ECDC	RKI	ECDC	EODY	ECDC	NNK	ECDC	FHM	ECDC
January	424	29	2,043	166	12,800	658	214	13	750	12
February	497	48	4,439	178	8,950	462	196	29	1,991	254
March	1,701	222	17,249	340	26,300	1,080	204	52	10,565	242
April	1,636	59	14,878	118	31,900	1,300	223	46	8,782	30
May	1,675	141	10,008	151	18,300	565	206	44	8,367	129
June	1,011	77	6,779	199	32,400	1,160	220	34	5,187	30
July	1,031	49	7,388	140	52,200	1,100	219	29	4,091	21
August	1,459	90	9,212	104	26,500	668	193	49	4,629	24
September	1,720	126	7,115	189	29,900	660	159	59	3,585	127
Total	**11,154**	**841**	**79,112**	**1,585**	**239,250**	**7,653**	**1,834**	**355**	**47,947**	**869**
National agency vs. ECDC mentions factor	**~13**		**~50**		**~30**		**~5**		**~55**	

Please note

Some results may include duplicate publications (e.g. articles published in both the web and print version of a newspaper, or identical articles published in various local newspapers from one publisher); some do not include mentions on television or radio broadcasts. The absolute numbers between countries might not be comparable considering the differences in media coverage, data availability and sources used. The comparison should mainly be done for the ratio between national agency mentions and ECDC for the respective countries. The countries were partly selected based on availability of data.

1 Factiva. (Retrieved 2020-12-01)
2 Genios database. (Retrieved 2020-10-08)
3 Google News. https://news.google.com/ (Retrieved 2020-10-08)
4 Google news. https://news.google.com/ (Retrieved 2020-10-08)
5 Retrieve database: https://web.retriever-info.com/ (Retrieved 2020-10-07)

Sweden

A press analysis shows that ECDC has a certain media visibility in Sweden, with 869 hits in Swedish printed magazines and newspapers since the beginning of the year. Most mentions are in the first quarter of the year, when the outbreak of COVID-19 reached Europe. Compared to the national public health institute, Folkhälsomyndigheten (FHM), ECDC's media presence is marginal. Folkhälsomyndigheten has been mentioned ~55 times more often than ECDC – almost 48,000 times – in Swedish media in 2020.

In roughly 80% of articles where ECDC is mentioned, it is as a source of information or, most often, as a source of data, without additional commentary specific to ECDC's work or findings. The remaining 20% cite conducted interviews with ECDC staff, often commenting on their most recently published outputs or evaluating developments and trends related to the current situation. No articles commenting on the effectiveness of ECDC as an organisation, or on their specific role in responding to COVID-19, were identified in the press search for Sweden.

Greece

ECDC has been mentioned 7,653 times since the beginning of January until end of September according to a press search on Google News covering publications on websites, excluding print press. In contrast, the National Public Health Institute of Greece (EODY) has been mentioned 239,250 times during the same time period. This reveals that EODY has been mentioned roughly 30 times more than ECDC since the beginning of the pandemic. Most mentions of ECDC took place during March to July, whereas the peak of mentions of EODY are dated to July.

Scanning through a sample of articles, ~50% of ECDC mentions have been related to data or brief mentions. The remaining ~50% mentions have been detailing the results of ECDC reports, replaying interviews of the ECDC Director, discussing ECDC protective protocols, virus trends etc. In most cases these were dedicated articles to ECDC. No articles containing discussion or commentaries on the effectiveness of ECDC or their specific role in responding to COVID-19 were identified.

France

A press analysis shows that ECDC has a rather limited media visibility in France, with 841 hitsin French national press since the beginning of the year. In contrast, Santé Publique France (SPF), the national public health institute, was mentioned 11,154 times, or about 13 times more often. The outbreak of COVID-19 in Europe naturally increased the media visibility of both organisations, but the ratio changed little, with ECDC mentions compared to SPF.

In roughly 95% of articles where ECDC is mentioned, it is as a source of data, or, most often, as a source of information without additional commentary specific to ECDC's work or findings. In fact, the majority of French articles mentioning ECDC do it usually once, rarely twice, aiming essentially at sharing and informing about ECDC's findings, results and recommendations in the COVID-19 context. However, these articles usually do not provide readers with comments, analysis or any assessments on ECDC's work, results, decisions or organisational activities. Only a handful of articles providing such qualitative and subjective commentary were identified in the press search: for example, one which discusses whether the ECDC deserved to be criticized for its "belated" reaction to COVID-19 epidemic, or one which alludes to ECDC's lack of powers and means compared to its American counterpart, the US CDC.

Germany

ECDC already had a certain media visibility in Germany before the pandemic spread throughout the country. An average of 176 hits per month were registered between January and September 2020 in a national press analysis covering printed and on-line magazines and newspapers, periodicals and specialist magazines or publications. In total, ECDC was mentioned 1,585 times whereas the Robert-Koch-Institute (RKI) was mentioned 79,112 times. ECDCs mentions peak in March, when the strictest COVID regulations ("lock down) were implemented, followed by a significant decrease in mentions afterwards.

Compared to RKI, the national disease control and prevention agency, ECDC's media presence is marginal. The RKI has been mentioned 50 times more often than ECDC – on average 8790 times per month – in the same period of time.

In roughly 90% of articles in which the ECDC is mentioned, it is either as a source of information or data, often accompanied by additional comments or statements from ECDC staff, evaluating developments and trends related to the current situation. The remaining articles are comments from German politicians, journalists or scientists on the work, decisions or funding of the ECDC. Some articles also comment on the effectiveness of ECDC as an organisation, or on their specific role in responding to COVID-19.

Hungary

ECDC has been mentioned a total of 355 times according to a press analysis of Hungarian media on Google News covering publications on websites, excluding print press. This is compared to 1834 mentions of NNK, the Public Health Agency of Hungary. The number of mentions has been quite steady month by month since March, prior to that ECDC was barely mentioned. In total, NNK has been mentioned roughly 5 times as frequently as ECDC – meaning the frequency of mentions are relatively similar. This indicates that ECDC has a relatively stronger presence in Hungary compared to other countries in this analysis – especially compared to Sweden.

The knowledge about ECDC's existence has, as seen in the frequency of mentions, increased steadily since the early months of 2020. Some early articles even mentioned that there was "no real epidemiology centre in the EU", whilst more recently, articles have started to cite ECDC outputs and report findings. For example, ECDC's opinion was used as a basis for the lock down decision in Hungary. Furthermore, some articles are linking to ECDC's website and dashboard – referring to it as a fact base.

3.3. Stakeholders' view on ECDC's response to COVID-19

This section covers the feedback and opinions on the relevance, quality and timeliness of ECDC's externally oriented activities and outputs in response to COVID-19. The views differ between different groups; whether they represent scientific organisations or are decision makers and whether they represent larger or smaller MS. In general, the scientific quality of ECDC's outputs is seen as high. Member State representatives are largely satisfied with ECDC's surveillance activities and data, and appreciate its scientific guidance to their national level development of recommendations. Especially smaller MS rely more heavily on these opinions. Many stakeholders see the timeliness, specificity and practicality of ECDC's outputs – the ability to translate them to concrete actions – as an important area for improvement. To enable this, ECDC could strengthen its internal processes for scoping and prioritising requests, and to better adapt the nature or responses to the needs of different audiences (e.g., a short email answer when appropriate).

The section also covers the purposefulness and effectiveness of ECDC's interaction and collaboration model and format with the MS, and with other international stakeholders. MS perceive the collaboration model largely as well-functioning. They highlight ECDC's role as a convenor of expert networks as one of its unique and most important functions. The role towards the WHO is well-defined with few problematic overlaps; however, the interaction model with other EU institutions and agencies, in particular with JRC, would benefit from clarification and codification.

3.3.1. External stakeholders

Relevance and quality of ECDC's outputs
Many stakeholders, especially from MS say:

- ECDC's response activities have been relevant and of high scientific quality
- In particular, the surveillance activities and the published European-level data is frequently used by all stakeholders
- EWRS is highlighted by many as a much-used and very good system

In particular, smaller Member States say that with limited national resources, they rely heavily on ECDCs technical guidance on a range of questions, and frequently implement them in their daily work.

Some stakeholders – mainly from EU institutions but also MS – point to the lack of modelling, forecasting and scenario building (for example, of local COVID-19 cases if further social restrictions are not enacted), a function that would be highly relevant for ECDC.

Some stakeholders, both from EU institutions and agencies as well as from Member States, pointed to specific content areas where they would have desired more guidance from ECDC, including on topics related to transport, travel and tourism; monitoring of MS response activity and national plans, and guidelines for the clinical management of COVID-19.

One Member State which was hit by COVID-19 early, says that ECDC's risk assessment and early warnings were not sufficient to support effective prevention and response, that important international data was missing and that learnings from early European outbreaks were not effectively captured and disseminated.

Practicality of ECDC's outputs
Most stakeholders say:

- ECDC's guidance would benefit from being less cautiously phrased, more practical and actionable, and more directly answer the question 'what should we do' – even in light of certain scientific uncertainty; for example, the recommendation for PPE came during times when said PPE was widely unavailable, thus a 'second-best option' would have been ideal
- ECDC could have taken a clearer stance on a range of issues earlier on, shaping a unified European approach to surveillance and risk assessment; an early case definition, for example, would have further harmonised the European approach from the beginning
- The timeliness of the outputs has sometimes been an issue, as immediate response action was often necessary and ECDCs outputs only came weeks later; for example, in the first months of the crisis, there was a vacuum on a range of questions, especially case definition and procedures – ECDC could have filled that gap but did it too late

Several European institutions, international institutions and some Member States would have liked to have seen ECDC offering more on-site, technical assistance to MS responses, including presence in the country or dedicated representatives, where needed, adapted to the specific circumstances of that MS.

The European Commission says:

- ECDC's outputs are often too technical and too scientific to be highly relevant and practical for decision making
- The outputs are not always timely or well adapted to the intended audience; ECDC should better differentiate between when an immediate, short answer should be given and when a larger scientific investigation is needed
- ECDC is too reactive, and should proactively identify prioritised action areas more often – if they scoped their responses to incoming requests more efficiently, they would also have time for this
- By improving on these areas, ECDC would enable the European Commission, and Europe as a whole, to respond in a more unified and more effective way to the pandemic

Collaboration and coordination with stakeholders
Many stakeholders say:

- Interactions between MS and ECDC have been effective and helpful; especially as networks were established prior to the pandemic, which enabled effectiveness early on
- ECDC's role as a convenor of an expert network and facilitator of knowledge exchange is highly valuable, sometimes more important than the output produced by ECDC itself
- ECDC is perceived as the primary PHE counterpart for technical cooperation on infectious diseases in the European context, and could assert this role even more clearly by channelling all requests received by other international institutions (such as the WHO) through ECDC, and by reducing the emphasis of content alignment with these institutions in all matters
- Notwithstanding the importance of collaboration and exchange with international institutions (such as the WHO), ECDC should more often prioritise speed and relevance to its own stakeholders than alignment with these institutions, especially when the latter is seen as a source of delay

Some stakeholders say:

- Networks with other international agencies should be strengthened to improve intelligence gathering – and working relationships with other EU institutions apart from DG SANTE should be enacted
- ECDC's collaboration with, understanding of, legitimacy in, and helpfulness for the Member States would be strengthened by dedicating analytical resources and representatives to each MS, including with physical representation, in peacetime, and particularly during crises

3.3.1.1. Findings from the external survey

ECDC's response activities on an overall level are rated very highly in terms of relevance and scientific quality by external stakeholders. While the feedback regarding timeliness was not as positive, external stakeholders were generally satisfied. Similar conclusions can be made regarding the actionability of ECDC's outputs.

- 84 per cent of respondents were satisfied with ECDC's response activities and found them relevant – 92 per cent were satisfied, or very satisfied, with the scientific quality of ECDC's outputs

In addition to the highly positive results related to relevancy and scientific excellence, 66 per cent of respondents were satisfied with the timeliness of ECDC's activities and 64 per cent were satisfied with the practicability/applicability of the outputs.

Risk assessments issued by ECDC are perceived very positively by external stakeholders and are described as timely and very useful by some. More specifically, the RRA outputs 'Corona virus disease in 2019 in the EU/EEA and UK – tenth update' and 'Novel corona virus disease 2019 pandemic: increased transmission in the EU/EEA and UK' were considered relevant, of high quality and useful by external stakeholders.

- 45 per cent of respondents in the external survey give ECDC's risk assessment the highest grade and describes it as very useful, an additional 39 per cent also see it as useful.
- More than 88 per cent of respondents found both RRA outputs (mentioned above) relevant and of high quality. In addition, 80 per cent found them useful and applicable

When probed in more detail on technical guidance and surveillance outputs specifically, most external survey respondents reported being satisfied with the technical guidance provided by ECDC. However, some respondents, once again, mentioned issues with applicability and translation into national guidelines/policies. In addition, a significant majority found the surveillance outputs from ECDC effective.

- 84 per cent of respondents were generally satisfied with the technical guidance from ECDC during the COVID-19 pandemic so far. When asked to elaborate, some of the answers were:
- 27 per cent of respondents rated ECDC's surveillance outputs with the highest score and found it very effective, an additional 54 per cent found the outputs effective
- Ratings to more specific surveillance and microbiology outputs from ECDC can be found in the Appendix

The level of coordination between a respondent's institution/country and ECDC was found to generally be quite effective – with some stakeholders not finding it optimal. In addition, majority of respondents want ECDC and their country/institution to work together as they do today, with some respondents wanting to collaborate even more closely.

- 62 per cent of stakeholders rated the level of coordination between ECDC and their institution/country as effective, 38 per cent found that there could be improvements.

- 54 per cent of respondents want ECDC and their institution/country to have the same level of collaboration as today. 32 per cent want slightly closer collaboration and 10 per cent want significantly closer. Only 4 per cent of respondents wanted to have less collaboration with ECDC

3.3.2. Internal stakeholders at ECDC

There is broad agreement that ECDC's outputs are largely relevant and of high scientific quality.

Internally identified factors affecting the nature and timeliness of outputs include incoming requests of varying nature and relevance – they range from answering journalist questions to producing scientific guidance on complex issues – there is no clear process for relative prioritisation or what kind of response would be most appropriate; often the output is more technical and scientifically thorough (and hence time consuming) than requested

- Scientific thoroughness and a preference to coordinate with the WHO, for example, before issuing opinions are main drivers of (perceived) delays of responses
- The boundaries of ECDC's mandate limit the extent to which ECDC can give clear recommendations on responses or collect and publish a broader (more relevant) set of indicators
- The PHE response is very reactive (not proactive), and lacks clear strategic direction. There is consensus that this is difficult to address due to: (a) lack of full coordination with the European Commission on a clear strategic direction, and (b) lack of resources due to the workload from incoming requests
- The strategic analyst is seen as vital to proactively defining the agenda of the PHE, but the role is limited and there is no process for acting on their recommendations

Collaboration and coordination with stakeholders

Internally, most stakeholders say:

- Collaboration and the division of roles with the MS and the WHO is clear and largely well-functioning
- Alignment with the WHO is an important source of delays, but important for consistent messaging and lack of double reporting
- There is a perceived overlap of activities especially with JRC, as JRC's role and responsibilities seem very similar to ECDC's, and there is a lack of a well-established collaboration model

3.3.2.1. Findings from the internal survey

As mentioned in Chapter 2, internal stakeholders want more involvement from ECDC and the ability to provide concrete, potentially binding, recommendations.

- 54 per cent of respondents answered, 'Significantly more involvement than today' and 36 per cent answered 'Slightly more than today', when asked what level of involvement they would want to see from ECDC in future Public Health Events

Regarding the PHE response – three main improvement areas were highlighted in the survey responses as key to improving the efficiency of the response:

- More personnel, mainly in the form of communication staff and different types of experts, is cited as the most important change required to improve the PHE. However, more funding is not considered a solution
  - 36 per cent of respondents chose 'more personnel', when asked what the single most important action would be to ensure more effective handling of PHE tasks.

  - Only 21 per cent of respondents thought ECDC currently had insufficient funds to fulfil its role

- Responsibilities need to be described more clearly within the PHE as a whole and there needs to be a more effective division of tasks. Within specific PHE Groups, however, roles are generally considered quite well defined
  - 24 per cent of respondents thought clearer task and responsibility description and division was the single most important measure to ensure more effective handling of PHE tasks
  - 45 per cent of respondents found roles and responsibilities as not clearly defined in the PHE as a whole
  - Only 24 per cent of respondents found that personnel is allocated to tasks in an effective manner within the PHE.
- Better prioritisation of tasks and an improvement of inefficient working processes (mainly driven by too many meetings). In addition, many stakeholders experience issues with prioritisation of the European Commission's requests as they are often treated as vital when this might not be the case
  - 16 per cent of respondents thought clearer prioritisation was the single most important measure to ensure more effective handling of PHE tasks
  - 57 per cent of respondents found the current PHE working processes inefficient. 53 per cent of respondents found that PHE tasks were prioritised ineffectively.

3.4. Observations

There appears to be a certain disconnect between the political and technical/scientific level, where technical experts in the MS appreciate the scientific quality of ECDC's work, while political decision makers, not least in the European Commission, expect faster and more actionable outputs – there is a need to bridge this gap.

There is a need for clearer scoping processes for different types of requests and to adapt the response to the needs of the requestor/decision maker. This entails more clearly understanding what the requestor needs, for example, a pragmatic best-effort email response versus a long scientific document. This in turn would lead to a higher share of requests handled more quickly and by a smaller group of contributors; hence freeing up capacity for proactive activities.

There is a demand for zECDC to have a stronger voice in its response activities, and concern about ECDC overstepping its mandate is not widely shared outside of the organisation. ECDC could hence be more bold in its opinions and guidance, taking a clear stance based on its expertise – and going further in offering direct, concrete support to its stakeholders risk management and response activities.

ECDC taking more control of the agenda, and proactively identifying important areas of analysis and scientific guidance, is a priority. Agreeing with the European Commission on strategic priorities regularly may also be beneficial in ensuring that ECDC can focus on the most value-adding activities.

ECDC's collaboration model with Member States and international institutions (such as the WHO) is perceived as largely well-functioning, although ECDC could play a larger role versus the international institutions, by removing the requirement for alignment on technical guidance, for example, while still aligning when not delaying outputs.

ECDC fills a unique role in Europe as a convenor of expert networks and a forum for exchange of expertise and experience; the role of these networks could be strengthened further to create additional leverage for ECDC's internal expertise and activities.

Contingent on an adjustment of ECDC's role, in crises and at peacetimes, stronger bilateral links with each MS, including local representation, could be considered; regardless of such a change, there is room for ECDC to broaden and deepen its understanding of individual health systems.

Finally, it appears that the division of roles and responsibilities between EU institutions and agencies needs to be clarified and the collaboration improved.

4. Management and organisation of the response

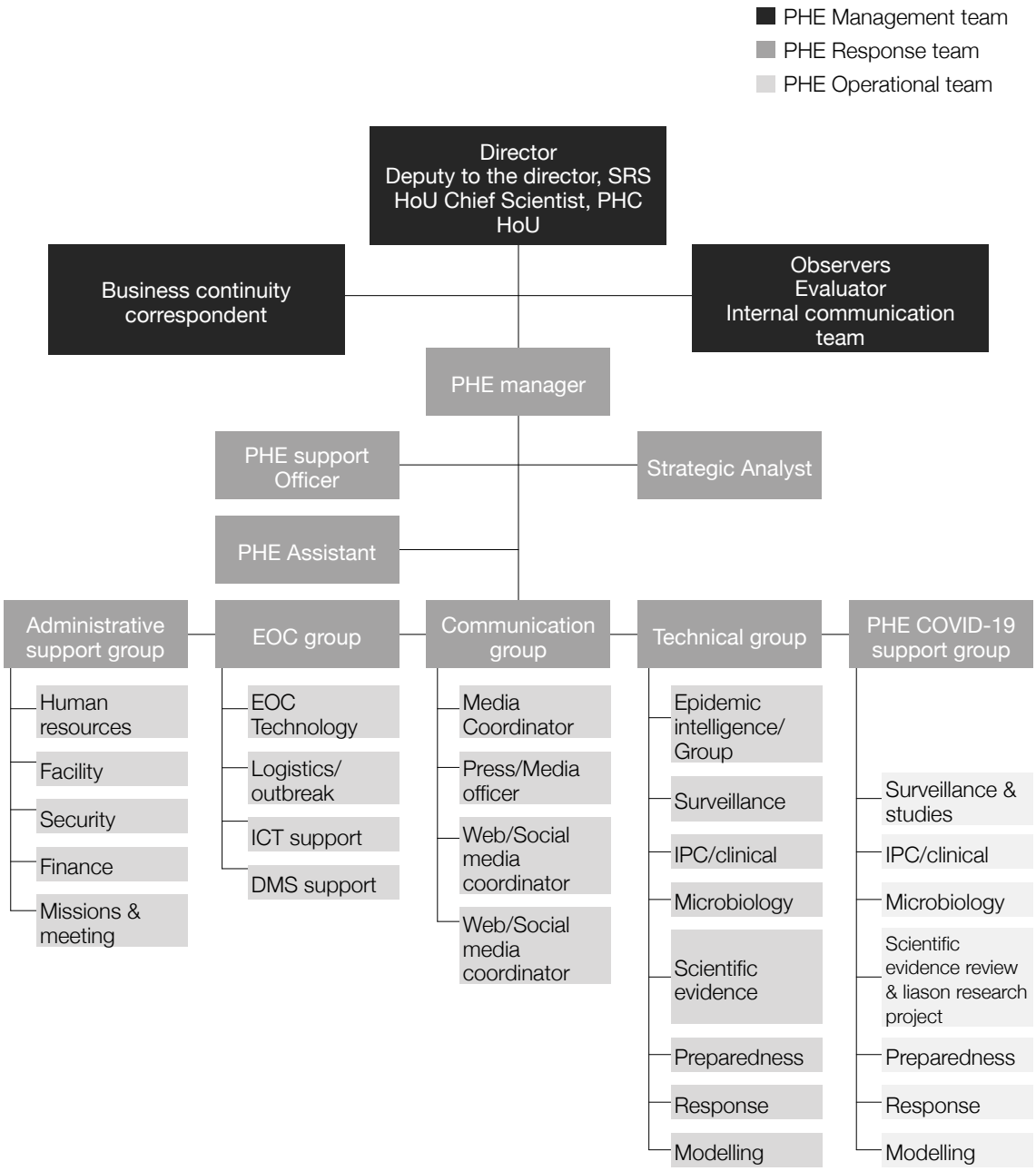
ECDC's organisation during a PHE is guided by their PHE plan, which although proved useful, has shown to be lacking with regards to long-duration PHEs like COVID-19. Similarly, the Business Continuity Plan (BCP) did not provide the necessary guidance on how different units should effectively decide which 'regular' activities should be prioritised and upheld during the PHE. Within the PHE organisation, employees described a culture of collaboration and commitment, while the same interviewees also identified a lack of strategic direction, effective prioritisation and resource allocation for activities. Internal evaluations noted some of these shortcomings, and more, but without a proper sponsor and structure their improvement opportunities were rarely implemented. Finally, Member States look to ECDC to strengthen their modelling and forecasting capabilities to prepare them for various potential scenarios ahead of time.

4.1. Internal organisation of the response activities

There are two main plans being activated during a PHE; the PHE Operations Plan and the Business Continuity Plan (BCP) which serve as guidance on work procedures and organisation during a crisis. The PHE Operations Plan describes capabilities and procedures needed to prevent, quickly respond to and recover from the ongoing crisis. The Business Continuity Plan provides procedures to be followed to minimise potential effects on ECDC's critical day-to-day activities carried out in the original organisation.

The PHE plan was updated in mid-March and again in mid-September to be better adjusted to the new demands and working conditions. Organisational to the originally planned PHE organisation structure were needed during the pandemic due to increased workloads. The accelerated demands and workloads for PHE staff led to the creation of the Support Group in mid-March 2020, with the aim to support the Technical Group with incoming requests and taking on the longer-term activities (see Exhibit 1 illustrating the new organisational structure). To ensure lessons learned from the PHE during COVID-19, yet another restructuring was to be put into operation as of 1st September 2020 (subsequently delayed to 15th September). The biggest changes stemming from this reorganisation have been the dismantling of the Support Group, meaning the staff is integrated into their regular teams under the ECDC organisation structure, and the creation of a new temporary disease programme on COVID-19 and influenza (Cal DP) and a COVID-19 Task Force, aimed to ensure cross-organisational coordination of all COVID-19 related work.

Exhibit 1 – PHE organisation structure after reorganisation in mid-March, resulting in the creation of the Support Group intended to assist the Technical Group (marked in grey)



The PHE organisation can be seen as a stand-alone business unit, activated during a public health crisis which is staffed by reallocating personnel from the regular ECDC organisation, based on demand. During the COVID-19 outbreak, the PHE management structure constitutes of two teams complementing each other; the Management Team and the Response Team. Both teams are supported by five operational groups which all have a responsible Group leader, who together with PHE manager coordinates all activities and incoming requests.

The PHE Management Team consists of the director, all heads of units except for the head of the Digital Transformation Services (DTS) Unit, the chief scientist, a PHE support officer, an internal communicator, an evaluator and a PHE manager. In addition, the director may also call upon advisors when required, for example, to discuss topics related to external communication with stakeholders and disease-specific issues. The main responsibility of the Management Team is to provide strategic direction to the PHE manager and approve allocation of personnel resources. The management meetings, held three times per week (daily initially), serve as an important platform to share views on managerial issues, during which decisions made by PHE manager during the day can be overridden.

The Response Team consists of nine people; a PHE manager, a PHE assistant, a strategic analyst, a PHE support officer and five operational group leaders. The team is led by the PHE manager who, according to the PHE plan, is foreseen to have decision-making power on staff allocation to and within the PHE, prioritisation of activities and incoming requests and processes needed to enact on the strategic direction decided by the Management Team. The strategic analyst plays an important role for the PHE, supporting the PHE manager and drawing upon ECDC subject expertise by reviewing and providing feedback to outputs created by the Technical Group. Furthermore, the strategic analyst is assigned to conduct the more forward-looking analyses, such as analysing anticipated transmission risks among young people during COVID-19, which are presented to the Management Team every second week.

The five operational groups (Technical Group, Support Group, Administrative Support Group, Emergency Operation Centre Group and the Communication Group) are led by their respective group leader. The actual response activities and creation of outputs are done within the Technical Group and the Support Group.

- The Technical Group provides subject expertise, including epidemic intelligence, microbiology, diagnostics monitoring and surveillance, risk assessment, scientific guidance and response. The Technical Group consists of about 7 to 12 experts within the fields of: Epidemic Intelligence, Surveillance, Infection Prevention and Control, Microbiology, Scientific Evidence, Preparedness, Response and Mathematical Modelling. Just as the rest of the staff within the PHE, they rotate between the PHE and their regular units in the ECDC organisation on a two-week basis. The composition of the Technical Group is determined by the workload and specific expertise needed to create the scientific outputs. Thus, the number of experts within specific areas can vary according to the magnitude and nature of incoming requests and planned activities in the PHE
- The purpose of the Support Group is mainly to ensure surge capacity in an escalating situation, improve coordination and reduce pressure on the PHE Response Team through assisting the Technical Group in their creation of scientific outputs. Furthermore, they are tasked with longer-term activities, such as strategic analyses, guiding

documents, surveys, testing protocols and risk communications. The Support Group consist of experts from the same fields as the Technical Group, however the number of staff involved during peaks of the pandemic have amounted to approximately 50 to 60 people

- The Administrative Support Group is responsible for support functions such as human resources, facility logistics, security, finance, missions and meetings
- The Emergency Operation Centre Group is responsible for technology, logistics and IT support
- The Communication Group is responsible for external communication coordination with the press and social media, coordinating with other communication groups dealing with the crisis, monitoring anxieties and rumours among Member States, professionals and other public stakeholders

4.1.1. Workflow in the PHE

ECDC has defined ongoing surveillance activities which should be updated on a regular basis, for example the RRAs (combining surveillance data, scientific updates and options for response) and the Weekly Threat Reports. During COVID-19, these predefined activities are carried out by the Technical and Support Group, accounting for approximately 40 per cent of all activities carried out in the PHE. The remaining 60 per cent is spent on responding to requests from external stakeholders, such as the European Commission, Member States and media representatives. The request handling system does not provide any concrete guidance or decision-making support for prioritising or allocating tasks, which is mentioned as one of the key reasons why the majority of time is spent on answering external requests.

All incoming requests should come into one single source: the PHE manager mailbox.

The type of requestor can be divided into five groups: ECDC Internal, EU Member States, European Commission, other EU Institutions and agencies and other (such as the press and other international institutions). Internally, the requests are divided into three groups depending on priority: low (about 2 per cent of requests), medium (about 58 per cent of requests) and high (about 40 per cent of requests). The share of requests coming from the different types of requestors and the distribution of request priority is shown in Table 1 below. As seen in Table 2, European Commission requests tend to have a higher priority compared to other requestor types – especially compared to EU Member States.

Table 2 – Describing requestor types, the share of requests each requestor type constitutes and the distribution of high-, medium- and low-priority requests received by each requestor type

Requestor type	Share of requests	High	Medium	Low
ECDC Internal	38%	31%	67%	2%
European Commission	33%	63%	37%	0%
EU Member States	11%	19%	79%	2%
Other	11%	21%	76%	2%
Other EU Institutions	7%	44%	56%	0%

The timeline of a given request is defined by the time from when the request is created in the internal request system until its deadline. The timeline of an average request is 14.2 days, but this varies depending on the requestor.

Table 2 shows the timeline (in days) distribution per requestor type. As seen in Table 2, EU Member State requests have a shorter timeline compared to ECDC Internal requests despite usually being lower priority.

Table 3 – Describing the average timeline per requestor type (i.e., time between when a request is logged in the system until its' deadline) and the distribution of timeline length for each requestor type

Requestor type	Average timeline (days)	<2 days	2–5 days	5–10 days	>10 days
ECDC Internal	21.4	24%	24%	20%	32%
European Commission	10.1	33%	30%	21%	16%
EU Member States	10.9	27%	38%	26%	9%
Other	8.6	22%	34%	18%	26%
Other EU Institutions	8.6	29%	29%	23%	19%

The estimated hours needed for each request are often detailed in the request itself, otherwise this is brought up for discussion and estimated by the Response Team. However, the requests are often quite short on details; not describing the nature of desired output, how the requestor intends to use the output and the urgency of the request (as opposed to the deadline).

Each morning, the Response Team discusses incoming requests, their feasibility and who would be best suited to take it on. Following this, team leaders share all requests with the staff in the Technical and Support Groups, and experts volunteer for their preferred tasks. In practice, tasks coming into the PHE are 'up for grabs' and often many experts are eager to contribute, sometimes leading to an uneven allocation of staff time with little management control: staff contributing in output creation without being delegated to do so.

The distribution of staff and allocation of tasks vary with the scope of the activities. For the creation of an RRA, experts from various different functions are often needed, resulting in up to 20 experts being staffed, while for the vast majority of requests, 1 to 2 experts from the Technical and/or Support Group are often enough to deal with the scope. Once the experts in the Technical Group have been allocated to work on a certain task, the team sets up their own working norms, such as anticipated outputs, cadence of discussion calls and how to collaborate in terms of writing. However, the ways of working vary with the nature of the task.

4.1.2. Management and decision making

According to the PHE Operations Plan, all strategic decisions should be taken under the oversight of the ECDC director, for example, what forward-looking activities need to be prioritised and necessary actions based on recommendations from organisation internal evaluations. This includes engaging executive and strategic management functions needed to respond to the emergency. Furthermore, the Management Team has the authority to overrule the decisions made by the PHE manager who, as previously mentioned, has the authority to ensure staffing levels and expertise meet the needs within the PHE as well as prioritise activities undertaken in the PHE. However, during COVID-19 many of the decisions within the mandate of the PHE manager have been brought for discussion with the Management Team.

In practice, this means that the Management Team has made decisions that according to the PHE plan are within the mandate of the PHE manager, such as personnel allocation and prioritisation of incoming requests from the European Commission and Member States. According to interviews with ECDC staff, there has been a large emphasis on extensive internal alignments when making small, as well as large, decisions throughout the pandemic.

4.1.3. Staffing aspects

Access to the right people is ensured on an on-demand basis, that is relocating staff from the ordinary ECDC organisation to the PHE. In practice, the PHE has been able to expand its workforce during COVID-19 by deploying ECDC staff, however there's limited possibility to hire additional staff quickly and for shorter periods due to the recruitment processes, limits in establishing posts, and legal limitations regarding contract length and number of possible renewals (note: the last two points likely only limit the attractiveness of the posts to potential applicants, but they are not limitations to the hiring itself).

In addition, ECDC has the possibility to: (a) procure services from external service providers to deliver pre-defined outputs and (b) hire interim staff on short-term contracts.

With regards to the first possibility, interviews with internal stakeholders indicate that the procurement process for attracting such external services is often perceived as time consuming, depending on the value of the contract, and delays the accessibility to demanded services, often needed immediately during a crisis. ECDC has an obligation to use already defined contracts when acquiring new services. If existing contracts do not enable access to the relevant competence and expertise, which according to some ECDC staff often is the case, procurement processes for new contracts must be initiated which is perceived as heavy and time-consuming. The same framework agreements that apply in business-as-usual times have been used during COVID-19, even though the existing contracts have been amended in about one third of the cases to accommodate new/modified services required by the outbreak. In relation to the second option, the process of recruiting new interim staff on short-term contracts generally span over 1 to 2 months (within a month in some cases, such as administrative support).

4.1.4. Tools and assets (capabilities)

According to ECDC's COVID-19 reporting protocols, Member States are requested to report surveillance data covering the total number of cases, total number of tests, total number tested in influenza sentinel surveillance, total number positive in influenza sentinel surveillance, number tested among hospitalised SARI (Severe Acute Respiratory Illness) patients by age group and description of the SARI surveillance system. These data sets should be reported to TESSy on a weekly basis. Variables with geographical information to TESSy (such as place of infection) are reported based on the European NUTS standard of regional classification, down to NUTS 3:

- NUTS 0: national level
- NUTS 1: major socio-economic regions
- NUTS 2: basic regions for the application of regional policies
- NUTS 3: small regions for specific diagnoses

The level of geographic detail reported by Member States varies largely.

The event-based surveillance, also known as Epidemic Intelligence, is run by a team screening on-line public data sources on a daily basis, ensuring access to the most up-to-date data. The main output originating from Epidemic Intelligence are maps to geographically illustrate the reported number of cases worldwide.

Beyond TESSy and public websites, ECDC also use the systems EWRS and EPIS. EWRS is a web-based platform owned by the European Commission where any Member State can share confidential information, such as early warnings regarding a specific virus that has started mutating. Through EWRS, Member States can easily investigate if the same trends and potential threats apply in neighbouring countries. EPIS is the more informal tool, serving as a communication platform especially for food- and water-borne diseases in Member States.

ECDC work with data harmonisation to improve robustness in their analyses. A joint case definition to be used by all Member States is provided together with a standardised set of variables related to the specific disease. The case definition has been updated during the pandemic; the initial version being defined in late February, while the current one was defined as of 29th May. ECDC's reporting protocols instruct data providers on how to use the case definitions and interpret variable definitions. Furthermore, the disease networks serve as important platforms to create a shared understanding of trends, risks and how data should be reported. The Advisory Forum meetings are attended by members from technically competent bodies in Member States

which undertake tasks similar to those of ECDC and meet no less than four times per year. The purpose of these meetings is to support the director in ensuring the scientific excellence of ECDC's outputs as well as exchange information on health threats.

ECDC has limited possibilities to ensure full data comparability in its surveillance report across countries. In practice, standardised surveillance processes cannot be assured across countries (for example, the reported cause of death may differ between countries). In-house comparability analyses are regularly conducted, all witnessing of the difficulties of doing comparisons between countries. This, in combination with many Member States uploading incomplete data sets, limits ECDC from performing more in-depth analyses. ECDC staff state the reason for Member States providing incomplete data sets to be a combination of themselves lacking data but also because they don't judge it to be important enough. Furthermore, Member States often fail to provide data within requested deadlines. Hence, ECDC is forced to use Epidemic Intelligence methods for completing data sets, for example, by screening the Member States' health agency websites, Twitter and other relevant on-line sources.

4.1.5. Business continuity of ordinary tasks

The BCP specifies the critical and semi-critical activities to be prioritised during a PHE (see Appendix 2). Interviews with ECDC staff reveal that the majority of listed critical activities have been prioritised during the pandemic, including, providing screening information through Epidemic Intelligence, creating RRAs, operating the EWRS, daily surveillance of travel associated legionnaires' diseases, and alerting Member States about events. However, as the plan does not provide disease-specific activities, room is left for interpretation of the actual tasks to be prioritised. For instance the RRAs, being listed as a critical activity, have indeed been successfully produced during the pandemic covering surveillance on COVID-19, but whether these RRAs should be produced for the ongoing pandemic or any other disease is not revealed in the plan.

Furthermore, the listed activities are of a generic nature, not detailing or guiding what specific actionable tasks should be undertaken by ECDC staff. Interviews with ECDC staff also reveal that the plan itself has not proven to be useful during the crisis – rather than following the plan to the letter, activities have been prioritised ad-hoc bases. It is also mentioned that since every PHE is of varying nature, ECDC would benefit more from having efficient processes for activity prioritisation in place rather than an exhaustive list of business-as-usual activities to be followed and applicable for any PHE. The current decision-making process for prioritisation begins with discussions with staff working in each respective unit, followed by a discussion with all the heads of units who, in turn, bring suggestions to the director ultimately making the executive decision.

4.2. Stakeholders' view on the response organisation

This section covers the feedback and opinions related to the PHE plan, the PHE organisation and the management structures and processes foreseen and practically implemented at ECDC during COVID-19. It also addresses organisational culture aspects affecting the efficiency and effectiveness in a fast-moving crisis situation. While the PHE plan has provided important structure during COVID-19, it has not always enabled clear prioritisations and effective procedures for resource allocation. Management during a

crisis must find a balance between continued scientific excellence and execution at speed, and the PHE plan may need adjustments to provide clearer guidance on that balance and procedures to enable shifts in the operating model to this end.

The section also covers feedback on the resources at ECDC's disposal to fulfil their tasks: funds, people, skills and expertise, systems and the organisations ability to use them effectively. ECDC's resources – especially the expertise of its staff – are deemed by most as relevant to fulfil their current responsibilities; however, in a large-scale crisis like COVID-19, more options to increase critical staff may be needed. ECDC's IT architecture is adequate, but inconsistent data reporting and quality from MS is a problem that cannot be solved only internally at ECDC. However, strengthening internal data analytics, and especially forecasting capabilities is seen by many as an important development.

Finally, the section also addresses the topic of business continuity of ordinary tasks, where clearer prioritisation of which tasks need to continue operating during a PHE may be needed.

4.2.1. External stakeholders

Preparedness, organisation and processes
Some stakeholders say:

- ECDC's response organisation is fit for purpose, but it took a long time to get organised
- Training and exchange platforms like EPIET and MS Track play an important role in ensuring preparedness on a European level through knowledge exchange and connectivity

On business continuity, some stakeholders – primarily on a political level – say that ECDC has not efficiently moved enough resources to handle the COVID-19 response, but rather a too sparse cadre of employees were moved to the PHE, leading to many people being kept executing business-as-usual tasks that could have been deprioritised during the crisis.

The World Health Organisation said ECDC could have played a larger role in preparedness planning in peacetime, supporting and quality assuring national plans in all MS, in collaboration with the WHO.

Assets and capabilities
Many stakeholders say:

- ECDC has good and relevant expertise and, to a large extent, systems that are fit for purpose
- Forecasting, modelling and advanced analytics are areas where it would be beneficial if ECDC would strengthen its capabilities
- The quality and inconsistencies of data collected and reported by MS is a bigger problem than ECDC's systems, however, ECDC does not have a sufficient toolkit (including harmonisation powers) to overcome these quality gaps

Some stakeholders say:

- ECDC's systems are not state of the art, leading to inefficiencies and disproportionate spend (time and money) on administration and IT, rather than on the core business
- Broadening ECDC's areas of expertise beyond medicine, biology and epidemiology, to include more knowledge about, for example, behavioural sciences, economics, political science, sociology, systems engineering and crisis management, may help ECDC build more effective system-level perspectives on public health and PHE responses

4.2.1.1. Findings from external survey

The opinion on ECDC's Preparedness guidance is divided among external survey respondents – where the majority leans slightly towards finding it effective enough. However, they also reported that the guidance lacks practicality at times.

- 53 per cent of respondents find the Preparedness guidance from ECDC effective.
- Ratings to more preparedness and response outputs from ECDC can be found in Appendix 3

External survey respondents view ECDC as very well equipped when it comes to their expertise. When it comes to funding, personnel and breadth of support, the response is not as overwhelmingly positive, however external stakeholders find them averagely equipped.

- 84 per cent of respondents find ECDC well equipped or very well equipped to support MS during a public health emergency, when it comes to their expertise
- However, only 44 per cent of respondents find the same to be true for overall resources (such as funding and personnel), with 35 per cent reporting that ECDC is not equipped from a resource standpoint to support Member States during a public health emergency
  - In the follow-up survey for focus group interviewees, only 33 per cent of respondents found ECDC to be well equipped, with 30 per cent reporting that ECDC is not equipped to support MS during a PHE

4.2.2. Internal stakeholders

Preparedness, organisation and processes

- The PHE plan and the PHE organisation have provided helpful structures for mobilising and organising resources
- It was not well adapted to the magnitude and length of the COVID-19 crisis, but with adjustments along the way it has functioned
- The addition of the Support Group to the PHE in March is generally seen as a beneficial change to the organisation's structure, as it has to some extent reduced the workload on the Technical Team and allowed for more proactive output creation

Identified issues and bottlenecks include:

- Not all ECDC personnel have PHE training, hence cannot be used in PHE
- The strategic analyst is an important role to drive a proactive response for the PHE, and there is consensus that this 'role' should be expanded into a 'team' – but, there is no clear process on how to incorporate their recommendations into the PHE agenda, which needs to be rectified
- The PHE manager in practice doesn't have the decision-making power foreseen in the PHE plan, but often needs to go through the full PHE Management Team for every decision, adding process layers and slowing down decision making
- Some stakeholders have highlighted that the internal evaluator plays an important role in identifying potential areas for improvement regarding processes and working practices within the PHE, but no formal processes to act on their observations exist
- Unlike in ECDC's regular management meetings, PHE management documents and presentations, including not urgent ones, are delivered at or a few hours before the PHE management meeting not allowing time for proper preparation and reflection

Assets and capabilities

- ECDC has the relevant expertise to solve its tasks

- Too little staff to be able to simultaneously respond to all incoming requests, proactively own its agenda and uphold a satisfactory level of business continuity during a PHE
- The head of the Digital Transformation Services Unit is not participating in the PHE management meetings, resulting in lacking prerequisites to capture opportunities and potential improvements in the digital sphere
- With current rules, ECDC is not able to hire more statutory staff to manage COVID-19, even when they have surplus funds to do so
- Data reported from MS is often inconsistent, uncomplete, submitted late and quite often data sets are incomparable due to Member States changing their own surveillance processes. ECDC has no power to enforce Member States to improve data quality

Business continuity

- Ordinary tasks have, largely, been halted as key staff have moved over to the PHE and contractors have become unavailable
- A minimum level of business continuity must remain a priority even in face of a large scale crisis, as the negative effects of halting these may be serious
- The business continuity plan did not provide clear structures and prioritisation of which ordinary tasks need to continue and how to secure sufficient resources for these
- Staff without PHE training could not effectively perform their ordinary tasks, but were not moved to the PHE organisation either due to lack of PHE competencies

4.2.2.1. Findings from internal survey

The PHE plan has been perceived with mixed signals by internal stakeholders, although leaning slightly positive. The PHE structure is generally seen as somewhat ineffective and going through too many changes. However, some respondents believe that the structure changes that will be effective from 14th of September 2020 will provide more stability.

- 42 per cent of respondents agree that the PHE plan has been useful in preparing ECDC for a PHE, whilst 28 per cent disagree. 30 per cent neither agree nor disagree.

Only 26 per cent of respondents find the PHE organisational structure effective. Generally, business continuity has been perceived as being upheld quite well given the circumstances. However, certain units such as Disease Programmes, report having been less successful in maintaining business continuity due to personnel being occupied by the PHE. In order to improve business continuity, more personnel and clearer priority of (non-PHE) activities are suggested as improvement actions.

- 58 per cent of respondents answered somewhat or completely when asked how well their section within ECDC has managed to uphold business continuity during COVID-19
- However, within the Disease Programmes Unit, 63 per cent cited the opposite – that they were not able to uphold business continuity during COVID-19. When asked what the most important element to ensure improved business continuity of ordinary tasks would be, clearer prioritisation of key non-PHE activities was selected as the most important (35 per cent of respondents) and more personnel as the second most important (34 per cent of respondents)

As mentioned in previous chapters, increasing personnel, more specifically in the form of communications staff and different types of experts (such as epidemiological experts), are consistently suggested as one of the most important improvement areas by internal survey respondents.

- 36 per cent of respondents chose 'more personnel', when asked what the most important action would be to ensure more effective handling of PHE tasks.
- More funding is not suggested as a solution to problems within ECDC – instead emphasis should be on increasing staff and improving personnel allocation procedures: only 21 per cent of respondents thought ECDC currently had insufficient funds to fulfil its role

ECDC perceives itself internally as having an effective data collection and dissemination infrastructure to support PHE activities. Still, differences in reporting from the Member States are seen as impacting the quality of some data driven ECDC outputs.

47 per cent of respondents agree that ECDC is able to collect, use and disseminate necessary data during a PHE. The culture within the PHE is seen as action-oriented with a positive and supportive team spirit. However, at the same time, the atmosphere was also considered chaotic and stressful. Conversely, ECDC's overall culture is seen as very process-oriented, rigid and bureaucratic. Some internal stakeholders even describe it as non-people-centric.

- 60 per cent of respondents lean towards 'action-oriented and efficient' when indicating what the PHE culture and working norms are like.
- Conversely, 77 per cent of respondents lean more towards 'process-oriented and rigid' when describing ECDC's overall culture and working norms.

When asked to describe ECDC's culture during the PHE in three words, the most used words were quite positive, namely 'collaborative, team spirit and committed' – however, this was followed by more negative perceptions like 'chaotic and stressful'. ECDC's culture in general was mainly described using words such as 'process-oriented', 'non-people-centric' and bureaucratic', with few positive words.

Guidance and support from direct management, both within and outside the PHE, is (on average) considered effective by internal stakeholders.

Exhibit 2. Highlighting the most frequently used words to describe ECDC's and the PHE's culture in general

Culture during PHE

Culture in general

- 51 per cent of respondents answered effective or very effective when asked how effective the guidance and support are from their closest manager in the PHE
- For ECDC in general, 61 per cent of respondents answered effective or very effective on the same question

4.3. Observations

While the PHE plan has been helpful in organising the work in the initial phases of the pandemic, it was not well adapted to the scale and duration of the crisis – an additional PHE level might be needed to address more serious and longer pandemics.

The current structures have not provided sufficient guidance on how to prioritise activities, efficiently allocate resources and adapt working methods and processes to the varying needs of the situation.

A culture of scientific excellence, adherence to procedures and internal alignment may have impacted efficiency negatively in the context of a fast-moving crisis. PHE procedures and management that places a larger emphasis on efficient decision making and hard priorities and outputs may be beneficial.

Internal evaluations often identify shortcomings and opportunities for improvement for the PHE, spanning from more strategic and structural issues to highly operational matters, but there is a lack of follow-through with regards to implementation of their suggestions

The possibility of procuring external expertise could be used to meet the personnel demand, however, the process needs to be improved by stating clear requirements on what expertise is needed.

Processes for enabling flexibility in obtaining staff without long-term commitments, for example, through shorter secondments and/or with the possibility to work remotely could potentially be formulated to aid during a PHE.

With the current mandate and level of European harmonisation, improving data quality is difficult to achieve as it is the responsibility of the MS.

Building stronger modelling and forecasting capabilities may be a priority to be able to have a forward-looking view on development of the number of cases and to ensure stakeholders have the possibility to prepare for different scenarios ahead of time.

Creating greater incentives for MS to provide data in agreed formats, and within timely manner, should be a priority.

5. Learnings from international peers

In the following chapter, ECDC is benchmarked against similar international institutions active in the public health space..

It is important to acknowledge that ECDC is a unique institution in the public health space globally, and thus the benchmarked institutions below are not fully comparable to ECDC. There exist clear and crucial differences, such as the geographies they operate in, the context regarding both when and why they were established, their mandate and level of resources. Nevertheless, useful insights can be generated by comparing these institutions to ECDC according to a set of dimensions, and even more importantly, by reviewing the learnings that can be drawn from other CDCs' COVID-19 response so far.

To identify the main differences between ECDC and other CDCs/the WHO going forward, a description of the organisations based on a few key dimensions is outlined in this chapter. More so than its peers, ECDC is a risk assessor organisation only, whilst the other organisations to various degrees have the mandate to act as a risk manager – although some only in limited areas. This difference in mandate impacts the responsibilities and outputs expected by ECDC compared to the other actors. In addition, ECDC is solely focused on infectious diseases whilst other organisations also are responsible for non-infectious diseases. In terms of funding and staff, ECDC is significantly smaller compared to US CDC and the WHO, but quite significantly larger than ACDC. Further differences between the organisations are detailed on the next page.

Dimension	Mission and mandate	Funding	Staff	Coordination with stakeholders	PHE organisational set up
US CDC	Mainly risk assessor, some risk management Responsible for infectious and non-infectious diseases	USD ~12 billion (FY19)[7]	~11,200 FTEs[8]	Collaboration between government (federal and state), private sector and NGOs leveraging the National Incident Management System[8]	Emergency operations are divided in four branches: Emergency and Risk Communication; Logistics Support, Operations Branch; Plans, Training, Exercise and Evaluation[9]
ACDC	Risk assessor and manager Responsible for infectious and non-infectious diseases	USD ~20 million	~40 FTEs	RCCs coordinate regional public health initiatives among Member States with guidance from ACDC headquarters	Role of Emergency Preparedness and Response Department is to: develop preparedness and response plans for PHEs, support creation of national Public Health Emergency Operations Centres (PHEOC), establish and manage national and regional emergency stockpiles, and facilitate partnerships for multi-sectoral coordination
KDCA	Risk assessor and manager Responsible for infectious and non-infectious diseases[6]	USD ~500 million	~1,500 FTEs	Collaboration with National Institute of Health, regional centres for disease control and prevention and two national hospitals[6]	PHE organisation is divided into four major departments: Emergency Capacity Development, Risk Assessment, Epidemiological Investigation Analysis and Public Health Emergency Response Research[6]
WHO	Risk assessor and manager Responsible for infectious and non-infectious diseases	USD ~6 billion (budget FY21)	~7,000+ FTEs	World Health Association, composed of representatives from 194 Member States, serves as the WHO supreme decision-making body	PHE organisation is divided into two major departments – preparedness and response –that have smaller sub-departments who develop standardised approaches for readiness and response and assist regional offices in responding to emergencies
ECDC	Risk assessor Focus on infectious diseases only	EUR ~60 million (budget 2020)	~260 FTEs (Have allowance for 280, which was increased to 300 due to COVID-19)	Interaction with Member States leveraging expert and disease networks	PHE organisation is split into four groups: Technical, Emergency operating centre, Communication and Admin support, with a PHE manager running the PHE with continuous input from ECDC's Management Team

6 KDCA (2020): website, http://www.cdc.go.kr/cdc_eng/
7 US CDC (2020): Office of Financial Resources 2019 Fiscal Year Annual Report, https://www.cdc.gov/funding/documents/fy2019/fy-2019-ofr-annual-report-508.pdf
8 US CDC (2020): website, https://www.cdc.gov/
9 US CDC (2020): website, https://www.cdc.gov/

5.1. Dashboard analysis

During COVID-19, many public health institutes have made data on case numbers and the likes publicly available. These dashboards serve as important sources of information for scientists, practitioners and first and foremost the general public. The below is a summary of an evaluation of >100 COVID-19 dashboards led by Dionne S. Kringos, which was republished with her permission[10]. In addition, a further qualitative assessment of usability and user experience of selected dashboards has been conducted. Since the analysis was performed, several institutions, including ECDC, may have made edits to their published dashboards that fully or partly address the issues described below.

ECDC's dashboard convinces with the richness of information included: It covers international data, which can be broken down by 'sex' and 'age' as well as analysed on different levels (international, national and regional). The abundant data comes with a shortfall however, as the site is hard to navigate and often has troubles loading.

When comparing the features and information listed on the dashboards, the main difference lies in whether dashboards cover only national data or data on an international level. Otherwise, the information shown is similar across most dashboards, with some differences mainly within indicator themes and breakdowns. For indicator themes, the most commonly shown data is case spread and deaths, while some dashboards show additional information, like testing and hospital care. If a breakdown is available, it is often into categories like sex and age, and rarely other information such as comorbidities or mode of transmission. Some dashboards have a scope beyond epidemiological information and include information on infection control measures or social and economic implications, for example. The dashboards with a lot of information in addition to the traditionally reported data are usually dashboards with national data only, while dashboards showing international data are usually more limited regarding indicator themes and breakdowns.

For example, the only differences between the dashboards created by the WHO Europe and ECDC is firstly, the possibility to obtain regional information via an ECDC's dashboard while the WHO Europe's ends at the national level. Secondly, the indicators 'spread' and 'death' (which are the same for both dashboards) can be broken down by sex and age in ECDC's version, while this is not possible in the WHO's dashboard.

The main differentiation factor for dashboards is the usability/user experience, that is fitness for purpose and use. ECDC's dashboard is rather hard to navigate, partly due to the fact that it includes a lot of data which makes the dashboard slow to load. In addition, it lacks important information around variation in reported data (such as clear disclaimers) and interpretive text (including clarity on who the intended audience is). The WHO Europe's dashboard includes adequate explanations and descriptions to ensure the user understands the scope and use of the data. The US CDC's dashboard has one of the best user experiences based on its intuitiveness (it is easy to filter on individual states and different variables) and the automatic updates based on filters chosen by the user. In addition, it is aesthetically appealing and easy to navigate (if the users click on a state on the map, they get redirected to the state's official website).

The dashboard from Sledilnik Slovenia could serve as a source of inspiration for future improvements, as it stands out as a best-in-class example due to providing all

10 Kringos et al. (forthcoming 2020, under review):. Are COVID-19 dashboards fit for purpose and use? A review of the actionability of 158 public, web-based COVID-19 dashboards

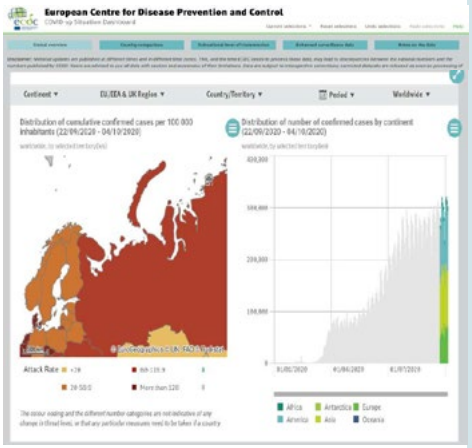
information a member of the general public might be interested in and, in contrast to other international dashboards, it shows a map of Europe with information on travel restrictions. Furthermore, the user can choose from displaying the absolute number of cases or cumulative rate per population by municipality.

Detailed screenshots and evaluation of the different dashboards:

ECDC's dashboard

European Centre for Disease control

https://qap.ecdc.europa.eu/public/extensions/COVID-19/COVID-19.html



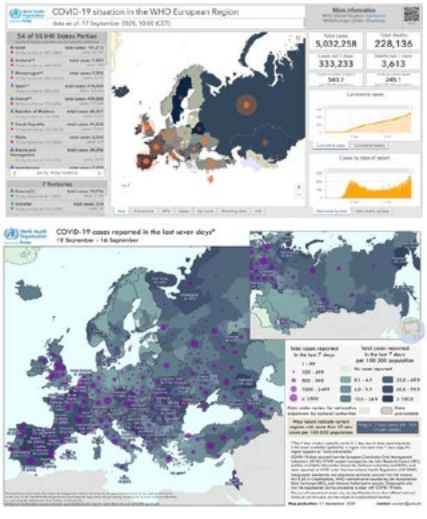
General	Level (country)	International
	Org (type)	European Centre for Disease Prevention and Control
	Language(s)	Only English
	Scope of info	Epi info
Why	Purpose of use	No
	User	No
What	Indicator themes	Spread and death
	Data sources	Yes, various countries and agencies
	Metadata	Yes
	Updates	Daily, stated explicitly
How	Time trend	By day, by week
	Levels of analysis	International, national, regional
	Breakdowns	Sex, age
	Display	Maps, graphs/charts, tables
	Interpretation	No
	Simplicity techniques	Use of colour coding, size variation
	Interactiveness	More information, change of information

Reviewer notes
This dashboard is hard to navigate, too much info in a narrow space, making it still hard to load no matter how good the internet connection is. For an international dashboard, it still lacks essential features (variation in reported data, interpretive text, diversified breakdowns, clarity of purpose and target users).

WHO Europe's dashboard

WHO Regional Office for Europe

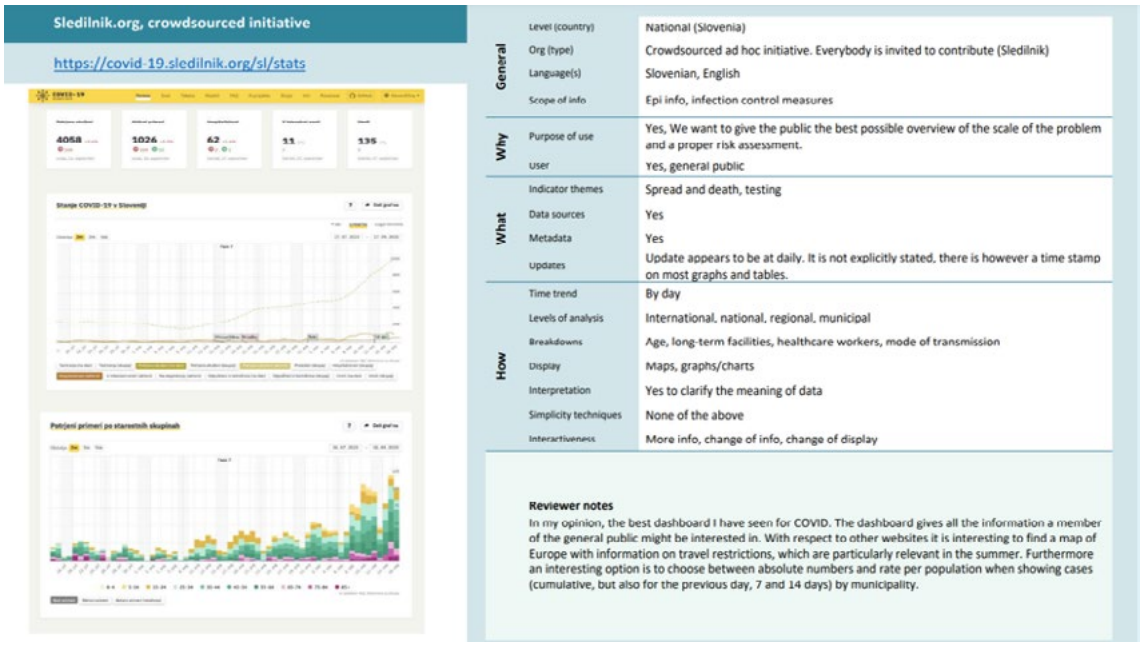
https://who.maps.arcgis.com/apps/opsdashboard/index.html#/ead3c6475654481ca51c248d52ab9c61



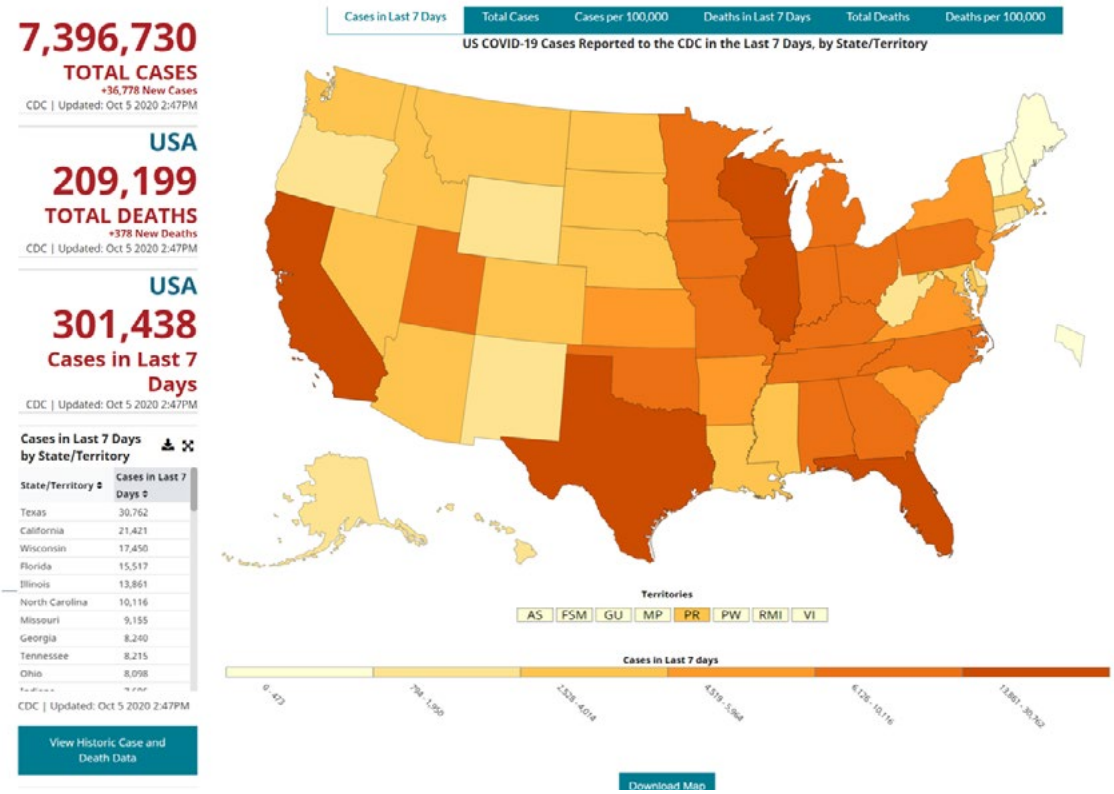
General	Level (country)	International
	Org (type)	WHO Regional Office for Europe (International org)
	Language(s)	English
	Scope of info	Epi
Why	Purpose of use	No
	User	No
What	Indicator themes	Spread and death
	Data sources	Yes
	Metadata	Yes
	Updates	Daily
How	Time trend	By day
	Levels of analysis	International, national
	Breakdowns	None
	Display	Maps, graphs, tables
	Interpretation	Yes, to clarify data quality, to clarify meaning
	Simplicity techniques	Colour coding, size variation
	Interactiveness	More info, change of info, change of display

Reviewer notes
Adequate explanations and descriptions to understand the scope of use of the data.
Adequate highlight of what is important in the numbers in most graphs (e.g. coloured incidence plateau)
Data downloads with further stratification (age/sex) not enabled, which would make it perfect.
But places too much emphasis on case count, etc. (as other dashboards) and falls short on policy implications, as could be expected from WHO.

Sledilnik's (Slovenia) dashboard



US CDC's dashboard



5.2. Timeline of key outputs

An analysis was conducted of the timeline of key outputs of ECDC and a selection of international global health institutes namely the WHO, US CDC, KCDA and ACDC. For the analysis, a set of key outputs from ECDC was selected and comparable outputs from peers identified. The publication of the identified outputs were subsequently visualised on a timeline for better overview.

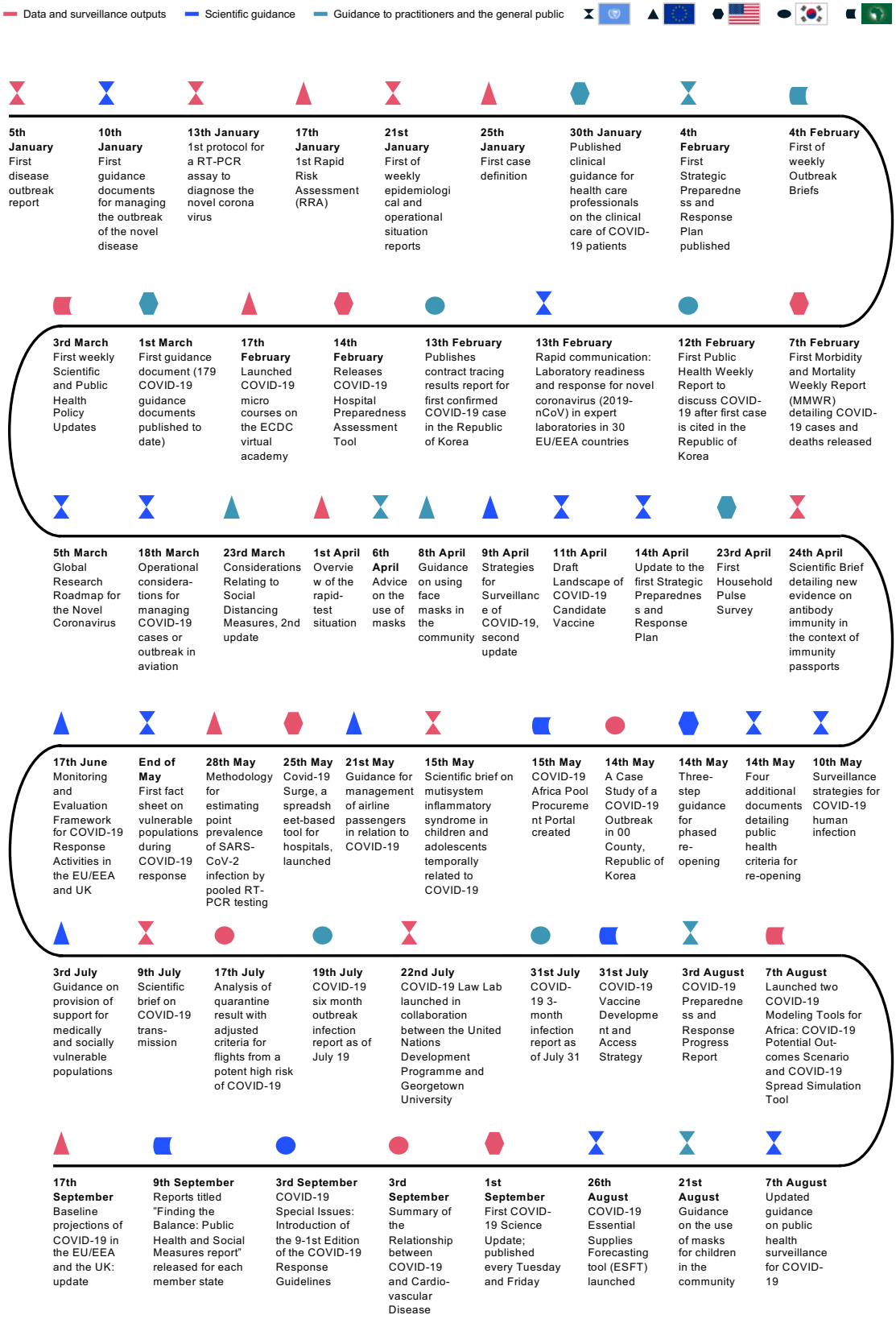
It is worth noting, that due to the large amount of documents published and differing report topics, categories and formats used by the different institutions, a direct comparison between fully comparable outputs is not possible in all instances. Therefore, the analysis and conclusions drawn based on the presented information should be read with some caution.

See exhibit 3 on next page

Looking at the key outputs listed in the timeline above, ECDC initiated their publication of outputs by mid-January whereas the WHO Europe published several COVID-19 related outputs during the first two weeks in January. Furthermore, on 10th January the WHO Europe published their first guidance document, that is, a document providing scientific guidance or guidance to practitioners and the general public, covering how to manage the outbreak of the disease. US CDC and ACDC published their first guidance documents on 30th January and 4th February respectively. ECDC published their first scientific guidance, which covered PPE needs in healthcare settings, on 7th February.

As an example of comparable outputs, a document covering operational considerations for managing COVID-19 cases or outbreak in aviation was released by the WHO Europe on 18th March. A guidance document for management of airline passengers in relation to COVID-19 was published almost two months later by ECDC, on 21st May. Furthermore, the WHO Europe published advice on the use of face masks on 6th April. ECDC published a document on a similar topic, namely, guidance on using face masks in the community, two days later. Strategies for surveillance of the pandemic were published by ECDC on 9th April, whereas the WHO Europe came out with updates on their surveillance strategies every month between May and July. Additionally, on 3rd July ECDC published guidance on provision of support for medically and socially vulnerable populations, whereas the WHO Europe issued their first fact sheet on vulnerable populations in May, approximately one month earlier than ECDC.

Exhibit 3. Timeline of key outputs published by ECDC, WHO, US CDC, KDCA and ACDC.



5.3. Learnings from comparable institutions

Despite the structural differences between ECDC and its peers as presented in the benchmarking of the 'starting point', each CDC has emerged from the COVID-19 crisis with some key learnings. Some of the most important learnings for ECDC from other CDCs have been identified by conducting expert interviews and a press search analysis and are presented below for the US CDC, ACDC and KDCA.

5.3.1. Africa CDC

Africa's CDC (ACDC) is a young organisation, founded in 2017. Their funding mostly stems from voluntary donations and amounts to a yearly operational budget of approximately USD 20 million. Thus, ACDC was perhaps not fully equipped to handle a crisis like COVID-19, especially given the operational role it had to play to support countries with weak national public health systems. Part of their response was establishing the 'Africa Joint Continental Strategy for COVID-19' together with the African Union COVID-19 Response Fund. Through the response fund, ACDC aimed to raise additional funding for the procurement of medical supplies or deployment of rapid responders, to name a few.

More broadly, ACDC's response included several best practices that can be of inspiration for ECDC.

First and foremost, ACDC's experts anticipated early on that COVID-19 would hit the continent severely. This early foresight was made possible by ACDC strong international collaborations which provided them with timely first-hand information. The close collaboration was enabled by the likes of a few employees from the China CDC who are currently seconded to the ACDC. This set-up with secondees to/from other international CDCs should be considered by ECDC in the future to ensure first-hand information about public health events early on.

Building on the early foresight, ACDC convened a set of regional trainings in January and February before COVID-19 even reached the continent at scale. The trainings covered different topics, such as basics of infection prevention and control and how to carry out a COVID-19 test. These trainings provided countries' experts and healthcare personnel with important hands-on skills for handling pandemics. In large PHEs, European countries could benefit from ECDC convening similar preparatory trainings/learnings very early in a similar fashion as the ACDC, while the exact content of the trainings should be tailored towards the needs of the EU countries.

Lastly, ACDC was aware of the importance that their outputs and recommendations were easily interpretable, not only by the scientific community, but also by policymakers. To ensure this, ACDC sourced temporary external help that supported with the translation of the scientific outputs into simple guidance that heads of states were able to act on. This showcases one possibility of how ECDC, too, could make sure that their recommendations are well received and understood by all relevant stakeholders.

5.3.2. Korea DCA

The Korea Disease Control and Prevention Agency (KDCA) made important learnings from its handling of the MERS outbreak in 2015. Since then, Korea has been working hard to strengthen its infectious disease surveillance and response capacity and during COVID-19, they have been considered successful in containing the virus early on. KDCA have several success factors that ECDC potentially could learn from.

KDCA has, through assignment from the government, taken on a risk manager role

through assisting with prevention, containment, on-site response, treatments and quarantine measures. They have been heavily involved in developing fast procedures for testing, which has allowed rapid case identification and isolation without requiring far-reaching mobility restrictions or business closures. Furthermore, they have been equipped with additional staffing and training capacities, especially related to epidemiology expertise, which have allowed them to better handle the increased workloads stemming from the pandemic. This has also allowed them to, in collaboration with the Korea International Cooperation Agency, work on infectious disease-related projects as part of the country's contribution to the global public health agenda.

Moreover, KDCA has had good coordination with external stakeholders such as provincial and municipal governments and specialised hospitals, for which subnational centres for epidemic countermeasures have been set up to coordinate with central authorities. This has led to public and private stakeholders working together to improve global health even further, including the World Bank Group as it rolls out its USD 14 billion facility to help developing countries deal with the COVID-19 crisis and build capacity for the response to future crises[11].

5.3.3. US CDC

Similar to ECDC, the US CDC leads the data gathering across the different states and creates regular surveillance outputs by trying to streamline and harmonise the data received. The US CDC also publishes technical reports and guidance for policymakers and practitioners. In addition to its mandate as a risk assessor, the US CDC is also responsible for parts of the risk management, such as keeping stockpiles and allocating scarce supplies.

One of the challenges encountered by the US CDC includes the relationship between the CDC and the states; as states have their own jurisdictions – similar to the situation in the EU – which made it difficult for the US CDC to enforce their recommendations. It also created challenges in data harmonisation as states had different reporting standards. Additionally, in a fast-moving crisis like COVID-19, it was not clear to stakeholders which actions and outputs were to be expected from the US CDC and what the timeline looked like.

In this context, the learning for the US CDC – which is transferable to ECDC – is to set the expectations on their emergency response by developing a clear plan during peacetime shared with key stakeholders. This plan can be leveraged and referred to during a PHE. This plan should detail a CDC's activities and outputs: (a) within the first 30 days (including a clear case definition coordinated with key stakeholders) and (b) the first 90 days (including an evaluation of the introduced response measures) after an outbreak. Such a plan is aimed to ensure that a CDC can shape its own agenda and respond in a strategic and proactive way, while managing stakeholder expectations proactively.

5.4. Potential learnings

As described earlier, there are considerable differences between ECDC, ACDC, KDCA, US CDC and WHO and each of these institutions has a very different starting point. Despite these differences, the experience of the response from other institutions raises a number of issues and potential avenues for ECDC to explore further, by (to a yet larger extent):

- COVID-19 dashboards: apart from the information displayed in the dashboard, improving usability and user experience, better describing and interpreting the data, and better describing data gaps and comparability issues

- Anticipation: gathering intelligence on international outbreaks early on by leveraging close-knit collaboration networks; and taking action accordingly based on what is helpful for stakeholders
- Actionability: ensuring that all audiences understand guidance documents; considering hiring temporary external help in case in-house “translation”-expertise is missing
- Collaboration: acting as a convenor of different types of stakeholders, such as representatives from national/regional/ municipal levels as well as private and public stakeholders
- Expectation management: developing a clear plan during peacetime which is shared with key stakeholders and referred to during a PHE; this plan could detail a CDC’s activities and outputs (a) within the first 30 days and (b) the first 90 days after an outbreak

6. The way forward: recommendations for strengthening ECDC's PHE response

ECDC has through the COVID-19 pandemic, been thrust into the spotlight, receiving more attention than ever since becoming operational in 2005. This spotlight has provided the unique opportunity for ECDC and the EU to gather invaluable feedback presented in the sections above from the many stakeholders impacted by ECDC's work and response to COVID-19. Below, we utilise these important learnings from stakeholders and the internal organisational assessment to identify key areas of strengths and potential improvement areas. It should be noted that, since the assessment and conclusions have focused on ECDC's operations in response to COVID-19, the recommendations primarily apply to crisis response in a PHE. Nevertheless, many initiatives should be of general relevance, and could serve to improve ECDC's effectiveness in peacetime as well.

In the following sections, we first highlight ECDC's key strengths (the 'keep-as-is'); then we describe potential improvement areas, as well as the corresponding recommended actions on 'how' ECDC could potentially realise these improvements. These sections are all categorised into the five key topics presented in the introduction chapter: (1) PHE response, including surveillance, (2) PHE planning, preparedness and internal organisation, (3) assets and capabilities, (4) collaboration and coordination with stakeholders and (5) mandate and scope.

Finally, potential longer-term options that should increase the effectiveness of the European PHE response are also presented. These options are presented separately, as they would require system-level considerations outside of ECDC's control.

6.1. Strengths to maintain and develop

Since the beginning of the COVID-19 pandemic, ECDC have been put to the test. The organisation has experienced major challenges and has had to adapt significantly to face the crisis. While it is important for an organisation to stay flexible and adapt to changing circumstances, it is equally important for it to remember and retain its core strengths. As this report highlights improvement areas for ECDC, the numerous strengths the organisation has exhibited must not be forgotten. Therefore, this chapter highlights several key strengths ECDC should maintain and develop even further to handle a future crisis even better.

Overall perception
ECDC is a very well-respected agency that is trusted among their stakeholders on all levels: national (Member States), European (EU institutions and agencies), international (the WHO). ECDC's strong scientific foundation is one of the key reasons behind its credibility – for example, one Member State stakeholder suggested that ECDC's advice is the 'gold standard of guidelines'. Several other stakeholders suggested that policy suggestions based on ECDC outputs are much more credible compared to suggestions that are not.

Guidance and outputs
Many stakeholders highly value the guidance and outputs from ECDC due to its high quality and scientific robustness. Guidance is consistently considered relevant to the ongoing circumstances. ECDC outputs are tailored well to the more scientific audience and are generally received very positively. Many stakeholders, mainly smaller Member States that lack internal resources, rely heavily on ECDC's guidance and tend to use their outputs as a foundation for policymaking. ECDC's guidance during peacetime, consisting mainly of preparedness planning and training, has also been received positively by some Member States.

Surveillance data
One of ECDC's core strengths is its surveillance data. Different types of stakeholders, ranging from small Member States to large international institutions, consistently use this data and insights generated by it. Although there are some limitations due to non-harmonised data gathering and reporting by Member States, ECDC's data is considered reliable and of high quality. In addition, many internal stakeholders describe ECDC's intelligence infrastructure as very capable of intelligence gathering worldwide. This strength could, however, be developed even further; many stakeholders mention that the user friendliness of the data outputs could be improved and disclaimers on possible harmonisation gaps are lacking. This is discussed further in the following chapters.

Networks and collaboration
ECDC's role as a facilitator and platform for knowledge exchange between stakeholders is highly appreciated, by the Advisory Forum in particular. Some external stakeholders even go as far as to say that networks facilitated by ECDC are as beneficial for Member States as ECDC's own output. In addition, many Member States have described their interaction and cooperation with ECDC as very helpful and effective. ECDC have found a good balance between cooperation and 'hands-off' interactions, allowing Member States to focus their time on value-adding activities. This strength could be improved further by aligning even more with MS, setting up ad-hoc processes for urgent questions of common interests and potentially arranging even more frequent meetings that enable knowledge exchange between stakeholders. Development suggestions regarding ECDC's network and collaboration are discussed even further in the following chapters. Collaboration with the WHO has also been perceived largely positively, especially with regard to data collection and communication, where ECDC has effectively acted as a joint interface for both organisations.

Internal management
Management guidance and support is appreciated by internal stakeholders. Both PHE and non-PHE colleagues find guidance and support from their closest management effective, given the circumstances. This strength could be further improved by developing clear decision making within the PHE at each level. Again, this is further discussed in the coming chapters.

PHE organisation and processes
ECDC has effectively been able to adapt to the extreme circumstances during the pandemic – showing strong resilience and flexibility in the organisation. The alert levels within the PHE were successfully adjusted and capacity rapidly increased. The atmosphere and culture within the PHE are generally perceived as collaborative with a good team spirit, where everyone is willing to go the extra mile for a colleague. While this culture description is not mentioned outside of the PHE, it is an important strength to highlight. In addition, the recently implemented Support Groups have been perceived positively, allowing for better collaboration and prioritisation due to the increase in overall request handling capacity and longer planning horizons.

Capabilities and expertise
Experts from ECDC are considered very knowledgeable and have deep expertise, specifically in the fields of epidemiology and microbiology. Colleagues at ECDC are considered very committed and hard-working. However, adding expertise in other fields (such as political and behavioural science) would further improve this. This is also discussed in the following chapters.

6.2. Potential improvement measures – how to achieve the envisioned future state

Building on these underlying strengths, and acting on the learnings, feedback and suggestions that have been put forward during the evaluation, there are several areas where ECDC could review its practices and organisation, in the short and medium term, to respond to a PHE even more effectively. Some of these areas could be addressed immediately, to strengthen ECDC's continued work in the context of COVID-19, whereas others may require structural and organisational changes or additional resources and a longer implementation process. They cannot be implemented all at the same time, but should, as a next step, be prioritized based on the expected impact, and the feasibility of execution in the near term. In that context, ECDC should carry out a deeper analysis of the organisational and resource requirements for each initiative, and add further detail to the practical implementation of those initiatives that are prioritized.

The recommended actions and initiatives aim to enable a desired end state, whereby:

PHE response (including Surveillance)
- Outputs are actionable and easy to interpret
- Outputs are timely and adapted to the needs of the requester
- ECDC's activities and outputs are guided by a proactively defined agenda and forward-looking approach
- Internal resources and expert's time is used efficiently, especially in times of urgency and resource shortage
- The decision-making guidelines are clear within the PHE at each level, that is, it is clear which decisions can be made by PHE managers and/or group heads, and which decisions need to go to the Management Team
- Country responses are systematically assessed and learnings disseminated
- ECDC provides effective response support to Member States and contributes to cross-country learnings

PHE preparedness, organisation and processes

- ECDC's PHE plans are adapted to effectively handle emergencies of different severities and durations
- There is an appropriate balance between continuity of strategic positions and rotation of the high workload-response roles within the PHE
- ECDC effectively uses peacetime to ensure preparedness of Member States
- ECDC has an effective business continuity plan in place for future PHEs of varying durations
- ECDC's PHE structure includes the necessary horizontal functions (such as administration, communication, digital transformation and international relations) in an efficient manner
- ECDC effectively identifies issues and/or improvement potential within the PHE and ensures follow-through on implementation of remediation measures

Assets and capabilities

- ECDC has best-in-class modelling and forecasting capabilities to better develop potential scenarios and risks for stakeholders in a timely and more detailed manner; also covering medium- and long-term scenarios
- ECDC receives data in a more harmonised and timely manner from Member States
- ECDC has more personnel to draw upon during a PHE, in flexible and timely manner (such as, an emergency response workforce)
- All ECDC staff are PHE trained to transition into the PHE organisation as needed
- ECDC has a broader pool of cross-functional expertise that enables them to build more effective system-level perspectives on public health and PHE responses

Collaboration and coordination with stakeholders

- ECDC's Advisory Forum and expert networks are used as effective tools for ad-hoc problem-solving of prioritised issues of common interest
- ECDC is viewed by its stakeholders as a transparent organisation, that makes its information and priorities easily accessible
- ECDC's role within the EU landscape is well defined and its unique purpose understood clearly
- ECDC has strong ties to, and good knowledge of, the health system in each Member State
- ECDC coordinates European collaboration on building a scientific fact base to: (1) enable a more complete overview of scientific findings and (2) reduce overlaps and the duplication of work in Europe
- ECDC has an independent, strong voice and position, coordinated with the WHO, but not bound or delayed by WHO coordination
- ECDC further strengthens cooperation with global and international partners including in particular the WHO and other CDCs to ensure strong global intelligence on emerging health threats and during global crises

Mandate and scope of ECDC

There is clarity of ECDC's role in supporting the coordination of national response measures, whereby ECDC's existing mandate enables a more direct and larger role in supporting the Member States, European institutions and agencies.

Below, initiatives and changes are described that could contribute to achieving each of these objectives.

6.2.1.PHE response (including Surveillance)

Today, ECDC is known for offering a solid fact base of technical and scientific advice tailored to an audience with a scientific background (for example the public health community). While being scientifically robust, outputs and opinions are put forward late at the expense of proactively guiding policies and reducing unclarity. For future crises, stakeholders expect ECDC to guide the agenda of what scientific advice Europe needs, that means anticipating knowledge needs ahead of critical points in time, liaising with the European Commission and boldly prioritising these over reactive responses to incoming requests. Stakeholders further need outputs tailored to various audiences' needs, with a higher degree of 'so what's' and in a more timely manner. In addition, stakeholders expect ECDC to take a larger role in collating practices from Member States, and sharing outputs that draw learnings from these. To enable such a proactive strategy to scientific outputs, ECDC needs to reconsider its working practices; moving from an organisation that largely operates reactively and is fully consumed by incoming requests to clear prioritisation and scoping of tasks and agile practices to speed up decision making and mitigate bottlenecks. Finally, stakeholders (especially hard-hit countries during a PHE) would benefit from a closer operational linkage to ECDC, with potential task forces being deployed to select countries to advise more closely.

Outputs are actionable and easy to interpret

To ensure that outputs are more action-oriented and directly support decision making in the European Commission or in MS, ECDC could place a larger emphasis on practicality of outputs, by:

- Adapting research/response processes to the expressed needs of requestor
- When relevant, drawing more on the capabilities of the requestors and expert networks when creating outputs, such as by convening small ad-hoc (external) working groups to solve issues directly in a knowledge-sharing workshop
- Giving recommendations explaining caveats, shortcomings and needs for contextualisation/local adaption (rather than refraining from recommendations due to these caveats)
- Clear and consistent communication from management that practicality is a priority equal to scientific excellence
- Considering developing recommendations that are specific to certain groups of countries, regions or stakeholders with common special characteristics, such as islands, smaller countries, federal versus centralised countries and countries relying heavily on travel and transport

Furthermore, ECDC can create an easy to understand and actionably oriented 'so what' synthesis at the beginning of important documents that is easily understood by the relevant audience (including decision makers without technical expertise). To this end, ECDC could involve communication expert(s) from early on in the production of outputs, to assure interpretability of the broader audience.

Outputs are timely and adapted to the needs of the requester

To ensure outputs are timely and adapted to the needs of the requestor, ECDC could:

- Develop guidelines and processes for scoping of all incoming requests (such as adapting the outputs to requestors' needs), including a clear view on the nature and format of desired outputs and an understanding of how the outputs will be used through adapting lean processes, such as assessing process efficiencies and

assigning the right competencies to the right priority level of requests

- Define and apply different response approaches depending on the nature of request and needs of requestor – for example, when relevant and helpful, employ a multistep approach (day 1 answer based on best available evidence – including which knowledge gaps remain - updated with 1-week answer, finalised with 3-week scientific report); ad-hoc expert workshop; referral to other sources or previous responses
- Create guidelines and process for triaging and prioritising requests, based on relevance, and alignment with overall strategic agenda agreed upon with the European Commission (see also below)
- Increase the decision-making mandate of the PHE manager role, after reviewing the selection criteria of the role and/or increasing the seniority level of the person(s) responsible for defining and ensuring adherence to the priority levels of each request/activity

ECDC's activities and outputs are guided by a proactively defined agenda and forward-looking approach

Better prioritisation and clear processes for resource allocation to tasks will free up resources, which could be used for more proactive agenda setting – a more proactive approach in turn supports prioritisation and resource allocation.

- Create and solidify the strategic agenda of the PHE regularly, in dialogue with the European Commission, to enable better prioritisation and triaging of requests
- Ensure that the appropriate seniority level is present at these meetings from both ECDC and the European Commission

Strengthen and solidify the role of the strategic analyst by:

- Ensuring continuity by evolving the Strategic Analyst position to a permanent more senior Strategic Lead position, supported by additional rotating Strategic Analyst(s)
- Co-creating the strategic agenda and reviewing the approach and interim findings regularly with the Management Team
- Developing guidelines and a process for how to incorporate the output from strategic analysts into the workflow of the PHE (for example, by assigning a dedicated team)
- Clearly defining the responsibilities and who the strategic analyst reports to by determining where in the PHE organisation structure the role fits

Internal resources and experts' time are used efficiently, especially in times of urgency and resource shortage

Develop and apply guidelines for resource and time allocation of staff, based on the effort needed (scope and approach), priority and urgency of the task, and apply agile best practices (such as quick daily stand-up meetings where daily targets and bottlenecks are defined and staffing an agile coach)

Free up resources through a larger share of fast, focused answers in the mix of response approaches

Ensure that personnel do not take on additional tasks without being assigned through the proper channels (such as by the PHE manager or group head)

Consider tracking resource allocation per task to assess efficiency and time requirements for tasks, specifically for larger requests from external requestors (such as the European Commission)

The decision-making guidelines are clear

within the PHE at each level, that is, it is clear which decisions can be made by PHE managers and/or group heads, and which decisions need to go to the Management Team

Develop guidelines and clear criteria of which decision types are tackled at which level of the PHE organisation, for example, which decisions are needed to be taken at management level versus by PHE manager and/or unit heads

Country responses are systematically assessed and learnings disseminated

Define a new regular output (similar to RRA), a systematic analysis of the approaches Member States are undertaking on various prioritised topics (such as mask wearing) and extract learnings for other Member States

ECDC provides effective response support to Member States and contributes to cross-country learnings

On invitation, deploy task forces in select countries to improve overall risk assessment and ensure learnings on operational response, for example:

- Senior experts who support national management as sparring partner, building on understanding of local context and international best practices,
- Experts who facilitate gathering and interpreting international data and learnings,
- Experts who locally monitor and collect learnings for further dissemination across Europe.

6.2.2. PHE preparedness, organisation and processes

ECDC's current PHE plan is adapted to three levels of severity of a public health crisis, but lacks the dimension of time. As a result, the current PHE plan, operating at maximum capacity, becomes too intense to sustain for the organisation (such as taking employee health into consideration) and prevents effective decision making outside of the normal hierarchical line of the organisation. A future PHE plan, including a new PHE level which is operated more in line with business as usual, is required to sustain operations over a long period of time. In addition, the PHE is currently evaluated continuously by internal evaluators, but their conclusions and recommendations have so far mostly been overlooked. Looking ahead, this role needs be strengthened by, for example, assigning a senior sponsor to ensure that the PHE is effectively improved continuously and learnings captured.

Business continuity planning needs to be ensured, for example, through defining the sufficient activities (in coordination with key stakeholders), resourcing and competence to sustain other critical functions even in a PHE. Finally, stakeholders look towards ECDC to reinforce their guidelines for Member States preparedness, to ensure that these are clearly understood and ideally followed by Member States.

ECDC's PHE plans are adapted to effectively handle emergencies of different severities and durations

Develop a PHE plan to differentiate not only between PHE levels but also different scenarios of crisis depth and length, adapting procedures and the organisation to the nature of the PHE

Consider integrating PHE functions into the 'ordinary' organisation in a lengthy and large-scale PHE (like COVID-19)

There is an appropriate balance between continuity of strategic positions and rotation of the high workload-response roles within the PHE

Identify the strategic decision-making roles that benefit from long-term perspective and continuity – this could include, for example, evolving the strategic analyst position to a

permanent more senior strategic lead position and/or reducing the rotation on the PHE manager role

ECDC effectively uses peacetime to ensure preparedness of Member States
ECDC establishes and follows up on guidelines more regularly for recommendations of planning and preparedness which each MS should be guided by

Based on strong local ties with, and knowledge of each MS, including potentially a local presence (e.g. through secondments or other temporary setup, see below under collaboration) support MS in setting up the preparedness measures

ECDC has an effective business continuity plan in place for future PHEs of varying durations
Align with key stakeholders (such as the European Commission and MS) on what the exact key 'regular' activities are that must be kept up and running during a PHE (per PHE level) and codify into a new business continuity plan

Clearly identify the minimum level of resources (per type of personnel) needed to uphold these 'regular' activities for each Unit/Section through, for example, establishing a score card for effectiveness of business continuity using a weekly pulse tracker or other KPI

ECDC's PHE structure includes the necessary horizontal functions (such as administration, communication, digital transformation and international relations) in an efficient manner
Nominate a representative for administration, digital transformation and international relations in the PHEMT group with the objective of simplifying two-way communication between the PHE decision makers and these horizontal functions

Establish a communication channel between the PHE manager and the respective horizontal functions in order to assure coordination of activities at operational level and liaise with them and involve them in meetings and discussions relevant to their areas of competence

ECDC effectively identifies issues and/or improvement potential within the PHE and ensures follow-through on implementation of remediation measures
Strengthen and solidify the role and structures of the Internal Evaluator by:

- Clarifying the role and the responsibilities (for example, by writing a clearer role description)
- Assigning a clear sponsor from the Management Team who meets with the internal evaluator on a fixed, regular basis to discuss and decide on which initiatives are to be prioritised, and potentially, whom to assign
- Making sure there is always a team of internal evaluators, complementing each other with different areas of expertise and experience (not all active within the PHE at all times, but rotating in and out)
- Creating a continuously updated progress document and/or tool to transparently track ongoing initiatives including their completion
- Ensuring actions and initiatives stemming from internal evaluations are always clear and measurable, to enable efficient tracking of progress

6.2.3. Assets and capabilities

During COVID-19, ECDC has deployed most PHE-trained staff on tasks related to the ongoing pandemic. This has lead to a lack of resources and competences to sustain both the ongoing PHE and non-PHE activities. For the future, scalable processes for both resources and competence in terms of emergency are required, such as, creating an emergency response workforce (possibly through

secondments), training all staff at ECDC to operate in PHE and broadening the recruitment of profiles beyond epidemiologists. In addition, stakeholders are asking for strengthened data practices and modelling capabilities since this is not available today, such as, taking a larger role in harmonising collected data, improving breadth and usability of data outputs, and building a broader set of capabilities, including stronger forecasting and modelling skills to support Member States and other EU institutions lacking their own capabilities.

ECDC has best-in-class modelling and forecasting capabilities to better develop potential scenarios and risks to stakeholders in a timely and more detailed manner; also covering medium- and long-term scenarios
Build strong ECDC modelling and forecasting capabilities, by either:

- Recruiting and building in-house capabilities
- Establishing permanent partnerships with leading external institutes or providers
- Creating, together with the MS, a process for capability sharing between MS, based on existing national capabilities and ensure sharing of best practices – MS can potentially conduct analyses on European data (collected and disseminated by ECDC) with national resources

ECDC receives data in a more harmonised and timely manner from Member States
Within the current mandate, there are opportunities to incentivise Member States to further adhere to standardisation standards set by ECDC:

- Prioritise very early and be more proactive in defining common standards and definitions across Member States at the beginning of a crisis (for example, during COVID-19: case definition)
- Improve data reporting and usability of data outputs to Member States to incentivise them into wanting to share data with ECDC in a standardised and timely manner
- Hire competencies to focus solely on aiding MS in their data gathering and reporting?

ECDC has more personnel to draw upon during a PHE, in flexible and timely manner (such as, an emergency response workforce)
Create processes for enabling, during a PHE, flexibility in obtaining staff without long-term commitments, for example and when possible, through shorter secondments and/or with the possibility to work remotely

All ECDC staff are PHE trained to transition into the PHE organisation as needed
Set up regular and mandatory PHE trainings for all staff members

ECDC has a broader pool of cross-functional expertise that enables them to build more effective system-level perspectives on public health and PHE responses
Broaden the body of ECDC's competencies and capabilities to include different expertise from, for example, behavioural science, crisis management, economics, political science and systems engineering

6.2.4. Collaboration and coordination with stakeholders

Stakeholders in the European landscape look to ECDC as the voice of the European Union on matters relating to communicable diseases and as the key convenor of networks on the topic. Experts in MS public health institutions look to ECDC for data, information, networks and guidance on matters of European interest. However, ECDC's role within the EU landscape is still not fully clear to everyone. Stakeholders

expect ECDC to take a clear stance on its role in the European landscape (versus Member States and other EU institutions and agencies, such as the JRC of the Commission) and dare to take a position themselves if time doesn't allow for alignment with other international institutions (such as the WHO). Coordination and alignment with the WHO should continue to be the ambition, but not hinder a timely response. In such cases, alignment can be found at later stages as the fact base emerges.

Stakeholders are also looking for ECDC to boldly own the agenda of events versus Member States and actively/transparently disseminate local or international learnings within the EU community through its various channels. Member States also clearly indicate a willingness for ECDC to strengthen even further the expert networks within the union to more effectively facilitate the exchange of knowledge and experiences, but to also allow Member States to potentially influence the EU-response agenda.

ECDC's Advisory Forum and expert networks are used as effective tools for ad-hoc problem solving of prioritised issues of common interest

Align with MS, and set up processes for ad-hoc management of urgent questions of common interest – such as the exchange of experiences or recommendations related to a request – including in smaller regional or topical constellations

Potentially arrange more frequent meetings to enable sharing of learnings and best practices as well as debating priorities; also to increase visibility of ECDC

Ensure that input from these meetings are effectively incorporated into the PHE workflow (the pool of tasks) and prioritised relative to other work

ECDC is viewed by its stakeholders as a transparent organisation, that makes its information and priorities easily accessible

Build, maintain and publish FAQs for all stakeholders, that is a list of questions asked, by whom, and whether an answer has been found

Publish request answers and outputs not only for the requestor, but for all stakeholders/expert networks

Transparently share on-line and/or through regular updates to stakeholders what outputs are being worked on, and which priorities are being focused on with an expected timeline of when which activity will be finished

ECDC's role within the EU landscape is well defined and its unique purpose understood clearly

Clarify and codify the boundaries, working mode and collaboration between other similar organisations (such as JRC)

Establish closer collaborations with agencies/ institutions whose areas are usually affected by public health topics

Set up processes during peacetime on how to collaborate with the other agencies' partner DG for remaining agencies/institutions, who don't have a natural connection to public health

ECDC has strong local ties to, and good knowledge of, the health system in each Member State

Establish dedicated country contacts in every MS both during peacetime and crises, who monitor and build knowledge about the local system

Potentially establish local presence in MS, during peacetime and crisis, for example through extended country missions or secondments to national institutions

ECDC coordinates European collaboration on building a scientific fact base to: (1) enable a more complete overview of scientific findings and (2) reduce overlaps and the duplication of work in Europe

Coordinate with MS on activities which make sense to split responsibilities across countries and ECDC; for example, divide topics for literature review not only between ECDC experts, but share the burden with MS experts as well

ECDC has an independent, strong voice and position, coordinated with the WHO, but not bound or delayed by WHO coordination

Position ECDC as a European shared asset and strong entity, which represents the European interest and perspective at all times

Collaborate and coordinate with the WHO and other international organisations, but take independent line if contradictions arise

When needed, prioritise speed and accuracy before alignment with the WHO

ECDC further strengthens cooperation with global and international partners including in particular the WHO and other CDCs) to ensure strong global intelligence on emerging health threats and during global crises

Coordinate more with the WHO and other CDCs on gathering the International perspective for dissemination to Member States; for example, collaborate on global data collection on similar datapoints that are collected within MS

6.2.5. Mandate and scope of ECDC

At the moment ECDC interprets its mandate narrowly and defines outputs with the same rigour as for its responsibilities. Still, many stakeholders see room for wider interpretation of ECDC's responsibility in the short term during an ongoing crisis and bold decisions regarding which activities might be helpful to Member States; this includes increasing breadth of data collected (for example, including health system indicators) and making clear and actionable recommendations on scientific advice. In the medium term, some stakeholders would also welcome an expansion of ECDC's mandate in discussion with co-legislators to include, for example, an explicit differentiation of mandate in peacetime versus emergency and a broadened role in both recommendations and data collection. In the longer term, the European Commission and Member States should also consider the role of ECDC in the broader sense; and its role to assess risks and support the most effective possible risk management at the European level.

There is clarity of ECDC's role in supporting the coordination of management of national response measures whereby ECDC's interpretation of its existing mandate enables a more direct and larger role in supporting the Member States, European Commission and other stakeholders institutions and agencies

- Set new guidelines at management level, and communicate a broader interpretation of the mandate to the whole organisation, including a shift towards giving direct recommendations when requested and relevant, and monitoring health system level indicators (such as hospital capacities and Member State activities) where possible
- Broaden monitoring and surveillance beyond the current activities, for example, by monitoring the roll-out and following up on vaccination
- Set guidelines to assess incoming requests and proactively identified topics based on relevance to PHE response rather than on alignment with mandate as defined narrowly

6.3. Long-term options for a more effective European PHE response system

Further to the recommendations and considerations outlined above, several larger, systemic questions and ideas have surfaced during this evaluation and stakeholder consultation. These relate to potential initiatives and changes beyond the control of ECDC or the European Commission, but must be part of a longer-term dialogue between European institutions, the Member States and other stakeholders in the public health landscape, including the WHO.

On this systemic level, European stakeholders need to address a broad set of questions related to how their response to PHEs should be designed; based on what preparedness, what organisational structures and what division of responsibilities is required. It is clear that in the COVID-19 pandemic, European countries' responses were only coordinated to a limited degree, and that outcomes varied between different regions. The level of preparedness, and the resources available for responding effectively, also varied largely. It has been voiced by many stakeholders, both internally and externally, that a higher degree of European coordination, in areas ranging from data collection to border controls and clinical treatment recommendations, could have contributed to a more effective response to the pandemic. However, the need for locally defined and adjusted responses has also been a common theme. It is ultimately a matter of political choice whether a higher level of coordination – both for peacetime preparedness and pandemic response – is desirable.

Whatever the outcome of such a political process, there would be implications on the mandate and responsibilities of ECDC, and the resources and capabilities the organisation would need to be equipped with to effectively carry our these responsibilities.

A medium-term dialogue on adjustments of ECDC's mandate, based on the learnings of COVID-19, could include questions on:

- An explicit differentiation of ECDC's responsibilities – and assets linked to these – in peacetime and in emergencies
- A broader role in risk management during a PHE and mandate to issue direct action-oriented recommendations (which may potentially influence policymaking)
- An explicit and broadened role to monitor and support on health system level topics beyond infectious diseases

In the longer term, questions to address include, for example:

- The role of ECDC in building and ensuring crisis preparedness in all Member States
- The role of ECDC in continuously monitoring, and giving recommendations on, public health work in the Member States
- The depth of bilateral relationships and cooperation between ECDC and individual Member States, in peacetime and in crisis
- The role of ECDC – or other European institutions – in guiding Member States' responses during a crisis directly and on-site
- The degree of harmonisation of data collection and reporting between Member States, and the tools needed to ensure the desired level of comparability of such data

TECHNICAL APPENDIX

Appendix 1: Methodology

The research method behind the assessment builds on five categories of approaches and information sources: (1) review of relevant ECDC documentation, (2) internal stakeholder consultation, (3) external stakeholder consultation, (4) international benchmarking and learnings based on document and literature reviews and (5) external independent expert consultations. The ECDC documentation review laid the foundation for which the remaining research was built upon. The stakeholder consultations, benchmarking and expert consultations were carried out in parallel in complement of each other. Findings were continuously and iteratively combined to identify and solidify recommendations.

1. ECDC documentation

Desk research of relevant documentation, selected by both ECDC and consultants, from ECDC was conducted with the purpose of building an initial fact base related to topics such as ECDCs responsibilities, organisation, resources and activities. The initial fact base provided a foundation on which additional, more in-depth, research could be conducted. In addition, this document review provided indications as to where potential improvement areas could exist and should be probed further through internal consultations. Furthermore, a review of previous ECDC-led internal evaluations was also conducted with the purpose of incorporating and capturing previous learnings. Table 1 below lists the documents received and reviewed. In addition to the below listed documents, publicly available information on ECDC's website has been used.

Area	**Topic**	**Type of document**
Strategy, scope and outcomes	Mandate and mission	Founding regulation
	Roles and responsibilities	ECDC org chart
		Roles per function
Preparedness and planning	PHE plan	PHE org chart
		PHE operations plan
	PHE response	List of all requests received during COVID-19 (with details)
		List of activity highlights between March-May
		PHE upgrading SOP

		Internal evaluation documents
		External evaluation documents
		Suggested list of key outputs used to benchmark ECDC against comparable institutions
		Published outputs on ECDC website
Resources, capabilities and funding	Funding	Annual reports
		Financial regulation
		Annual budget
	Competencies	Personnel information (non-personally identifiable), incl. job titles, roles, responsibilities and functions
		Documentation on all staff involved in PHE between March-May
		Example of staff development dialogue report
		High-level overview of key BAU activities plus PHE activities
	Capabilities	Data reporting protocols
		Definition of NUTS classification
		ECDC online documentation on data systems

Organisation and processes	Org and reporting lines	Business continuity plan, incl. annexes
		Standard operational procedures (SOPs)
		ECDC org. chart before and after reorganisation in January
		PHE org. chart before and after reorganisation in March and September, incl. documentation on integration plan
		Documentation on structures and interactions with ECDC's coordinating competent bodies
		Documentation from management meeting, incl. meeting minutes and analysis conducted by Strategic Analyst
	Procurement	Documentation on procurement processes
		Description of staff types and contracts

Table 1: List of documents received and reviewed

2. Internal stakeholder consultations

Consultations were conducted with different stakeholders from ECDC internally. This was done with the purpose of: (a) gaining a deeper understanding of how ECDC was structured (in terms of responsibilities, organisation, resources and activities) and (b) collecting internal feedback and understanding ECDC's strengths, weaknesses and forward-looking opportunities. The consultations were conducted with employees cutting across sections, units, roles and levels of seniority to ensure breadth of input and opinions. In total, approximately 70 ECDC employees were consulted between the end of August 2020 until the end of October 2020.

The consultations followed different formats: (1) internal focus groups, (2) internal survey and (3) ad-hoc interviews and working meetings. A more detailed description of each consultation format can be found below.

The interview guides and surveys were co-created by the consultant team and ECDC with multiple iterations to ensure relevance, breadth and depth were achieved through each format of consultation.

Confidentiality was adhered to and all interactions were under the promise of anonymity.

Internal focus groups

The internal focus groups followed a semi-structured discussion format guided by an interview guide shown in Appendix 5, subsection 1. Questions were open-ended which facilitated an interactive discussion between participants. The semi-structured format allowed interviewers to steer the discussion towards topics relevant for the research, while giving enough room for the participants to express their opinions openly. In addition, this format allowed for input to be provided on questions not initially deemed important by the researchers – ensuring the research encapsulated a wide range of topics.

Seven internal focus groups were held in total, all organised by the consultant representatives without any ECDC management representatives present. A total of 41 ECDC employees attended the focus groups.

- Focus group with PHE Managers – 4 attendees
- Focus group heads of PHE groups – 6 attendees
- Focus group with Strategic analysts – 4 attendees
- Focus group with staff from PHE Technical Group – 2 attendees
- Focus group with randomly selected PHE staff – 10 attendees
- Focus group with randomly selected non-PHE-staff – 11 attendees
- Focus group with internal evaluators – 4 attendees

The composition of focus groups and selection of participants aimed at a broad representation of perspectives, roles, seniority, inside and outside of the PHE.

Internal survey

An internal online survey was distributed to all ECDC employees with the purpose of quantifying relevant topics and giving all internal stakeholders the opportunity to voice their opinions. This was done to ensure that findings from document reviews and internal stakeholder consultations were further probed to ensure validity.

All survey respondents were kept anonymous, and results were only presented to ECDC in an aggregated form.

Qualtrics XM was used as the provider of the survey. The survey was sent out to 264 ECDC employees out of which 196 provided answers, resulting in a 74 per cent response rate. Only respondents expressing an opinion were included in the final analysis of each question – respondents who indicated ‘I don’t know’ or ‘I have no opinion on that’ were not included in the analysis of that particular question. The full list of survey questions and answer distribution can be found in Appendix 2.

Ad-hoc interviews and working meetings

Ad-hoc interviews and meetings were conducted with different internal representatives during the study. The stakeholders provided answers on unplanned questions and topics that were discovered throughout the document reviews and planned consultations. The purpose of these ad-hoc interviews was to: (a) solidify the fact base were gaps existed and (b) test hypotheses of important findings and

potential emerging recommendations with relevant person(s). 18 ad-hoc consultations were conducted with 30 representatives from the various sections in the following units:

- Directors office
- Public health functions
- Resource management service
- Disease programmes
- Scientific Methods and Standards

The consultations ranged between 30min and 1hr and consisted mainly of targeted-, deep-dive- and follow-up-questions originating from the continuous research. The consultations followed a semi-structured format.

3. External stakeholder consultations

Consultations were conducted with external stakeholders as well, where feedback was collected from relevant, senior stakeholders in organisations that either rely on ECDC's outputs and/or collaborate with ECDC. The purpose of the consultations was to get an understanding of external stakeholders' views on the quality, relevance and timeliness of ECDC's outputs, its role in the organisations' COVID-19 response, the effectiveness of ECDC's processes, and ECDC's key strengths, weaknesses and forward-looking improvement areas.

The approach used focused on identifying patterns between groups of stakeholders. The goal was to understand which groups of stakeholders had which experiences, what perspectives different stakeholders had, what some of the common themes for all stakeholders were and understanding differences/similarities between internal and external stakeholder perspectives.

The consultations followed three different formats: (1) in-depth one-on-one interviews, (2) focus groups with stakeholders from similar groups and (3) an online survey. A more detailed description of each consultation format can be found below.

Similar to the internal stakeholder consultations, the interview guides and surveys were co-created by the consultant team and ECDC through multiple iterations to ensure relevance, breadth and depth were achieved in each format of consultation.

The stakeholders were divided in three categories: Member States (EU/EEA), EU Institutions and agencies, and international institutions.

All Member States were given the chance to give feedback through at least one of the three formats described above.

The specific EU Institutions and agencies as well as international institutions that were selected were proposed by ECDC. This selection was based on organisations with whom ECDC had interacted with most during the COVID-19 pandemic. In addition, ECDC proposed individual stakeholders from these organisations that were deemed most relevant to conduct a consultation with.

3.1. One-on-one interviews

Individual interviews were conducted with a selection of the most senior representatives and decision makers from stakeholders ECDC frequently interact with. This included mainly CCB Directors and MB

Members from Member States, senior representatives (such as directors and programme managers) from EU institutions and agencies as well as international institutions. The aim was to achieve a deep understanding of specific topics and the perspectives from each respective stakeholder. Each interview adhered to confidentiality and kept the interviewee anonymous with respect to their input, allowing them to express their opinions freely.

The interviews were conducted with two external consultant representatives, with at least one representative matching seniority with the interviewee. As with the internal focus groups, the interviews followed a semi-structured format guided by an interview guide. The interview guide varied based on the type of stakeholder. These various interview guides are shown in Appendix 5. Questions were deliberately open-ended, aimed at facilitating an interactive discussion between interviewer and interviewee. The semi-structured format allowed interviewers to steer the discussion towards topics relevant for the research, while giving enough room for the interviewee to express their opinions openly. In addition, this format allowed for input to be provided on questions not initially deemed important by the researchers – ensuring the research encapsulated a wide range of topics.

The interviewees were selected with the purpose of getting a broad and representative view of the stakeholders ECDC interacts with. For EU institutions and agencies and international institutions, senior representatives from the following organisations were interviewed:

- EC – Commissioner, health and food safety
- DG SANTE
- EMA
- Integrated Political Crisis Response
- JRC
- WHO Europe

A sample of Member States were selected based on four criteria, structured to get a sufficiently broad representation of EU/EEA countries and allowing the results to be generalised: geographic distribution and country size, resources in the national health system, severity of the outbreak in the Member State and nature of COVID-19 public health response measure.

The interviews were complemented by a brief quantitative in-meeting survey, with questions designed to enable a structured analysis and comparability with the online survey. It also allowed for a more objective comparison across interviewees.

3.2. Focus groups

External focus groups were held with groups of 2 to 6 stakeholders with similar roles from different Member States or comparable organisations. The focus groups were grouped by: OCPs/NFPs from Member States, AF members from Member States, representatives from EU agencies and institutions, and other international institutions. The purpose of the focus groups was to reach a broader sample size, talking to representatives from several Member States and selected organisations. An additional purpose of this approach was to generate an in-depth discussion with several stakeholders, facilitate a dynamic exchange of experiences from different perspectives and create an opportunity to pressure test and validate individual experiences directly through peers.

The external focus groups followed the same semi-structured format discussed under Appendix 1 sub-section 2.1 and 3.1. In addition, the focus groups were also complemented by the same brief

quantitative in-meeting survey as mentioned above, with questions designed to enable a structured analysis and comparability with the online survey. It also allowed for a more objective comparison between focus group sessions.

Different interview guides were created for the different focus groups depending on the type of stakeholders that were attending. The different interview guides can be found under Appendix 5.

3.3. Online survey

An external online survey was created and distributed to stakeholders from the three categories described above: Member States, EU Institutions and agencies, and international institutions. The survey was created with the purpose of gaining an even larger sample size of relevant representatives, giving external stakeholders that were not consulted the opportunity to voice their opinion. The survey served the additional purpose of ensuring that findings from external stakeholder consultations were further probed to ensure validity. The survey mainly targeted the following profiles, but was sent out to additional profiles as well:

- Operational Contact Points for Surveillance in Member States
- National Focal Points for Preparedness and Response
- National Focal Points for Threat Detection
- National Focal Points for Microbiology
- National Focal Points for Influenza

Qualtrics XM was used as the provider of the survey. In total, the survey was sent out to 225 representatives. 54 respondents answered the survey, resulting in a response rate of 24 per cent. ECDC sent multiple reminders over the span of three weeks in September. This response rate was lower than expected and results were thus merged with responses from the smaller in-meeting surveys that were filled out during the interviews, where appropriate. Despite this merge, takeaways from these survey results should be analysed with caution.

All questions and answers to the survey can be found in Appendix 3.

4. International benchmarking and learnings

A benchmarking analysis was conducted, comparing ECDC to other similar international institutions active in the public health space. The benchmarking analysis was conducted with a dual purpose: (a) comparing ECDC according to a certain number of criteria to reveal comparability and potential learnings and (b) review learnings that can be drawn from other CDC's COVID-19 actions.

The international institutions used in the benchmarking were: US CDC, Africa CDC, Korean CDC and the WHO.

Background research was conducted to get a good baseline understanding of the current situation for the compared CDC's, across different dimensions: mission and mandate, funding, staff, coordination with stakeholders and PHE organisational set-up.

A dashboard analysis was then conducted, based in part on material received by Dr Dionne Kringos (which was conducted in June and July 2020), complemented with a qualitative assessment of

usability and user experience of the selected dashboards (conducted in October 2020). The purpose was to identify how well ECDC's dashboards compare to other, similar, dashboards.

An analysis of the timeline of key outputs was also conducted, with the purpose of identifying the timeliness of ECDC's outputs and potential overlap with the WHO Europe outputs. The outputs were categorised into three overarching buckets to ensure comparability: (1) data and surveillance outputs, (2) scientific guidance and (3) guidance to practitioners and the general public. The analysis was conducted through researching publicly available information published by the international institutions themselves with the purpose of identifying what outputs were published and when. The full list of sources used can be found in Appendix 7.

Finally, to capture key learnings from the compared institutions, expert interviews and a press search analysis were conducted. The expert interviews were primarily conducted with senior consultant experts with direct and recent experience with the respective CDC where broad discussions on potential learnings were in focus. The press search analysis identified key learnings as highlighted by the media/press that could also be incorporated.

5. External independent experts

Consultations with two groups of experts were conducted, with the purpose of gaining an independent perspective on ECDC and its stakeholders. In addition, the expert consultations served as guidance for the research and to ensure that the methodology of the approach was sound, provided best practises and learnings from the international field, tested and validated emerging findings and recommendations, and independently assessed the quality of some ECDC outputs.

The two expert groups consisted of:

- Senior advisory group: Nine senior consultant experts working within global public health internationally
- Academic advisory board: Academic experts within the field. Comprised of Dame Sally Davies, GCB, DBE, FRS, FMedSci; Prof. Till Bärnighausen; Dr. Dionne Kringos; Prof. Lasse Lehtonen, MD, Ph.D, LL.D.
- The key content discussed was related to: understanding their expert observations/perceptions on ECDC's output during COVID-19, reviewing the approach methodology reviewing emerging findings and reviewing final findings. In addition, Dr Dionne Kringos provided material that was used as a basis for the Dashboard Analysis.

Appendix 2: Internal survey

Below, all questions and response distributions in the internal survey are listed. The internal survey was distributed to all ECDC employees (N = 286). The number of respondents (n) is reported for each question.

What unit do you belong to (outside PHE)? (n=185)	***Answer***
Scientific Methods and Standards	11%
Disease Programmes	23%
Public Health Functions	24%
Digital Transformation Service	9%
Resource Management Services	22%
Director’s office	12%

What unit do you belong to (outside PHE)? (n=183)	***Answer***
Management (HoUs)	2%
Managerial role, non-HoUs	20%
Expert role, non-managerial	44%
Administrative role	27%
Other	7%

Have you, at some point during the COVID-19 pandemic, worked under the PHE structure on the pandemic response? (n=189)	***Answer***

Yes	57%
No	43%

Within the PHE, which group(s) have you been a part of? (n=102)

(NOTE: Respondents could choose multiple alternatives, thus the sum of share exceeds 100%)	***Answer***
Technical Group	31%
PHE COVID-19 Support Group	32%
EOC Group	3%
Communication Group	10%
Other (e.g., PHE manager, strategic analyst, administrative, etc.)	24%

Do you feel that ECDC's current mandate enables the agency to effectively support Europe's response to the pandemic? (1 = No not at all; 5 = Yes, completely) (n=161)	**Answer**
1	4%
2	26%
3	41%
4	22%
5	7%

What level of involvement would you like to see ECDC take in future large-scale public health emergencies? (n=164)	Answer
Significantly more than today	54%
Slightly more than today	36%
Same as today	9%
Slightly less than today	1%
Significantly less than today	0%

How well has ECDC as an agency managed to uphold business continuity of ordinary tasks during COVID-19? (1 = Not at all; 5 = Completely) (n=164)	Answer
1	3%
2	29%
3	31%
4	29%
5	8%

How well has your section within ECDC managed to uphold business continuity of ordinary tasks during COVID-19? (1 = Not at all; 5 = Completely) (n=164)	Answer
1	4%
2	23%

3	16%
4	37%
5	21%

What would be most important to ensure better business continuity of ordinary tasks? Selected choice (n=95)	Answer
More personnel	34%
More funding	2%
Improved continuity planning	15%
Clearer prioritisation of key non-PHE activities (i.e., ordinary tasks)	35%
Other, please specify	15%

In your opinion, how useful has the PHE plan been in preparing ECDC for a PHE (if you do not know the PHE plan, please select 'I don't know')? (1 = Not useful at all; 5 = Very useful) (n=79)	Answer
1	13%
2	15%
3	30%
4	28%
5	14%

What would be most important to ensure more effective handling of all PHE activities? (n=152)	Answer
More personnel/activation of emergency staff additions	36%
More funding/activation of emergency budget	2%
Improved PHE planning	10%
Clearer prioritisation of key activities	16%
Clearer description and division of tasks and responsibilities of each function/role	24%
No changes are needed	1%
Other, please specify	11%

Do you feel that ECDC has sufficient personnel to handle all activities needed during a PHE (e.g., COVID-19)? (1 = No, not at all; 5 = Yes, fully sufficient) (n=152)	Answer
1	20%
2	31%
3	25%
4	18%
5	6%

How pleased are you with the current PHE rotation schedules? (1 = Not pleased at all; 5 = Very pleased) (n=89)	Answer
1	13%

2	17%
3	45%
4	19%
5	6%

In your view, does ECDC have sufficient funding (for other purposes than personnel) to effectively fulfil its role? (1 = No, not at all; 5 = Yes, fully sufficient) (n=140)	Answer
1	4%
2	17%
3	29%
4	25%
5	24%

Is ECDC able to effectively collect, use and disseminate necessary data during a PHE? (1 = No not at all; 5 = Yes fully able) (n=89)	Answer
1	7%
2	19%
3	27%
4	36%
5	11%

How effective is the PHE organisational structure in enabling effective and efficient handling of PHE tasks? (1 = Not effective at all; 5 = Very effective) (n=91)	Answer
1	8%
2	30%
3	36%
4	23%
5	3%

Roles and responsibilities are clear within the PHE as a whole (i.e., clearly defined, followed and communicated). (1 = I do not agree at all; 5 = I fully agree) (n=94)	Answer
1	10%
2	35%
3	29%
4	21%
5	5%

Roles and responsibilities are clear within the PHE group I've worked most with (i.e., clearly defined, followed and communicated). (1 = I do not agree at all; 5 = I fully agree) (n=94)	Answer
1	2%

2	18%
3	23%
4	33%
5	23%

Cross-functional/cross team knowledge-sharing, communication and collaboration within the PHE is effective. (1 = I do not agree at all; 5 = I fully agree) (n=91)	**Answer**
1	8%
2	25%
3	29%
4	32%
5	7%

Personnel is allocated to tasks within the PHE in an effective manner (i.e., right person to the right task at the right time). (1 = I do not agree at all; 5 = I fully agree) (n=85)	**Answer**
1	14%
2	31%
3	32%
4	21%
5	2%

Our working processes are efficient within the PHE (i.e., time is mostly spent on value-adding activities and not too much time spent on e.g., meetings, finding documents, etc.). (1 = I do not agree at all; 5 = I fully agree) (n=90)	Answer
1	23%
2	33%
3	26%
4	17%
5	1%

The work on different activities (e.g., requests and/or outputs to create) within the PHE is prioritised effectively (1 = I do not agree at all; 5 = I fully agree) (n=83)	Answer
1	18%
2	35%
3	23%
4	19%
5	5%

Do you consider the coordination and communication with the European Commission and other agencies to be effective (if you have been staffed in PHE org. then specifically within the PHE context, otherwise in general)? (1 = No, not effective at all; 5 = Yes, very effective) (n=126)	Answer

1	13%
2	39%
3	24%
4	18%
5	6%

In your opinion, do you believe ECDC's assistance provided to the Member States during the PHE has been effective? (1 = No, not effective at all; 5 = Yes, very effective) (n=91)	**Answer**
1	4%
2	14%
3	35%
4	41%
5	5%

ECDC's procurement of external outputs is efficient and effective (if you have been staffed in PHE org. then specifically within the PHE context, otherwise in general)?(1 = I do not agree at all; 5 = I fully agree) (n=112)	**Answer**
1	23%
2	28%
3	32%

4	13%
5	4%

Please indicate on the scale below what you think most applies to the PHE culture and working norms. (n=98)	Answer
1-Process-oriented and rigid	2%
2	7%
3	7%
4	10%
5	12%
6	18%
7	16%
8	20%
9	5%
10-Action-oriented and efficient	1%

Please indicate on the scale below what you think most applies to the culture and working norms in your regular ECDC section. (n=97)	Answer
1-Process-oriented and rigid	5%
2	8%

3	16%
4	11%
5	10%
6	18%
7	13%
8	9%
9	4%
10-Action-oriented and efficient	4%

Please indicate on the scale below what you think most applies to ECDC's culture and working norms (n=66)	**Answer**
1-Process-oriented and rigid	11%
2	26%
3	21%
4	5%
5	15%
6	8%
7	8%
8	5%
9	2%

10-Action-oriented and efficient	2%

Please indicate on the scale below what you think most applies to the culture and working norms in your section. (n=70)	Answer
1-Process-oriented and rigid	11%
2	13%
3	3%
4	7%
5	16%
6	11%
7	6%
8	19%
9	7%
10-Action-oriented and efficient	7%

In your opinion, how effective is the guidance and support you receive from your closest manager(s) in the PHE organisation? (1 = Not effective at all; 5 = Very effective) (n=98)	Answer
1	8%
2	13%
3	28%

4	36%
5	15%

In your opinion, how effective is the guidance and support you receive from your direct management? (1 = Not effective at all; 5 = Very effective) (n=72)	Answer
1	7%
2	10%
3	22%
4	36%
5	25%

Appendix 3: External Survey

1. External survey sent to focus group interviewees

The following survey was conducted with external (non-ECDC) focus group participants in direct connection with the focus group interview. All questions, response distribution and number of respondents (n) are listed below.

Relevance of ECDC's activities: Overall, how relevant do you think ECDC's activities have been during the COVID-19 outbreak? (1 = Not relevant at all; 5 = Very relevant) (n=27)	**Answer**
1	0%
2	4%
3	11%
4	37%
5	48%

ECDC involvement: What level of involvement would you like to see ECDC take in the future? (n=27)	**Answer**
Significantly more than today	19%
Slightly more than today	52%
Same as today	30%
Slightly less than today	0%
Significantly less than today	0%

Effectiveness and relevance of the response: How satisfied are you with ECDC's technical guidance in the COVID-19 pandemic so far? (1 = Not at all satisfied; 5 = Very satisfied) (n=27)	Answer
1	0%
2	4%
3	11%
4	59%
5	26%

Surveillance: How would you rate the effectiveness of ECDC's surveillance guidance? (1 = Not at all effective; 5 = Very effective) (n=26)	Answer
1	0%
2	8%
3	23%
4	50%
5	19%

Preparedness: How would you rate the effectiveness of ECDC's preparedness guidance? (1 = Not at all effective; 5 = Very effective) (n=26)	Answer
1	0%
2	12%

3	38%
4	38%
5	12%

Risk assessments: How would you rate the level of insight in ECDC's risk assessments? (1 = Not at all insightful; 5 = Very insightful) (n=27)	**Answer**
1	0%
2	0%
3	11%
4	48%
5	41%

Coordination: How would you rate the level of coordination between your organisation and ECDC? (1 = Not at all effective; 5 = Very effective) (n=27)	**Answer**
1	4%
2	7%
3	30%
4	48%
5	11%

2. Main external survey

Below, all questions and response distributions in the external survey are listed. The external survey was distributed to stakeholders in the Member States (see Appendix 1 above) outside of interviews and focus groups (N = 225). The number of respondents (n) is reported for each question.

Please select the options that most accurately define your role (please choose multiple if your role goes across categories) (n=54) *(NOTE: Respondents could choose multiple alternatives, thus the sum of share exceeds 100%)*	**Answer**
I am an OCP for Surveillance	36%
I am an NFP for Preparedness and Response	56%
I am an NFP for Threat Detection	33%
I am an NFP for Microbiology	15%
I am an NFP for Influenza	51%
None of the above applies to me	21%

When interacting with ECDC or handling information from ECDC; please indicate which of the following institutions you represent. (n=54)	**Answer**
Representative from an EU/EEA Member State	94%
Representative from an EU institution (not ECDC)	2%
Representative from a non-European institution, e.g., the WHO, CDCs	2%
Other, please specify:	2%

Please indicate the level of exposure to ECDC information (n=54)	**Answer**

I handle ECDC information on a daily basis	57%
I handle ECDC information on a weekly basis	31%
I handle ECDC information 1-4 times per month	9%
I handle ECDC information less than once per month	2%

Please indicate the level of interaction with ECDC (n=54)	**Answer**
I interact with ECDC on a daily basis	11%
I interact with ECDC on a weekly basis	43%
I interact with ECDC 1-4 times per month	26%
I interact with ECDC less than once per month	20%

How do you rate ECDC's response activities with regard to the following:? (1 = Not at all satisfied; 5 = Very satisfied) (n=50)	**1**	**2**	**3**	**4**	**5**
Overall relevance	0%	0%	16%	56%	28%
Timeliness	2%	4%	28%	42%	24%
Scientific quality	0%	2%	6%	46%	46%
Practicality/applicability	0%	10%	26%	42%	22%

What level of involvement would you like to see ECDC take in a future large-scale public health emergency? (n=52)	**Answer**

Significantly more than today	13%
Slightly more than today	42%
Same as today	40%
Slightly less than today	4%
Significantly less than today	0%

Overall, how well equipped do you think ECDC is to support Member States during a large-scale public health emergency? (1 = Not at all equipped; 5 = Very well equipped) (n=41)	**1**	**2**	**3**	**4**	**5**
With regards to resources (i.e., funding and no. of personnel)	5%	30%	25%	30%	10%
With regards to expertise	0%	7%	9%	48%	36%
With regards to breadth of support	2%	15%	27%	46%	10%

In the future, would you like ECDC to have a broader set of capabilities? (1 = Significantly broader set of capabilities; 5 = Significantly more narrow set of capabilities) (n=51)	**1**	**2**	**3**	**4**	**5**
With regards to resources (i.e., funding and no. of personnel)	22%	27%	39%	10%	2%
With regards to expertise	18%	29%	41%	10%	2%
With regards to breadth of support	16%	31%	39%	6%	8%

How satisfied are you in general with ECDC's technical guidance in the COVID-19 pandemic so far? (1 = Not at all satisfied; 5 = Very satisfied) (n=49)	Answer
1	0%
2	0%
3	16%
4	59%
5	24%

How would you rate the effectiveness of ECDC's surveillance outputs, e.g., the aggregated surveillance data for Europe? (1 = Not at all effective; 5 = Very effective) (n=45)	Answer
1	0%
2	2%
3	11%
4	56%
5	31%

How would you rate the effectiveness of preparedness guidance? (1 = Not at all effective; 5 = Very effective) (n=49)	Answer
1	0%
2	4%

3	41%
4	43%
5	12%

How would you rate the usefulness of ECDC's risk assessments? (1 = Not at all useful; 5 = Very useful) (n=47)	Answer
1	0%
2	2%
3	17%
4	34%
5	47%

How would you rate the level of coordination between your institution/country and ECDC? (1 = Not at all effective; 5 = Very effective) (n=46)	Answer
1	2%
2	4%
3	30%
4	37%
5	26%

In the future, would you like ECDC to work closer and collaborate more with your country/institution? Please choose the answer which reflects your opinion the best. (n=50)	**Answer**
I would like ECDC to work a lot closer with my institution/country	10%
I would like ECDC to work slightly closer with my institution/country	32%
I would like ECDC and my country/institution to work together at the same level as previously	54%
I would like ECDC to work slightly less close with my institution/country	2%
I would like ECDC to work a lot less close with my institution/country	2%

ECDC's risk assessment output. (1 = Very low; 5 = Very high): *Rapid Risk Assessment: COVID-19 in the EU/EEA and the UK – tenth update (n=41)*	**1**	**2**	**3**	**4**	**5**
Relevance	0%	0%	10%	34%	56%
Quality	0%	0%	12%	37%	51%
Usefulness/applicability	0%	0%	15%	51%	34%

ECDC's risk assessment output. (1 = Very low; 5 = Very high): *Rapid risk assessment: COVID-19 pandemic: increased transmission in the EU/EEA and the UK – sixth update (n=41)*	**1**	**2**	**3**	**4**	**5**
Relevance	0%	0%	7%	41%	51%
Quality	0%	0%	10%	40%	50%
Usefulness/applicability	0%	0%	20%	45%	35%

ECDC's Microtraining output. (n=34)	**1**	**2**	**3**	**4**	**5**
Relevance of the output	0%	6%	29%	38%	26%
Quality of the output	0%	9%	24%	44%	24%
Usefulness/applicability of the output	0%	12%	38%	35%	15%

ECDC's Surveillance output: *Strategies for the surveillance of COVID-19 (n=14)*	**1**	**2**	**3**	**4**	**5**
Relevance of the output	0%	0%	7%	29%	64%
Quality of the output	0%	0%	14%	43%	43%
Usefulness/applicability of the output	0%	0%	14%	29%	57%

ECDC's Surveillance output: *Case definition for COVID-19, as of 29 May 2020 (n=14)*	**1**	**2**	**3**	**4**	**5**
Relevance of the output	0%	0%	0%	21%	79%
Quality of the output	0%	0%	14%	29%	57%
Usefulness/applicability of the output	0%	0%	21%	21%	57%

ECDC's Surveillance output: *Weekly COVID-19 country overview (n=11)*	**1**	**2**	**3**	**4**	**5**
Relevance of the output	0%	0%	8%	42%	50%
Quality of the output	0%	0%	9%	27%	64%

Usefulness/applicability of the output	0%	0%	8%	42%	50%

ECDC's Preparedness and Response output:

Considerations relating to social distancing measures in response to COVID-19 – second update (n=13)	**1**	**2**	**3**	**4**	**5**
Relevance of the output	0%	0%	8%	38%	54%
Quality of the output	0%	0%	14%	29%	57%
Usefulness/applicability of the output	0%	0%	23%	46%	31%

ECDC's Preparedness and Response output:

Using face masks in the community – Reducing COVID-19 transmission from potentially asymptomatic or pre-symptomatic people through the use of face masks (n=13)	**1**	**2**	**3**	**4**	**5**
Relevance of the output	0%	0%	7%	43%	50%
Quality of the output	0%	0%	7%	50%	43%
Usefulness/applicability of the output	0%	8%	8%	54%	31%

ECDC's Preparedness and Response output:

Guidance on the provision of support for medically and socially vulnerable populations in EU/EEA countries and the UK during the COVID-19 pandemic (n=11)	**1**	**2**	**3**	**4**	**5**
Relevance of the output	0%	8%	17%	33%	42%
Quality of the output	0%	8%	25%	25%	42%
Usefulness/applicability of the output	0%	9%	36%	27%	27%

ECDC's Preparedness and Response output:

Early Introduction of Severe Acute Respiratory Syndrome Coronavirus 2 into Europe (n=11)	1	2	3	4	5
Relevance of the output	0%	0%	9%	45%	45%
Quality of the output	0%	0%	8%	42%	50%
Usefulness/applicability of the output	0%	0%	36%	36%	27%

ECDC's Microbiology outputs:

Laboratory readiness and response for novel coronavirus (2019-nCoV) in expert laboratories in 30 EU/EEA countries, January 2020 (13 February) (n=7)	1	2	3	4	5
Relevance of the output	0%	0%	0%	57%	43%
Quality of the output	0%	0%	14%	43%	43%
Usefulness/applicability of the output	0%	0%	0%	57%	43%

ECDC's Microbiology outputs:

An overview of the rapid test situation for COVID-19 diagnosis in the EU/EEA (1 April) (n=9)	1	2	3	4	5
Relevance of the output	0%	0%	11%	22%	67%
Quality of the output	0%	11%	0%	44%	44%
Usefulness/applicability of the output	0%	11%	0%	56%	33%

ECDC's Microbiology outputs:	1	2	3	4	5

Methodology for estimating point prevalence of SARS-CoV-2 infection by pooled RT-PCR testing (28 May) (n=8)

Relevance of the output	0%	0%	13%	50%	38%
Quality of the output	0%	0%	13%	63%	25%
Usefulness/applicability of the output	0%	0%	25%	38%	38%

Appendix 4: Business Continuity Plan

Critical and semi-critical activities

Critical activities

1. Screening Information (Epidemic Intelligence tasks)
2. Rapid Risk Assessments
3. Operating the EWRS
4. Daily surveillance of Travel Associated Legionnaires' Disease
5. Alert Member States about events
6. Molecular Typing
7. Screening information (Epidemic Intelligence tasks)

Semi-critical activities

1. Ensure delegations
2. Assessment of EU enlargement countries communicable disease surveillance and prevention systems
3. Euro surveillance Editorial Office – Rapid communications
4. Disease programmes – Scientific advice
5. Scientific advice coordination – Handling requests
6. Weekly surveillance of influenza outbreaks (weekly between weeks 40-20)
7. Ensure IT-security
8. Select a new ECDC fellowship (EPIET EUPHEM) EU Track Cohort
9. Budgetary commitments of funds
10. Prepare and submit the draft budget for ECDC
11. Monitor conflicts of interest
12. Salary payments
13. Plan, coordinate, arrange and follow-up meetings and missions in Sweden and other Member States – long-term planning using MIS plan
14. Plan, coordinate, arrange and follow-up meetings and missions in Sweden and other Member States – ad-hoc meetings, e.g., in connection with a PHE
15. Internal communications

Appendix 5: Interview guides

1. Internal focus group interview guide

Strategy, scope and outcomes

1. What specifically does ECDC's mandate encompass (and what does it not cover), and thus, what is ECDC tasked with and expected to do in a crisis?
    a. What are the differences in mandate compared to international counterparts?
    b. Could the mandate be inhibiting ECDC from a more effective response to a PHE such as COVID-19? Does their mandate differ from other comparable international CDCs (e.g., ACDC)?
2. What are the roles and responsibilities of each of ECDCs functions?
    a. What functions do ECDC need in order to support PHE?

Preparedness, planning and response

1. What are the main features of the PHE plan(s)?
    a. Has the PHE plan been followed?
    b. Has the PHE plan been a useful guidance in the crisis?
    c. How do ECDCs PHE plans/planning procedures compare to other comparable international institutions?
    d. How could the PHE plan be evolved to be even more useful in future crises?

2. What does the timeline of main response activities within the PHE look like since the start of the COVID crisis?
    a. Were outputs delivered in a timely manner?
    b. Were the outputs relevant?

Funding, competencies and capabilities

1. What funding structure does ECDC have?
    a. Is the funding/budget structure sufficient for ECDC to effectively fulfil its role, specifically in a PHE scenario (e.g., sufficient funding to handle PHE plus BAU)?
    b. Is there any reserve funding during a PHE if necessary?
2. Which competencies can ECDC draw upon in a PHE? (number of experts, areas of expertise, mandate to mobilise additional resources, etc.) How many FTEs split by type of expertise and allowance for contract workers do they have?
    a. Does ECDC have sufficient resources to handle all activities related to a PHE such as COVID-19 (i.e., are there sufficient numbers of each relevant type of scientist)?

3. What capabilities can ECDC draw upon in a PHE? How do they capture data and what type of data tools do they have access to/use?
    a. Is ECDC able to efficiently collect, use and disseminate necessary data, and are there specific issues here (e.g., quality of received data varies, definitions of variables unclear, data competencies lacking, data tools insufficient)

Organisation and processes

1. How is the PHE organisation and governance structured and how does it fit into the regular organisation structure?
    a. Is the PHE organisation structured in accordance with international best practices?
2. What were the concrete changes made in the reorganisation structure effort in January?
    a. Did the reorganisation lead to tangible benefits/drawbacks for handling PHEs?
3. What are the core processes for knowledge sharing/communicating across functions, teams and roles?
    a. Are processes of communication/collaboration/knowledge sharing/workflow clear, adhered to and inducive to effective delivery? Is there any potential along these processes, and/or how much do they deviate from best practices?
4. How are resources (i.e., personnel) allocated to the various tasks within the PHE organisation?
    a. Are resources used in an efficient and effective manner (i.e., following international best practices)?
5. How are activities/requests prioritised?
    a. Are current prioritisation practices clearly communicated, understood and followed?
    b. Is ECDC following best practices when it comes to decision making and prioritisation?
6. How does ECDC's procurement of external expertise work (i.e., processes and criteria) and what share of operational/staffing expenses does this constitute?
    a. What is the process for ensuring that the 'right' expertise are procured?
    b. How does ECDC ensure timeliness of execution of these procurements?
7. How does ECDC cooperate/work with externally procured expertise (i.e., processes of collaboration)?
    a. How do you ensure the quality, timeliness and relevance of outputs from these external contractors?
8. What are the core elements in terms of mindset at ECDC/PHE, including positive aspects and potential drawbacks?
    a. How solution-oriented and motivated are co-workers at ECDC? Is the organisation rule-based? How do they adjust when needed? What is their mindset around knowledge sharing and collaboration?

2. External focus group interview guide: AF group

Introduction

1. What is the nature of the interactions with ECDC and information received since the start of the COVID-19 outbreak?
2. Which of ECDC's activities have been most relevant for your organisation (e.g., scientific guidance, surveillance activities, planning activities, risk assessments, dissemination of information, facilitation of information exchange)?
3. During the COVID-19 outbreak, how have ECDC's activities complemented/overlapped with: (a) what you did nationally and (b) what other international institutions did?
4. What would you have wanted ECDC to do more of, which they did not do sufficiently during the COVID-19 outbreak? (Follow up: have you asked ECDC for these activities?)
5. Which role would you want ECDC to take in public health emergencies going forward? I.e., which level of involvement and responsibility?
6. Reflecting on the COVID-19 crisis so far, what worked well and what should be improved?
7. What are the changes that need to be introduced to improve the quality and relevance of ECDC's activities?

ECDC's assets and capabilities

1. In your view, does ECDC have the proper resources to effectively support Member States during a crisis like COVID-19 (e.g., the right expertise, sufficient personnel, effective systems)?
2. According to your experience, what would be needed for ECDC in terms of capabilities and competencies to be more effective and relevant in their handling of public health emergencies like COVID-19?

Relevance and usage of ECDC's surveillance activities

1. How did ECDC provide your organisation/country with support for COVID-19 surveillance? (i.e., which ECDC surveillance guidance/advice did you concretely use, and how?); [for examples, refer to links provided]. Which surveillance activities should ECDC be performing, that they do not do today?

   Example outputs:

   Strategies for the surveillance of COVID-19

   Case definition for COVID-19
2. How could the quality or usefulness of ECDC's surveillance outputs be improved?

   Example output:

   Situation updates COVID-19

ECDC's performance in the preparedness area

1. How did ECDC help your organisation/country ensure preparedness for outbreaks like COVID-19 (i.e., which ECDC preparedness guidance/advice did you concretely use and how)? Which preparedness activities should ECDC be performing, that they do not do today? How could the quality or usefulness of ECDC's preparedness activities be improved?

   Example outputs:

   Infection prevention and control and preparedness for COVID-19

   Checklist for hospitals preparing for COVID-19 patients

   Guidance for health system contingency planning

2. Have you leveraged the risk assessments provided by ECDC when deciding on preparedness measures?

   Example output:

   COVID-19 risk assessment

ECDC's collaboration and coordination with stakeholders

1. Could you elaborate on how your organisation and ECDC collaborate/coordinate today?
2. Do you feel that collaboration and coordination between ECDC and your organisation has been effective, and could you elaborate on why/why not? What should ECDC be doing differently to ensure more effective and streamlined collaboration with your organisation?
3. Is there a good mechanism in place that gives you the possibility to give feedback to ECDC? If so, does ECDC act on it?
4. Where do you see ECDC fit in to the overarching landscape of global public health institutions? I.e., how does ECDC complement/work together with the WHO and other CDCs?

Communication and media

1. How do you assess the ECDC media presence in your country during COVID-19? How could it be improved in the future?
2. How do you assess ECDC's overall visibility during COVID-19? How could it be improved in the future?

Closing

Reflecting on the different topics discussed during the meeting, is there anything you want to add regarding:

1. ECDC's most relevant activities for your organisation?
2. Activities missing that you would have wished to see?
3. Activities that would have been better handled by another institution?

3. External focus group interview guide: EU Institutions

Introduction

1. What is the nature of the interactions with ECDC and information received since the start of the COVID-19 outbreak?
2. Which of ECDC's activities have been most relevant for your organisation (e.g., scientific guidance, surveillance activities, planning activities, risk assessments, dissemination of information, facilitation of information exchange)?
3. How have you concretely used/implemented ECDC's guidance and/or advice? What would need to happen to use/implement more of ECDC's guidance?
4. During the COVID-19 outbreak, how have ECDC's activities complemented/overlapped with: (a) what has been done nationally and (b) what other international institutions did?
5. What would you have wanted ECDC to do more of, which they did not do sufficiently during the COVID-19 outbreak? (Follow up: have you asked ECDC for these activities?)
6. Which role would you want ECDC to take in public health emergencies going forward? I.e., which level of involvement and responsibility?
7. Reflecting on the COVID-19 crisis so far, what worked well and what should be improved? What are the changes that need to be introduced to improve the quality and relevance of ECDC's activities?
8. Do you feel that collaboration and coordination between ECDC and your organisation has been effective, and could you elaborate on why/why not? What should ECDC be doing differently to ensure more effective and streamlined collaboration with your organisation?

ECDC's collaboration and coordination with stakeholders

1. Could you elaborate on how your organisation and ECDC collaborate/coordinate today?
2. Is there a good mechanism in place that gives you the possibility to give feedback to ECDC? If so, does ECDC act on it?
3. Does ECDC collaborate effectively with other EU institutions and agencies?
4. Within the EU system and in context of the COVID-19 crisis, has the division of responsibilities been clear between the involved institutions? If not, how could a clear division of responsibilities be ensured?
5. Where do you see ECDC fit in to the overarching landscape of global public health institutions? I.e., how does ECDC complement/work together with the WHO and other CDCs?

ECDC's assets and capabilities

1. In your view, does ECDC have the proper resources to effectively support Member States during a crisis like COVID-19 (e.g., the right expertise, sufficient personnel, effective systems)?

2. According to your experience, what would be needed for ECDC in terms of capabilities and competencies to be more effective and relevant in their handling of public health emergencies like COVID-19?

Effectiveness and relevance of the response guidance implemented during COVID-19

1. How effective and relevant do you feel ECDC's advice and/or support has been during the months of the COVID-19 crisis? How could this be improved in the future?
2. How operationally applicable has ECDC's advice been (i.e., has their guidance been clear and actionable)? How could this be improved in the future?

Relevance and usage of ECDC's surveillance activities

1. How did ECDC provide your organisation with support for COVID-19 surveillance? (I.e., which ECDC surveillance guidance/advice did you concretely use and how)? Which surveillance activities should ECDC be performing, that they do not do today?
2. How could the quality or usefulness of ECDC's surveillance outputs be improved?

ECDC's performance in the preparedness area

1. How did ECDC help your organisation/country ensure preparedness for outbreaks like COVID-19 (i.e., which ECDC preparedness guidance/advice did you concretely use and how)? Which preparedness activities should ECDC be performing that they do not do today? How could the quality or usefulness of ECDCs preparedness be improved?
2. Have you leveraged the risk assessments provided by ECDC when deciding on preparedness measures?

Closing

Reflecting on the different topics discussed during the meeting, is there anything you want to add regarding:

1. ECDC's most relevant activities for your organisation?
2. Activities missing that you would have wished to see?
3. Activities that would have been better handled by another institution?

4. External focus group interview guide: international institutions

Introduction

1. What is the nature of the interactions with ECDC and information received since the start of the COVID-19 outbreak?
2. During the COVID-19 outbreak, how have ECDC's activities complemented/overlapped with: (a) what has been done nationally and (b) what other international institutions did?
3. What would you have wanted ECDC to do more of, which they did not do sufficiently during the COVID-19 outbreak? (Follow up: have you asked ECDC for these activities?)

4. Which role would you want ECDC to take in public health emergencies going forward? I.e., which level of involvement and responsibility?
5. Reflecting on the COVID-19 crisis so far, what worked well and what should be improved? What are the changes that need to be introduced to improve the quality and relevance of ECDC's activities?
6. Do you feel that collaboration and coordination between ECDC and your organisation has been effective, and could you elaborate on why/why not?

ECDC's assets and capabilities

1. In your view, does ECDC have the proper resources to effectively support Member States during a crisis like COVID-19 (e.g., the right expertise, sufficient personnel, effective systems)?
2. According to your experience, what would be needed for ECDC in terms of capabilities and competencies to be more effective and relevant in their handling of public health emergencies like COVID-19?
3. Could you evaluate the level of expertise within ECDC based on your personal view? Where do you see weak spots, if any? (E.g., certain areas where they are lacking experts)

ECDC's collaboration and coordination with stakeholders

1. Could you elaborate on how your organisation and ECDC collaborate/coordinate today?
2. Is there a good mechanism in place that gives you the possibility to give feedback to ECDC? If so, does ECDC act on it?
3. Where do you see ECDC fit in to the overarching landscape of global public health institutions? I.e., how does ECDC complement/work together with the WHO and other CDCs.

Closing

Reflecting on the different topics discussed during the meeting, is there anything you want to add regarding:

1. ECDC's most relevant activities for your organisation?
2. Activities missing that you would have wished to see?
3. Activities that would have been better handled by another institution?

5. External focus group interview guide: OCPs/NFPs

Introduction

1. What is the nature of the interactions with ECDC and information received since the start of the COVID-19 outbreak?
2. Which of ECDC's activities have been most relevant for your organisation (e.g., scientific guidance, surveillance activities, planning activities, risk assessments, dissemination of information, facilitation of information exchange)?
3. During the COVID-19 outbreak, how have ECDC's activities complemented/overlapped with: (a) what you did nationally and (b) what other international institutions did?

4. What would you have wanted ECDC to do more of, which they did not do sufficiently during the COVID-19 outbreak? (Follow up: have you asked ECDC for these activities?)
5. Which role would you want ECDC to take in public health emergencies going forward? I.e., which level of involvement and responsibility?
6. Reflecting on the COVID-19 crisis so far, what worked well and what should be improved?
7. What are the changes that need to be introduced to improve the quality and relevance of ECDC's activities?

ECDC's assets and capabilities

1. In your view, does ECDC have the proper resources to effectively support Member States during a crisis like COVID-19 (e.g., the right expertise, sufficient personnel, effective systems)?
2. According to your experience, what would be needed for ECDC in terms of capabilities and competencies to be more effective and relevant in their handling of public health emergencies like COVID-19?

Relevance and usage of ECDC's surveillance activities

1. How did ECDC provide your organisation/country with support for COVID-19 surveillance? (I.e., which ECDC surveillance guidance/advice did you concretely use and how); [for examples, refer to links provided]. Which surveillance activities should ECDC be performing, that they do not do today?

   Example outputs:

   Strategies for the surveillance of COVID-19

   Case definition for COVID-19
2. How could the quality or usefulness of ECDC's surveillance outputs be improved?

   Example output:

   Situation updates COVID-19

ECDC's performance in the preparedness area

1. How did ECDC help your organisation/country ensure preparedness for outbreaks like COVID-19 (i.e., which ECDC preparedness guidance/advice did you concretely use and how)? Which preparedness activities should ECDC be performing, that they do not do today? How could the quality or usefulness of ECDC's preparedness activities be improved?

   Example outputs:

   Infection prevention and control and preparedness for COVID-19

   Checklist for hospitals preparing for COVID-19 patients

   Guidance for health system contingency planning

2. Have you leveraged the risk assessments provided by ECDC when deciding on preparedness measures?

   Example output:

   COVID-19 risk assessment

ECDC's collaboration and coordination with stakeholders

1. Could you elaborate on how your organisation and ECDC collaborate/coordinate today?
2. Do you feel that collaboration and coordination between ECDC and your organisation has been effective, and could you elaborate on why/why not? What should ECDC be doing differently to ensure more effective and streamlined collaboration with your organisation?
3. Is there a good mechanism in place that gives you the possibility to give feedback to ECDC? If so, does ECDC act on it?
4. Where do you see ECDC fit in to the overarching landscape of global public health institutions? I.e., how does ECDC complement/work together with the WHO and other CDCs.

Communication and media

1. How do you assess the ECDC media presence in your country during COVID-19? How could it be improved in the future?
2. How do you assess ECDC's overall visibility during COVID-19? How could it be improved in the future?

Closing

Reflecting on the different topics discussed during the meeting, is there anything you want to add regarding:

1. ECDC's most relevant activities for your organisation?
2. Activities missing that you would have wished to see?
3. Activities that would have been better handled by another institution?

6. External in-depth interview guide: EU institutions

Introduction

1. What is the nature of the interactions with ECDC and information received since the start of the COVID-19 outbreak?
2. Which of ECDC's activities have been most relevant for your organisation (e.g., scientific guidance, surveillance activities, planning activities, risk assessments, dissemination of information, facilitation of information exchange)?
3. How have you concretely used/implemented ECDC's guidance and/or advice? What would need to happen to use/implement more of ECDC's guidance?

4. During the COVID-19 outbreak, how have ECDC's activities complemented/overlapped with: (a) what has been done nationally and (b) what other international institutions did?
5. What would you have wanted ECDC to do more of, which they did not do sufficiently during the COVID-19 outbreak? (Follow up: have you asked ECDC for these activities?)
6. Which role would you want ECDC to take in public health emergencies going forward? I.e., which level of involvement and responsibility?
7. Reflecting on the COVID-19 crisis so far, what worked well and what should be improved? What are the changes that need to be introduced to improve the quality and relevance of ECDC's activities?
8. Do you feel that collaboration and coordination between ECDC and your organisation has been effective, and could you elaborate on why/why not?

ECDC's assets and capabilities

1. In your view, does ECDC have the proper resources to effectively support Member States during a crisis like COVID-19 (e.g., the right expertise, sufficient personnel, effective systems)?
2. According to your experience, what would be needed for ECDC in terms of capabilities and competencies to be more effective and relevant in their handling of public health emergencies like COVID-19?

ECDC's collaboration and coordination with stakeholders

1. Could you elaborate on how your organisation and ECDC collaborate/coordinate today?
2. Is there a good mechanism in place that gives you the possibility to give feedback to ECDC? If so, does ECDC act on it?
3. Does ECDC collaborate effectively with other EU institutions and agencies?
4. Within the EU system and in context of the COVID-19 crisis, has the division of responsibilities been clear between the involved institutions? If not, how could a clear division of responsibilities be ensured?
5. Where do you see ECDC fit in to the overarching landscape of global public health institutions? I.e., how does ECDC complement/work together with the WHO and other CDCs.

Closing

Reflecting on the different topics discussed during the meeting, is there anything you want to add regarding:

1. ECDC's most relevant activities for your organisation?
2. Activities missing that you would have wished to see?
3. Activities that would have been better handled by another institution?

7. External in-depth interview guide: international institutions

Introduction

1. What is the nature of the interactions with ECDC and information received since the start of the COVID-19 outbreak?
2. During the COVID-19 outbreak, how have ECDC's activities complemented/overlapped with: (a) what has been done nationally, and (b) what other international institutions did?
3. What would you have wanted ECDC to do more of, which they did not do sufficiently during the COVID-19 outbreak? (Follow up: have you asked ECDC for these activities?)
4. Which role would you want ECDC to take in public health emergencies going forward? I.e., which level of involvement and responsibility?
5. Reflecting on the COVID-19 crisis so far, what worked well and what should be improved? What are the changes that need to be introduced to improve the quality and relevance of ECDC's activities?
6. Do you feel that collaboration and coordination between ECDC and your organisation has been effective, and could you elaborate on why/why not?

ECDC's assets and capabilities

1. In your view, does ECDC have the proper resources to effectively support Member States during a crisis like COVID-19 (e.g., the right expertise, sufficient personnel, effective systems)?
2. According to your experience, what would be needed for ECDC in terms of capabilities and competencies to be more effective and relevant in their handling of public health emergencies like COVID-19?
3. Could you evaluate the level of expertise within ECDC based on your personal view? Where do you see weak spots, if any? (E.g., certain areas where they are lacking experts)

ECDC's collaboration and coordination with stakeholders

1. Could you elaborate on how your organisation and ECDC collaborate/coordinate today?
2. Is there a good mechanism in place that gives you the possibility to give feedback to ECDC? If so, does ECDC act on it?
3. Where do you see ECDC fit in to the overarching landscape of global public health institutions? I.e., how does ECDC complement/work together with the WHO and other CDCs.

Closing

Reflecting on the different topics discussed during the meeting, is there anything you want to add regarding:

1. ECDC's most relevant activities for your organisation?
2. Activities missing that you would have wished to see?
3. Activities that would have been better handled by another institution?

8. External in-depth interview guide: Member State representatives

Introduction

1. What is the nature of the interactions with ECDC and information received since the start of the COVID-19 outbreak?
2. How have you concretely used/implemented ECDC's guidance and/or advice?
3. During the COVID-19 outbreak, how have ECDC's activities complemented/overlapped with: (a) what you did nationally and (b) what other international institutions did?
4. What would you have wanted ECDC to do more of, which they did not do sufficiently during the COVID-19 outbreak? (Follow up: have you asked ECDC for these activities?)
5. Which role would you want ECDC to take in public health emergencies going forward? I.e., which level of involvement and responsibility?
6. Reflecting on the COVID-19 crisis so far, what worked well and what should be improved? What are the changes that need to be introduced to improve the quality and relevance of ECDC's activities?

ECDC's assets and capabilities

1. In your view, does ECDC have the proper resources to effectively support Member States during a crisis like COVID-19 (e.g., the right expertise, sufficient personnel, effective systems)?
2. According to your experience, what would be needed for ECDC in terms of capabilities and competencies to be more effective and relevant in their handling of PHEs like COVID-19?

ECDC's collaboration and coordination with stakeholders

1. Could you elaborate on how your organisation and ECDC collaborate/coordinate today?
2. Where do you see ECDC fit in to the overarching landscape of global public health institutions? How does ECDC complement/work together with the WHO and other CDCs.

Closing

Reflecting on the different topics discussed during the meeting, is there anything you want to add regarding:

1. ECDC's most relevant activities for your organisation?
2. Activities missing that you would have wished to see?
3. Activities that would have been better handled by another institution?

Appendix 6: External interviewees

Name	Country/institution
Allerberger, Franz	Austria
an der Heiden , Maria	Germany
Andrassy, Irena	Croatian presidency
Aparicio Azcárraga , Pilar	Spain
Bernard-Stoecklin , Sibylle	France
Bombay, Peter	DG MOVE
Bucher, Anne	DG SANTE
Carlson, Johan	Sweden
Chêne, Geneviève	France
Coignard, Bruno	France
Connell, Jeff	Ireland
Cotter, Irene	Cyprus
Daniliesz, Agnes	Hungary
Dara, Masoud	WHO
De La Fuente Garcia, Isabel	Luxemburg
De Raedt , Lieven	Belgium
Doherty, Lorraine	Ireland
Ryan, John	DG SANTE
Forland, Frode	Norway
Grgič Vitek, Marta	Slovenia
Gudnason , Thorolfur	Iceland
Hajdu , Ágnes	Hungary

Hamouda, Osamah	Germany
Hartwig, Marc-Arno	Frontex
Ionut Panait, Cristian	EASA
Jansen, Laura	DG SANTE
Juszczyk , Grzegorz	Poland
Kantardjiev , Todor	Bulgaria
Keller, Ingrid	DG SANTE
Kluge, Hans	WHO
Kyriakides, Stella	Health and food safety
Lesko, Birgitta	Sweden
Linina, Indra	Latvia
Marelsdottir , Iris	Iceland
Matias Dias, Carlos	Portugal
Melillo , Tanya	Malta
Meziani, Tarik	Council of the European Union
Molnar, Agnes-Marta	DG SANTE
Moore, Rebecca	European Institute of Women’s Health
Mossong, Joel	Luxemburg
Nathalie, Bossuyt	Belgium
Pancer , Katarzyna	Poland
Pebody, Richard	WHO
Perevoščikovs, Jurijs	Latvia
Philipp, Wolfgang	DG SANTE
Powel, Rowan	EASA

Raquel Moreira Ferreira , Mariana	Portugal
Rasi, Guido	EMA
Rexroth, Ute	Germany
Sadkowska-Todys, Małgorzata	Poland
Simón Soria , Fernando	Spain
Simon, Carsten	Frontex
Stoitsova, Savina	Bulgaria
Strohschneider, Michaela	DG MOVE
Tegnell, Anders	Sweden
Tytgat, Luc	EASA
Van Den Eede, Guy	JRC
Van Oyen , Herman	Belgium
Zampieri, Alessandra	JRC

Appendix 7: International benchmarking – timeline sources

Publication date	Issuer	Title	Link
January 5th	WHO	Pneumonia of unknown cause – China	https://www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/
January 10-12th	WHO	Package of guidance documents for managing the outbreak of a new disease	https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance
January 13th	WHO	Diagnostic detection of Wuhan coronavirus 2019 by real-time RTPCR	https://www.who.int/docs/default-source/coronaviruse/wuhan-virus-assay-v1991527e5122341d99287a1b17c111902.pdf?sfvrsn=d381fc88_2
January 17th	ECDC	Rapid Risk Assessment: Cluster of pneumonia cases caused by a novel coronavirus, Wuhan, China, 2020	https://www.ecdc.europa.eu/en/publications-data/rapid-risk-assessment-cluster-pneumonia-cases-caused-novel-coronavirus-wuhan
January 21st	WHO	Coronavirus disease (COVID-19) Weekly Epidemiological Update and Weekly Operational Update	https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports
January 25th	ECDC	All case-definition updates	No link
February 4th	WHO	Strategic preparedness and response plan for Coronavirus	https://www.who.int/publications/i/item/strategic-preparedness-and-response-plan-for-the-new-coronavirus
February 7th	US CDC	Morbidity and Mortality Weekly Report (MMWR)	https://www.cdc.gov/mmwr/puilications/index.html

February 11th	Africa CDC	Outbreak briefs for coronavirus in Africa	https://africacdc.org/download/outbreak-brief-37-covid-19-pandemic-29-september-2020/
February 12th	KDCA	Public Health Weekly Report on COVID-19 in Korea	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&cg_code=C04
February 13th	NDCA	Contact Tracing Results - First Confirmed COVID-19 Case in Republic of Korea	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&list_no=366189&act=view
February 13th	ECDC	Laboratory readiness and response for novel coronavirus in 30 EU/EEA countries	https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.6.2000082
February 14th	US CDC	Hospital Preparedness Assessment Tool	https://www.cdc.gov/coronavirus/2019-ncov/hcp/hcp-hospital-checklist.html
February 17th	ECDC	COVID-19 Micro courses on EVA (ECDC Virtual academy)	https://eva.ecdc.europa.eu/totara/catalog/index.php?catalog_cat_browse=16005&orderbykey=text&itemstyle=narrow
March 1st	US CDC	179 guidance documents	https://www.cdc.gov/coronavirus/2019-ncov/communication/guidance-list.html?Sort=Date%3A%3Adesc
March 3rd	Africa CDC	Weekly Scientific and Public Health Policy Updates	https://africacdc.org/download/covid-19-scientific-and-public-health-policy-update-22-september-2020/
March 5th	WHO	Global Research Roadmap for novel coronavirus	https://www.who.int/blueprint/priority-diseases/key-action/Roadmap-version-FINAL-for-WEB.pdf?ua=1
March 18th	WHO	Operational considerations for managing COVID-19 cases or outbreak in aviation	https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/2020/operational-considerations-for-managing-covid-19-cases-or-outbreak-in-aviation-interim-guidance,-18-march-2020

March 23rd	ECDC	Social distancing measures, 2nd update	http://www.ecdc.europa.eu/en/publications-data/considerations-relating-social-distancing-measures-response-covid-19-second
April 1st	ECDC	Rapid test situation for COVID-19	http://www.ecdc.europa.eu/sites/default/files/documents/Overview-rapid-test-situation-for-COVID-19-diagnosis-EU-EEA.pdf
April 6th	WHO	Advice on the use of masks in the context of COVID-19	https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/2020/advice-on-the-use-of-masks-in-the-context-of-covid-19-interim-guidance,-6-april-2020
April 16th	NDCA	Contact tracing results of 1st confirmed COVID-19 case in Republic of Korea	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&list_no=366925&act=view
April 8th	ECDC	Reducing COVID-19 transmission using face masks	http://www.ecdc.europa.eu/en/publications-data/using-face-masks-community-reducing-covid-19-transmission
April 9th	ECDC	Strategies for the surveillance of COVID	https://www.ecdc.europa.eu/en/publications-data/strategies-surveillance-covid-19
April 11th	WHO	Landscape of COVID-19 candidate vaccines	https://www.who.int/blueprint/priority-diseases/key action/Novel_Coronavirus_Landscape_nCoV_11April2020.PDF
April 14th	WHO	Update to SPRP	No Link
April 23rd	US CDC	Household Pulse Survey	https://www.cdc.gov/nchs/covid19/health-care-access-and-mental-health.htm
April 24th	WHO	Scientific Brief – Immunity Passports	https://apps.who.int/iris/handle/10665/331866
May 10th	WHO	Surveillance strategies for COVID-19 human infection	https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/2020/surveillance-strategies-

			for-covid-19-human-infection-interim-guidance,-10-may-2020
May 10-14th	WHO	Public health criteria in response to COVID-19	https://apps.who.int/iris/handle/10665/332073
May 14th	US CDC	Three-step guidance for economy re-opening	https://www.cdc.gov/coronavirus/2019-ncov/downloads/php/CDC-Activities-Initiatives-for-COVID-19-Response.pdf
May 14th	KDCA	Case Study of a COVID-19 Outbreak in OO County, Republic of Korea	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&list_no=367222&act=view
May 15th	Africa CDC	COVID-19 Africa Pool Procurement Portal	https://amsp.africa/
May 15th	WHO	Scientific Brief on multisystem inflammatory syndrome	https://apps.who.int/iris/handle/10665/332095
May 21st	ECDC	Guidance for the management of airline passengers	https://www.ecdc.europa.eu/en/publications-data/covid-19-aviation-health-safety
May 25th	US CDC	COVID19 Surge – spreadsheet-based tool	https://www.cdc.gov/coronavirus/2019-ncov/hcp/COVIDSurge.html
May 28th	ECDC	Point prevalence of SARS-CoV-2 infection using RT-PCR testing	http://www.ecdc.europa.eu/en/publications-data/methodology-estimating-point-prevalence-sars-cov-2-infection-pooled-rt-pcr
May	WHO	Fact sheet- Vulnerable populations during COVID-19 response – addressing the mental health needs of vulnerable populations	https://www.euro.who.int/en/media-centre/sections/fact-sheets/2020/fact-sheet-vulnerable-populations-during-covid-19-response-addressing-the-mental-health-needs-of-vulnerable-populations-may-2020
June 17th	ECDC	Monitoring and evaluation framework for COVID-19 response in EU/EEA/UK	https://www.ecdc.europa.eu/en/all-topics-z/coronavirus/threats-and-outbreaks/covid-19/prevention-and-control/monitoring

July 3rd	ECDC	Guidance on provision of support - Medically and Socially vulnerable population	http://www.ecdc.europa.eu/en/publications-data/guidance-medically-and-socially-vulnerable-populations-covid-19
July 9th	WHO	Scientific Brief on COVID-19 transmission	https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions
July 17th	KDCA	Analysis of Quarantine Result for flights from COVID-19	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&list_no=367821&act=view
July 19th	KDCA	6-month outbreak infection report in Republic of Korea	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&list_no=368318&act=view
July 22nd	WHO	COVID-19 Law Lab launch	https://www.who.int/news-room/detail/22-07-2020-new-covid-19-law-lab-to-provide-vital-legal-information-and-support-for-the-global-covid-19-response
July 31st	Africa CDC	Africa CDC COVID-19 Response Update	https://africacdc.org/download/africa-cdc-covid-19-response-update-31-july-2020/
July 31st	KDCA	3-month outbreak infection report in Republic of Korea	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&list_no=368317&act=view
August 3rd	WHO	COVID-19 Preparedness and Response Progress Report	https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#event-147
August 7th	Africa CDC	COVID-19 Potential Outcomes Scenarios and COVID-19 Spread Simulation Tool for Africa	https://africacdc.org/news-item/africa-cdc-arc-launch-covid-19-modelling-tool-for-africa/
August 7th	WHO	Updated guidance on public health surveillance for COVID-19	https://apps.who.int/iris/handle/10665/333752

August 21st	WHO	Guidance on the use of masks for children	https://apps.who.int/iris/handle/10665/333919
August 26th	WHO	COVID-19 Essential Supplies Forecasting tool	https://www.who.int/publications/m/item/covid-19-essential-supplies-forecasting-tool
September 1st	US CDC	COVID-19 Science Updates	https://www.cdc.gov/library/covid19/scienceupdates.html?Sort=Date%3A%3Adesc
September 3rd	KDCA	Summary - Relationship between COVID-19 and Cardiovascular Disease	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&list_no=368315&act=view
September 3rd	KDCA	9-1st Edition of the COVID-19 Response Guidelines	https://www.cdc.go.kr/board/board.es?mid=a30501000000&bid=0031&list_no=368316&act=view
September 9th	Africa CDC	Public Health and Social Measures report for member states	https://africacdc.org/download/finding-the-balance-public-health-and-social-measures-in-senegal/
September 17th	ECDC	Baseline projections of COVID-19 in EU/EEA and UK	https://www.ecdc.europa.eu/en/publications-data/baseline-projections-covid-19-eueea-and-uk-update
	ECDC	Graphics and Posters published on COVID-19	https://www.ecdc.europa.eu/en/covid-19-pandemic
	Africa CDC	Participation in #WorldMaskWeek with @PandemicAction	https://africacdc.org/news-item/world-mask-week-visuals/
	Africa CDC	Webinars on COVID-19 emergency response and preparedness	https://africacdc.org/video/africa-cdc-one-health-and-covid-19-webinar/
	Africa CDC	Press Briefings on COVID-19	https://africacdc.org/video/live-13th-africa-cdcs-press-briefing-on-covid-19/
	Africa CDC	Solidarity concert to raise money on Africa Day 2020	https://africacdc.org/video/live-solidarity-concert-for-the-covid19-response-fund-africa-day-2020/

	WHO	Press Briefings	https://www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/press-briefings
	WHO	Launch of #WearAMask challenge on social media	https://twitter.com/DrTedros/status/1291056191569887233?s=20
	Korea CDC	Colorful, informational flyers published with social distancing guidelines	http://www.cdc.go.kr/gallery.es?mid=a30505000000&bid=0010
	US CDC	Social Media Toolkit on social distancing, mask wearing, contact tracing	https://www.cdc.gov/coronavirus/2019-ncov/communication/social-media-toolkit.html

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