



Feasibility study on digital technology for cross-border contact tracing

Final report

Specific Contract No SC 2021 P1 03 in the context of the Single
Framework Contract Chafea/2018/Health/03

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List of Abbreviations

Abbreviation		Definition					
API		Advance Passenger Information					
CNAM		French National Health Insurance					
COVID-19		SARS-CoV-2 virus					
CT		Contact tracing					
DG SANTE		European Commission’s Directorate-General for Health and Food Safety					
DHIS2		District Health Information Software					
DPIA		Data protection impact assessment					
dPLF		Digital Passenger Locator Form					
EC		European Commission					
ECDC		European Centre for Disease Prevention and Control					
EDPB		European Data Protection Board					
EEA		European Economic Area countries					
ePLF		Passenger Locator Form exchange platform					
EU		European Union					
EUdPLF		European digital Passenger Locator Form					
EWRS		Early Warning and Response System					
GDPR		General Data Protection Regulation					
HSRM		Health System Response Monitor					
ID		Infectious Diseases					
IHR		International Health Regulations					
MoH		Ministry of Health					
Mpox		Monkeypox					
MS		Member States					
NFP		National Focal Point					
NPLF		National Passenger Locator Form					
PHA		Public Health Authority					
PHS		Public Health Services					
PNR		Passenger Name Record					
PTC		Pre-travel clearance form					
SORMAS		Surveillance, Outbreak Response Management and Analysis System					
STI		Sexually transmitted infection					
WHO		World Health Organization					
WHS		Whole Genome Sequencing					
European Union (EU) Member States							
Austria	(AT)	Estonia	(EE)	Italy	(IT)	Portugal	(PT)
Belgium	(BE)	Finland	(FI)	Latvia	(LV)	Romania	(RO)
Bulgaria	(BG)	France	(FR)	Lithuania	(LT)	Slovenia	(SI)
Croatia	(HR)	Germany	(DE)	Luxembourg	(LU)	Slovakia	(SK)
Cyprus	(CY)	Greece	(EL)	Malta	(MT)	Spain	(ES)
Czechia	(CZ)	Hungary	(HU)	Netherlands	(NL)	Sweden	(SE)
Denmark	(DK)	Ireland	(IE)	Poland	(PL)		
European Economic Area (EEA) Countries							
Iceland		(IS)		Norway		(NO)	
Liechtenstein		(LI)					
Non-EU/EEA countries included in the study							
Switzerland				(CH)			
United Kingdom				(UK)			

Executive summary

Introduction

Large scale cross-border contact tracing (CT) was conducted among European Union and European Economic Area (EU/EEA) countries during the COVID-19 pandemic through the selective exchange module of the electronic EWRS (Early Warning and Response System) of the European Union (EU). The European Commission's Directorate-General for Health and Food Safety (DG SANTE) commissioned a study to assess the lessons learned from the use of the EWRS and to identify future directions for cross-border CT. This was done by examining the processes and digital technologies that have been used at national, EU and international level for cross-border CT, and by identifying challenges and facilitators, including legal barriers. The Commission was interested in identifying areas where EU-support is needed, in line with the overall goal of contributing to the strengthening the EU's health security framework, and specifically assess the feasibility of linking national and EU-level digital CT technologies to the EWRS. The study was conducted by the EUHealthSupport consortium between June 2022 and July 2023.

Background and approach

Cross-border CT is defined as CT that takes place between two or more countries. Data that needs to be shared between countries to facilitate cross-border CT relates to travellers (by transport modes such as air, water, and ground) who tested positive for an infectious disease, such as COVID-19 and Monkeypox (Mpox), as well as their potentially exposed contacts. The study focused on cross-border CT in the 30 EU/EEA countries, with additional data from two neighbouring non-EU countries, including travel with planes as the most common transport method involving CT among the countries.

Based on the literature review and scoping discussions, which were conducted at the start of the study, a conceptualisation and graphic were developed on the flow of data within and between two countries identifying the key actors and categories of digital technologies used for CT during COVID-19 (Figure 1).

Given that the dataflows identified in the model below are between jurisdictions, the study also looked at the key legal instruments of the European Union (EU) and World Health Organisation (WHO) that provide the legal basis for international cross-border CT in EU/EEA and non-EU/EEA countries:

- *WHO International Health Regulations (IHR)*
- *Decision No 1082/2013/EU* which was repealed and replaced by *Regulation (EU) 2022/2371*

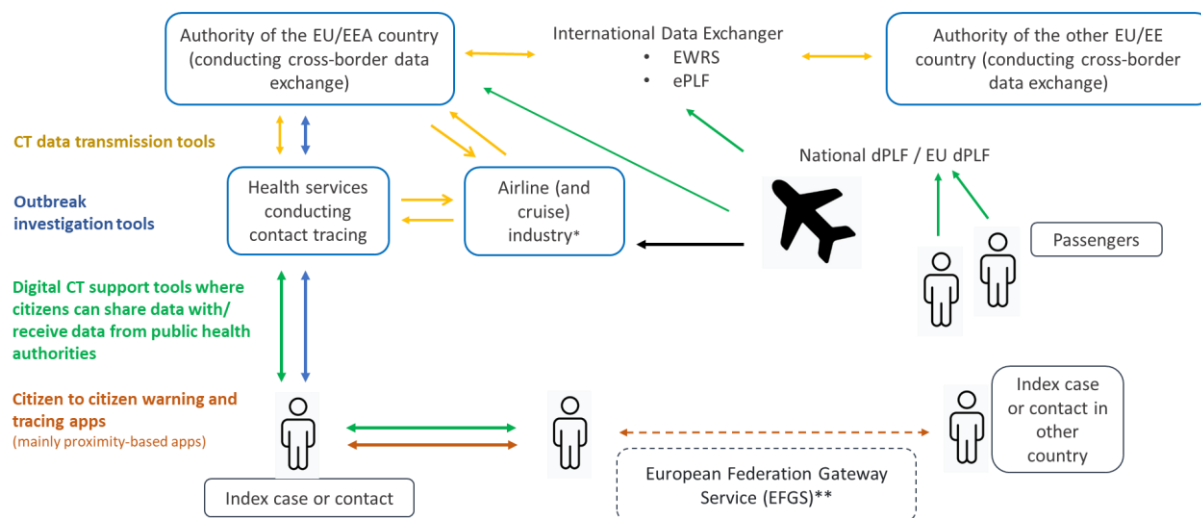
In addition to the above key international legal instruments related specifically to public health, the EU General Data Protection Regulation No 2016/679 (GDPR) as well as the national laws and national emergency laws that remain applicable in the case of public health threats were also explored.

Study questions were the following:

- What are the main challenges and facilitators for carrying out cross-border CT in EU/EEA countries?
- What (national and subnational) digital tools could be integrated into EWRS, and how could they be integrated to allow a more efficient and effective CT across borders?
- How do countries envision the future of international travel-related CT in Europe, including using EU digital Passenger Locator Forms (EU dPLFs) or national dPLFs?
- In what areas would EU-level support be valuable for facilitating cross-border CT?

Figure 1. Digital tools used for CT in EU/EEA countries during COVID-19

Digital technology used in contact tracing during COVID-19



CT data transmission tools (yellow): Digital technology that contributes to the transmission of CT data between the public health institutes or agencies, Public Health Authorities (PHAs) and other organisations. - **Outbreak investigation tools (blue):** Platforms and tools, such as CT case management systems used by PHAs to support the core tasks of CT. - **Digital CT tools where citizens can share data with/receive data from PHAs (green):** e.g. Online forms (including dPLF and EUdPLF) for collecting and sharing travellers' data with health authorities and digital contact tracing support (DCTS) tools for citizens to share their contacts with health authorities. - **Citizen to citizen warning and tracing apps (orange):** These are mainly proximity-based apps for detecting people who have been near to a person with an infection and possibly exposed to the infectious agent, using Bluetooth, Wi-Fi or GPS.

Methods

For this comprehensive mixed methods study, data were collected by means of the following:

1. A literature review on scientific and grey literature;
2. A comprehensive survey with largely open answer fields offered to all EU/ EEA countries to which 23 countries responded in December 2022-January 2023;
3. Semi-structured interviews with nine EU Member States (Austria, Czech Republic, Germany, Finland, France, Latvia, Malta, the Netherlands and Spain) and two non-EU countries (Switzerland and the United Kingdom); and
4. Two webinars with participants from various EU/EEA countries in which members of the Health Security Committee, Joint Controllers Group on EWRS and ePLF as well as members of relevant networks of European Centre for Disease Prevention and Control (ECDC) took part.

Survey and interview data were mainly analysed qualitatively with open coding followed by thematic analysis around research questions. The webinars were used to validate preliminary findings, obtain further insights, and discuss future perspectives.

Findings on national and cross-border CT practices and digital technology in EU/EEA countries in relation to COVID-19

In most countries, national public health institutes or agencies were responsible for cross-border CT and regional Public Health Authorities (PHAs) were responsible for subnational and national CT within countries. Countries used a large variation of CT digital tools, which were divided into the four categories (see Figure 1 above and Table 1, page 14): (1) Outbreak investigation and management tools, including CT case management systems (2) Digital CT tools where citizens and PHAs can share data, (3) Citizen-to-citizen warning and tracing apps, and (4) CT data transmission tools. Countries

varied in the number of CT case management tools used to register cases and their contacts: from no or one main case management system to various case management systems in different regions in a country.

A number of challenges for CT were identified during the COVID-19 pandemic due to the ease at which the virus spread, the large number of cases and the high levels of morbidity and mortality. The surge in cases led to insufficient human resources to conduct CT within most countries and some countries lacked digital technology that could have supported with the registration of all the cases and their contacts. Countries found that it could be difficult to obtain contact details from the public during CT especially in the later phases of the pandemic. Due to the decentralised organisation in most countries (see Table 7, page 32), CT was usually conducted, and relevant data stored at regional/subnational level. Several countries reported a lack of integration of policies, CT processes and digital technology among regions, making it difficult to share CT data or agree on guidelines. Several countries also reported that databases registering relevant CT data, such as test results or vaccine status, were not linked to the same cases registered in other digital systems. Most countries introduced new law(s) to enable the scale of CT that was required during the pandemic, with most of them using sunset clauses for legislative acts, meaning that many are now no longer in place.

To mitigate the transmission of the virus by people travelling between countries, cross-border CT was also conducted. Most authorities conducting cross-border CT received data from regional PHAs by secure mail or phone. Therefore, a lot of manual work was required, which was time-consuming and could be prone to error. They often received no response from other countries regarding the data they had sent and therefore did not know how the data had been handled. Several countries reported issues with missing information, errors, and delays in the CT data they received from other countries. There were also issues when it came to obtaining passenger data from airlines. As airlines were often reluctant to share these data, even though most countries confirmed that this practice had a legal base in national legislation, the data could also be late or incomplete. Different CT policies in each country meant that countries had varying definitions for CT-relevant concepts such as 'close contacts', which had implications for the type and quantity of data they shared with other countries. Cross-border CT practices also varied regarding when data sharing should continue or discontinue, meaning that over the course of the COVID-19 pandemic, data sent by one country was sometimes not acted upon by the receiving country. Doubts were expressed by countries as to the added value of conducting cross-border CT, especially at later stages of the pandemic when all countries faced high numbers of cases.

To address these issues, countries were compelled to devise strategies for conducting CT as efficiently as possible to try to curb the transmission of the virus. Large numbers of additional workforce members were recruited from various medical and non-medical fields, and new CT units, working spaces and materials were created. Digital case management systems were adjusted, upgraded, or newly developed to accommodate the rising numbers of cases. Additional tools including proximity-based apps were developed and new technology led to improved access to and monitoring of lab and vaccination data.

Special organisations were set up to implement national guidelines to be used across regions within a country, with some countries trying to standardise procedures as much as possible. Just over half of all countries reported using the same CT case management to register data. When it became too difficult to keep up with case numbers, CT policies adjusted to focus more on high-risk cases and their contacts. Several countries reported a shift to self-service by citizens to support the CT process and relieve the burden on PHAs conducting CT. Instead of lengthy phone calls between PHAs and index cases to obtain contact details, citizens were directed to online forms, for example, to fill in their contact details and at times they were asked to inform their contacts themselves. PHAs in several countries sent SMS messages to contacts instead of calling them, to inform them of their risk of exposure and to provide instructions on further steps to take. The evolving pandemic led countries to have to adopt a dynamic approach to CT strategies.

When countries reached a community level transmission and were often overwhelmed with cases at the national level, they chose to focus more on transmission within the country and cross-

border CT was often deprioritised. Bilateral communication between specific countries was considered beneficial, as well as policy decisions that limited cross-border CT only to certain conditions during the pandemic. Tools such as the EWRS and the EUdPLF were generally considered useful when it came to facilitating cross-border CT with EU/EEA countries, however most of the countries also kept using secure email.

Findings on the EWRS selective exchange module and integration of national tools

Despite countries' positive perspectives on the EWRS for being a safe and generally efficient platform, it was considered less efficient in peak periods of the pandemic, as it was labour-intensive. There was a need for definition of minimally required data and a standardised structure to share data through the EWRS to improve data quality, timeliness, and coordination between countries. According to MS, inclusion of dPLF data as part of the EWRS selective exchange could lead to better coordination of sharing data as well as increase usability, especially if all countries used dPLFs and the dPLFs were completely integrated.

The integration or linkage of national and subnational digital CT technologies into EWRS was considered to be beneficial for countries, to increase efficiency and effectiveness of cross-border CT. From the legal perspective, EWRS is a secure and GDPR compliant platform for sharing CT data with Regulation (EU) 2022/2371 permitting the continuous development of EWRS allowing for the use of modern technologies.

However, there were challenges in terms of organisational and policy aspects. There was a large variation in number/type of organisations involved in regular and cross-border CT in countries. Smaller countries excluded, most countries had a decentralised organisation of CT, where regional organisations had the most prominent role and managed the digital technologies used for CT, whereas guidance on when and how to carry out CT came from national authorities. From an organisational perspective, there appeared to be a low feasibility of integration of national and subnational digital CT technologies into EWRS, except for smaller countries and a few countries where CT (technology) was relatively centralised or being centralised.

From a technological perspective, there was a large variation in types of digital CT case management systems across and within countries and well known platforms such as Go.Data and SORMAS had limited use. A national EWRS operator conducting cross-border CT often got the data from (sub)national actors such as local or regional PHAs with secure email and by telephone and platforms, such as online forms. Having a very large variety and limited integration of national and subnational outbreak management systems used for CT in EU/EEA countries significantly limits the feasibility of linking them to EWRS.

For these reasons, the feasibility of integration of (sub)national tools into EWRS is limited at this moment. In current circumstances, an option would be to provide access to subnational actors for those countries who wish to have this. This can in particular improve timeliness and efficiency of cross border CT for larger countries with a decentralised organisation.

Findings on international travel-related CT in Europe

During the COVID-19 pandemic, almost all EU/EEA countries who responded the survey received passenger data from airlines for CT purposes on the basis of national (public health) laws or legislation adopted as response to COVID-19. However, this data often came with delays or were sometimes incomplete or incorrect. Several countries wished to have direct or easier access to passenger data, rather than communicating requests for data individually with each airline, but this is not possible under current EU and national legal frameworks.

When direct access to or direct availability of passenger data was not possible, using the dPLF (in particular EUdPLF) was often regarded as the next best option during pandemics or other large outbreaks. Using the national dPLF or EUdPLF increases efficiency, improves data security, accessibility and quality. During the COVID-19 pandemic, four countries used EUdPLF, but several countries reported they would consider using it if legal barriers were removed or that they were indeed already

preparing to join the EUdPLF. Legal challenges specific to EUdPLF were related to data storage concerns as well as the need for further considerations to amend national laws. The benefits, evidence of the effectiveness and efficiency of dPLFs, as well as proportionate use of dPLFs, especially balancing the public health benefit with potentially infringing the privacy of travellers, need to be further investigated. Most countries relied on new legislation with a sunset clause to introduce PLFs and would again need new legislative acts to re-activate these tools. Decision on whether to use PLFs and under what circumstances is an important national competence for pandemic preparedness.

Recommendations on potential areas of EU-level support to enhance cross-border CT with particular focus on digital tools

Surveys, interviews and webinars indicated the following potential areas where EU-level support would be valuable:

Potential EU-level action for cross-border CT:

- Developing evaluation frameworks and examining the evidence for effectiveness of performing cross-border CT to reduce transmission in the country of origin or destination, and during journeys by collective transportation means.
- Providing guidance on when to activate/deactivate cross-border CT in EU/EEA countries with a risk-based approach tailored to the context and needs of countries.
- Sharing minimum system requirements/functionalities for (sub)national CT technologies as several countries are moving forward with developing national or subnational systems for CT for future outbreaks.

Potential developments for EWRS:

- Facilitating sharing of country-specific and up-to-date CT-relevant measures and policies through common platforms, such as the EWRS, to support the alignment between countries in cross-border CT (while at the same time retaining country autonomy) on which countries can decide to send outgoing CT requests during outbreaks, the type of data to share, when to send this data, and in the definitions of CT-relevant concepts, such as 'close contacts'.
- Providing a system or development of a module that allows subnational actors to have access to EWRS selective exchange to share cross-border CT data.

Other potential areas of need:

On legal and ethical aspects

- Supporting the implementation of Regulation (EU) 2022/2371 in the context of digital technologies through EU engagement and discussions with MS.
- Guidance on how to apply GDPR to digital technology used for national and cross-border CT.
- Development of codes of practice for ethical CT when using digital technologies, along with codes to protect the privacy and fundamental rights of citizens.
- Creation of standardised data-sharing templates with the involvement and agreement of the European Data Protection Board (EDPB) to build acceptance of CT data sharing as a GDPR compliant form of data processing.

On collaboration across EU/EEA countries

- Providing an EU platform or other means to exchange good practices among EU/EEA countries on national and cross-border CT regarding issues such as organisation of CT with subnational actors, collaboration with airlines, standards of digital CT technologies, and ethical principles in CT for Sexually Transmitted Infections (STIs) and other diseases transmitted through close contact.

On collaboration beyond EU/EEA countries

- Development or identification of a GDPR compliant platform for sharing CT data with countries outside EU/EEA.

1. Introduction

1.1 Introduction to the EU feasibility study

The EUHealthSupport Consortium has undertaken a study commissioned by the European Commission's Directorate-General for Health and Food Safety (DG SANTE) to examine cross-border contact tracing (CT) among European Union and European Economic Area (EU/EEA) countries. Cross-border CT is defined as CT that takes place between two or more countries and the data to be shared pertains to travellers (by transport modes air, water and ground) who have tested positive for an infectious disease, such as COVID-19, as well as their potentially exposed contacts. The study focuses on CT data-exchange carried out in Europe through the Early Warning and Response System (EWRS) selective exchange module and aims to examine the digital technologies that have been used at national, EU and international level during the COVID-19 pandemic, to serve the overall goal of contributing to the strengthening of the EU's health security framework. To enable this, the European Commission (EC) would like to determine the feasibility of linking digital CT technologies to the EWRS.

To enable a more effective sharing of cross-border CT data, the EC would like to obtain information on the digital technology used for CT at national, European Union (EU) and international level by Member States (MS). This is needed to shed more light on the results of, a survey conducted by the EC in 2022 with national focal points (NFPs). The survey revealed that most of the countries recognise the need for a platform, such as the Passenger Locator Form exchange platform (ePLF), to enable a faster exchange of passenger data for CT purpose, and that it would be beneficial to connect the ePLF to the EWRS selective exchange module to ultimately improve the effectiveness of international travel-related CT in Europe for COVID-19 and other infectious diseases.

The present study explores overall gaps and challenges in CT practices and highlights where there are solutions and windows of opportunity to improve CT practices. Key issues examined were the following:

- What are the main challenges and facilitators for carrying out cross-border CT in EU/EEA countries?
- What (national and subnational) digital tools could be integrated into EWRS, and how could they be integrated to allow a more efficient and effective CT across borders?
- How do countries envision the future of international travel-related CT in Europe?
 - What are their experiences and views toward using EU dPLFs or national dPLFs integrated with ePLF?
 - What are their views towards linking these tools (EUdPLF and ePLF) with the EWRS?
- What are countries' future plans regarding use of different digital tools and applications and their utilisation for other communicable disease scenarios?
- In what areas would EU-level support be valuable for facilitating cross-border CT?

The study included the 30 EU/EEA countries, as well as two neighbouring non-EU countries (the United Kingdom (UK) and Switzerland (CH)). The EU countries are Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (EL), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), the Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES) and Sweden (SE). Additional EEA countries are Iceland (IS), Liechtenstein (LI), and Norway (NO). Countries will be referred to with these codes in the rest of the document.

1.2. Introduction to the final report

To investigate the research questions, the EUHealthSupport Consortium conducted a comprehensive mixed methods study. This final paper provides the findings gained from various sources of data brought together in the various phases of the study. In the first phase a **literature review** report was conducted, which was used to develop the frameworks for analysing the digital technology, the organisation of CT in countries and legal aspects. This framework for analysing digital technology consisted of four categories of digital technology used by public health services (PHS) and citizens for CT (see chapter 2 for more detailed information). Other than this, the literature review yielded limited information as it was skewed towards proximity-based apps. Second, a **comprehensive survey** was conducted and completed by EU/EEA countries in December 2022 and January 2023. The survey aimed to collect data on regular and cross-border CT practices, experiences, digitalisation, and legal frameworks, and identify lessons learnt from the COVID-19 pandemic in relation to CT and strengthening of cross-border CT practices at national, EU and international level. Third, **interviews** were conducted, from January to March 2023, with nine EU/EEA and two non-EU countries, investigating what national and international level barriers or facilitators impacted countries' ability, willingness or obligation to conduct cross-border CT. Finally, two **webinars** were held on the 6th of March and the 21st of April 2023, respectively, to validate preliminary findings from the literature review, survey and interviews and discuss future perspectives for cross-border CT in Europe.

This final report has been written by combining the four phases outlined above. The outline of the final paper is as follows:

- **Chapter 1** provides an introduction to the general study and this specific report, as well as the key questions that will be addressed.
- **Chapter 2** focuses on background information that is relevant to this study with regard to national and cross-border CT, and digital technology for CT.
- **Chapter 3** provides additional details pertaining to the various methods used in this study, as well as a description of the study population that provided the data.
- **Chapter 4** presents the findings regarding national and cross-border CT practices, digital CT technology and legislation in EU/EEA countries. These findings relate to COVID-19, as well as other infectious diseases.
- **Chapter 5** focuses mainly on the future of cross-border CT in EU/EEA countries. Several subsections cover topics, including countries' perspectives of the EWRS selective exchange module, the EUdPLF and national dPLFs; their experiences and views toward obtaining passenger data from airlines; and the ways in which countries would like digital technological and non-technological support from the EU for national and cross-border CT.
- **Chapter 6** presents the main conclusions and recommendations.

This report focuses on presenting the most important findings that serve the overall goals of the study. Some sections will refer to appendices in which additional information is given. Further details can be found in the separate literature review, survey, and webinar reports of the study.

2. Background: national and cross-border CT and digital technology

2.1 Relevance of cross-border CT

Contact tracing (CT) is an essential and effective measure when it comes to containing the transmission of infectious diseases⁽¹⁾. This process traditionally consists of identifying and notifying the contacts of index cases (individuals who have tested positive to an infectious disease), followed by monitoring the health of index cases and their contacts. Index cases and their contacts are provided with instructions on further steps to take, such as isolating (if having tested positive) or quarantining (if having been exposed to an index case). In many countries, local Public Health Authorities (PHAs) are responsible for conducting CT, whereas in some countries, centralised organisations are responsible.

As infectious diseases can spread into other countries via different routes including travellers, it is also important that CT enables the timely tracing of individuals who have become infected due to exposure before or during travel (index cases), as well as anyone they may have exposed before, during or after travel (contacts). Studies have shown that infectious agents spreading to other countries can drive up infection rates substantially in those countries⁽²⁾. Collective transport vehicles, such as airplanes, can also lead to large numbers of exposed and high-risk contacts, due to the proximity between passengers for lengthy periods of time^(3, 4). Timely cross-border CT may not only be essential for infectious disease outbreaks that may reach epidemic/pandemic proportions, but also in the scenario of a single or few case(s) of imported diseases with a severe impact (such as Ebola or other viral haemorrhagic fevers). This will enable early disease recognition, early treatment, if available, and the prompt implementation of measures to prevent onward transmission⁽⁵⁾.

2.2 Digital technology for CT

Digital technology is being explored by many countries worldwide as a mechanism to assist with different components of CT, as well as with the collection and sharing of CT data. As a result of the COVID-19 pandemic, which has overburdened CT functions within PHA^(6, 7), countries have been developing digital tools to facilitate the CT process. Some digital tools are geared to public health professionals, such as outbreak and management tools that enable the registration, storage, and exchange of CT data. Other tools are intended for citizens, such as the proximity-based apps. Our study identified four main types of digital tools used for CT (Table 1):

Table 1. Types of digital technologies used by PHA and citizens for CT

Outbreak investigation and management tools	Platforms and tools, such as CT case management systems used by PHAs to support the core tasks of CT including the registration of data relating to index cases and their exposed contacts, and the storing and sharing of CT data across authorities for purposes such as surveillance and international data-exchange. Examples of these tools identified during the literature review include the WHO's digital application Go.Data, which has been used in many countries ⁽⁸⁾ , the tools District Health Information Software (DHIS2) ⁽⁹⁾ and Surveillance, Outbreak Response Management and Analysis System (SORMAS®) ⁽¹⁰⁾ .
Digital CT tools where citizens can share data with/receive data from PHAs	These include online forms (including dPLF and EUdPLF) for collecting and sharing data on travellers with relevant health authorities and digital CT support tools (DCTS-tools). The digital tools dPLF and EUdPLF are discussed further on. DCTS-tools (e.g., websites or mobile apps) mimic traditional CT by enabling citizens to assume at least some of the tasks required for CT, such as collecting their contact details themselves. This information can then be shared with health services conducting CT. These tools can be used for three main phases of CT a) case and contact investigation (supporting PHA in the investigation of cases and/or contacts), b)

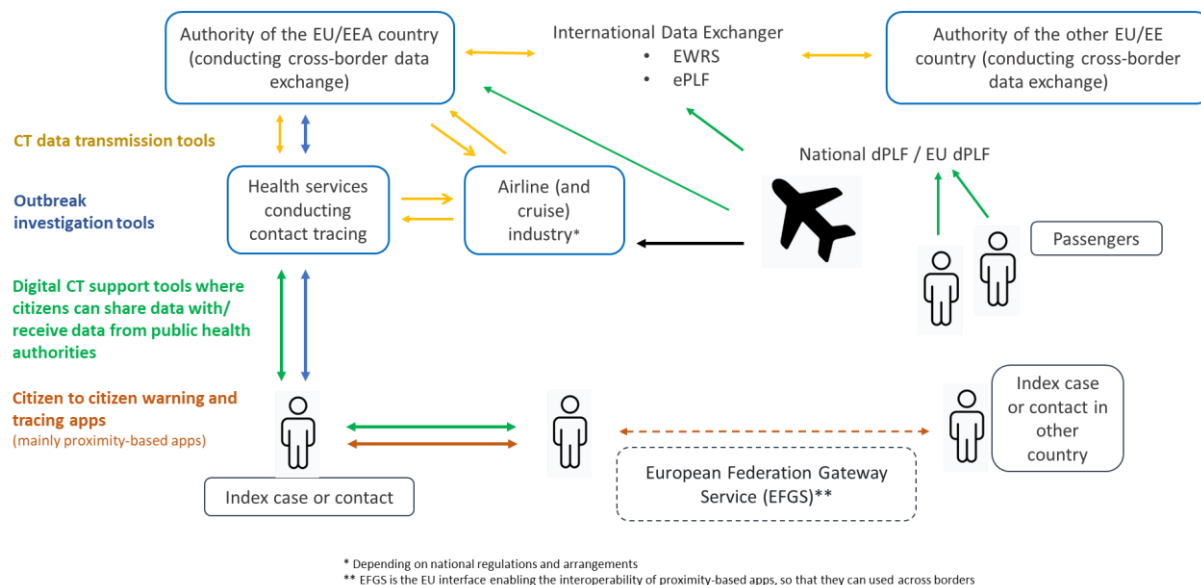
	contact notification (allowing PHA to notify contacts) and c) remote monitoring of the health of index case and contacts by PHAs ⁽¹¹⁾ .
Citizen to citizen warning and tracing apps (mainly proximity-based apps)	Proximity-based apps are mobile applications for citizens that have been developed in many countries for detecting people who have been near to a person with an infection and possibly exposed to the infectious agent, using Bluetooth, Wi-Fi or GPS ⁽¹²⁾ . These apps can have functionalities that enable citizens to share data with health services conducting CT, but they are generally used outside of the scope of these health services. DCTS-tools (described earlier) can also fall within this category when they are used by index cases to notify their contacts and provide them with instructions themselves.
CT data transmission tools	These types of digital tools have been coined by the EUHealthSupport Consortium to refer to the digital technology that contributes to the transmission of CT data between the public health institute or agency in charge of cross-border data exchange and other organisations in a country such as secure email, Excel, encrypted server (e.g., FTP server), online form or a secured communication platform (e.g., the EWRS).

Among the cross-border CT technologies, the EUdPLF and the ePLF were developed during the COVID-19 pandemic to facilitate the exchange of passenger data across EU/EEA borders. The EUdPLF is an online form and database for collecting and sharing passenger data with other countries, and it can be customised to each country's needs. PLFs (in paper or digital form, i.e., dPLF)⁽¹³⁾ had already been developed by the WHO (before the COVID-19 pandemic) as traveller documents for passengers of airplanes and other modes of transportation (e.g., ships or trains). They are used to collect personal information (e.g., contact details), so they can be traced in case of exposure for CT purposes. They may also be used in combination with other types of data, such as symptoms, vaccine certificates, negative test results or quarantine requirements. It is possible to connect many countries' dPLFs to the ePLF, a platform enabling the exchange of data with other countries. Countries that do not have dPLFs, or who's national dPLFs cannot connect with the EU exchange platform, can make use of the EUdPLF, which is already connected to the ePLF. During the COVID-19 pandemic, only four EU countries implemented the EUdPLF (FR, IT, MT and SI), and one additional country joined the ePLF platform with their national dPLF (ES). Reasons reported by EU countries for not using the EUdPLF or the ePLF included already having developed their own national PLFs, and concerns about legal aspects, such as data protection. Although many countries were interested in using the EUdPLF, there were countries that were less interested in the EUdPLF and plan to continue to use only EWRS for cross-border CT⁽¹⁴⁾.

The graph below depicts where the types of technology presented in Table 1 are used in the cross-border CT process, as well as the relevant actors and organisations involved (Figure 1).

Figure 1. Digital tools used for CT in EU/EEA countries during COVID-19

Digital technology used in contact tracing during COVID-19



Digital tools used for cross-border CT include the EWRS selective exchange functionality, the exchange platform ePLF and the EUdPLF⁽¹⁵⁾.

The EU regulatory framework (Regulation EU 2022/2371⁽¹⁶⁾ and before that the Decision No 1082/2013/EU⁽¹⁷⁾ which will be introduced in following sections) enables PHAs of the EU MS and EEA countries to use the EU EWRS and send selective exchange messages with personal data for cross-border CT purposes. The current selective exchange provides the functionality to exchange messages, using simple text and transfer attachments, without an agreed structure. The Commission Recommendation 2017/1140⁽¹⁸⁾ defines the procedures for the exchange of personal data and the type of variables, which can be exchanged using EWRS.

After the adoption of the new Regulation in November 2022, the EC proposed a number of developments for structured cross-border CT. The first development is reviewing the variables that can be exchanged for cross-border CT, updating the Commission Recommendation 2017/1140⁽¹⁸⁾. Second, the EWRS's new architecture will support the selective exchange for CT becoming an independent module, which will provide the ability to separate data access to specific users. The CT officers will be nominated by the MS Authorities, thus limiting the exposure of the sensitive data. The system will enable importing of CT data to the selective exchange messages and will also allow sharing with multiple recipient countries, while limiting actual access only to those involved. Appendix A provides a more detailed description of these developments.

Third, the working hypothesis is about integration of the ePLF to the EWRS selective exchange module, which is currently being considered by EWRS managers. The ePLF platform can support the exchange of traveller CT data, collected by the national dPLFs, including those countries that are linked with the EUdPLF. This integration will allow the EWRS to receive CT data from the ePLF system and to display it to the recipient country/countries via the EWRS selective exchange functionality.

2.3 Legal aspects of cross-border CT

There are two key international legal instruments (WHO and EU legislation) that provide the legal basis for international cross-border CT in EU and non-EU countries:

- **WHO International Health Regulations (IHR)**⁽¹⁹⁾: WHO MS are required to prevent, protect, control and provide a public health response to the international spread of certain diseases. The 194 countries that have signed these regulations need to have a national focal point that is responsible for exchange of health-related data on the diseases included in the IHR, using the WHO IHR platform.
- **Decision No 1082/2013/EU** of the European Parliament and the Council on serious cross-border threats to health^(17, 18): Decision No 1082/2013/EU established the EWRS through which MS authorities are obliged to notify alerts in relation to serious cross-border threats to health to a centralised platform. In cases where personal data need to be shared to facilitate CT, the Decision states that sharing personal data for the purpose of CT can only be done through the selective messaging functionality, which ensures the required security and confidentiality.

Decision No 1082/2013/EU has been repealed and replaced by **Regulation (EU) 2022/2371**⁽¹⁶⁾ on serious cross-border threats to health. This came into effect on 26th December 2022, following publication in the Official Journal of the European Union on 6th December 2022. The new regulation provides a more robust mandate for coordination and obligates EU MS to convey information on communicable diseases and other serious health threats with a potential cross-border dimension. Adding to the framework of the Decision, the Regulation will do the following: (1) Develop an EU health crisis and pandemic plan to complement national plans, the Commission will establish a preparedness and response plan; (2) Enhance risk assessments for health threats; (3) Increase power to enforce a coordinated response at EU-level; (4) Improve the mechanism for the recognition of and response to public health emergencies and (5) Strengthen surveillance systems.

In addition, there are national laws and national emergency laws that are applicable in the case of public health threats to establish the main characteristics of legal frameworks essential for pandemic preparedness. Data protection and data sharing arrangements across EU/EEA countries form a cross-cutting element of the legal framework. The requirement for lawful data processing, which is essential for CT, is a core part of the General Data Protection Regulation No 2016/679 (GDPR)⁽²⁰⁾.

2.3.1 Regulation (EU) 2022/2371 and the EWRS

Under the Regulation⁽²¹⁾, the EWRS ensures that national authorities and the Commission are informed about a serious cross-border threat to health in a timely manner and that a line of permanent communication is open (Art.18). It also provides for the continuous update of EWRS allowing for the use of modern technologies such as digital mobile apps, artificial intelligence models, or other automated CT technologies. The European Centre for Disease Prevention and Control (ECDC) in close cooperation with MS will facilitate interoperability with national systems for the purposes of EWRS.

The Regulation sets out mechanisms for the protection of personal data when utilising the EWRS selective messaging functionality for the purposes of CT only (Art.28). A selective messaging functionality will allow personal data, including contact and health data, to be communicated only to the national competent authorities involved in CT measures and medical evaluation procedures. The sharing of personal data necessary for the purpose of CT is permitted within the Regulation (Art. 19(3)(k)). Data will automatically be deleted from the selective message functionality 14 days after posting.

Regulation (EU) 2022/2371 allows for the exchange of personal data using CT technology, where necessary, and specifies that data should be retained for no longer than is required by national authorities in the context of their CT activities (Art.28(5)). Provision for delegated Acts is made within the Regulation, which will detail EWRS compliance with the GDPR and lists the categories of personal data that may be exchanged for the purpose of CT (Art.28(6)). Additional provision is made for implementing Acts which will set out procedures for the interlinking of EWRS with CT systems at Union and international level in addition to the modalities for processing CT technologies and their interoperability in compliance with GDPR (Art.28(7)). For the legal provisions, please refer to Appendix B.

2.4 CT at national and international level within Europe

2.4.1 National level

At the time of the study, there was limited information available in the literature regarding how CT for COVID-19 has been conducted nationally in EU and EEA countries throughout the pandemic. The available information stems mainly from 2020^(22, 23, 24). In 2020, the organisations conducting CT varied between countries and changed over time. CT was mainly carried out by public health services, but in some countries CT was conducted by call centres, General Practitioners, and other physicians or hospital staff⁽²³⁾. As the pandemic progressed, particularly when infection rates reached high levels, there were changes in the ways that organisations conducted CT. In DK, for example, there was a gradual shift in CT from a central CT organisation (the Danish Patient Safety Authority) to municipalities carrying out CT in early 2021. During the second wave of infections after the summer of 2020, many countries needed to increase their staff by enlisting volunteers or hiring others (e.g. medical students, members from the armed forces and civil servants⁽²⁴⁾). The CT approaches were also modified in many countries when the outbreak size was large and CT services were overburdened. Index cases, for example, were asked to identify and inform their own contacts regarding the requirement to go into quarantine and to monitor their own health. CT activities conducted by CT health services were focused on high-risk index cases and their contacts, e.g. index cases who were not able to identify and inform all their contacts, or whose contacts already had health issues⁽²³⁾.

2.4.2 International level

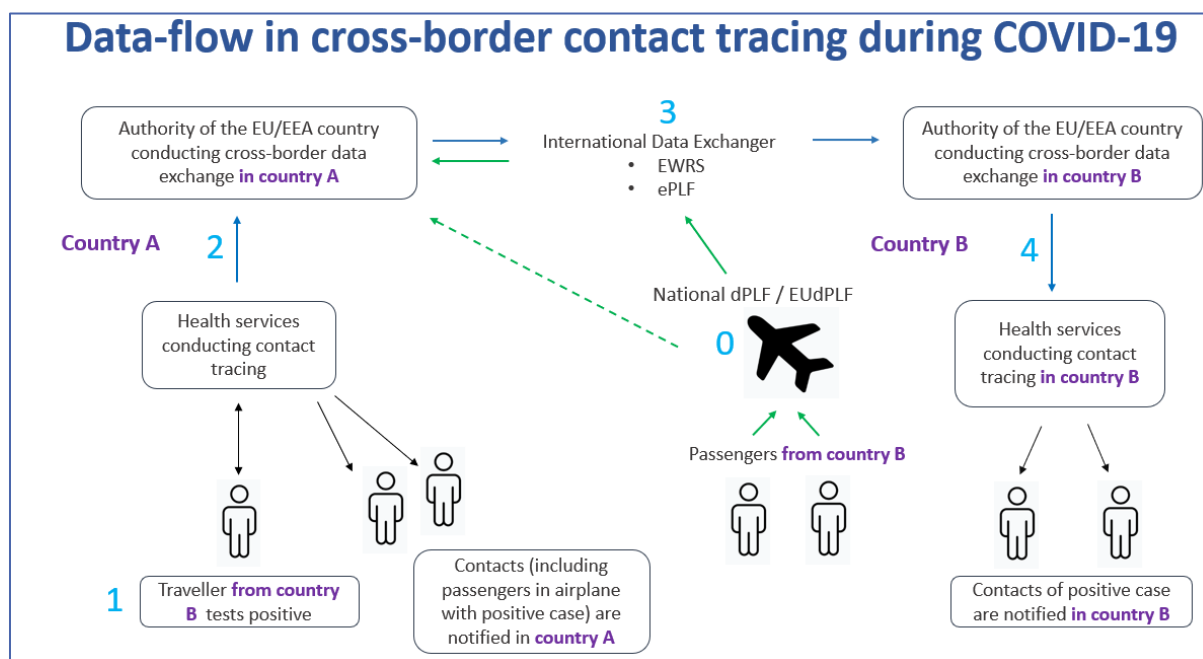
Information on how cross-border CT was conducted in EU countries during the COVID-19 pandemic is even scarcer in the literature than that of how national CT was conducted. DE published a study detailing how they conducted cross-border CT during the first few months of the pandemic in 2020⁽³⁾. The study reported that relevant information on index cases and their contacts were shared by local German PHAs with the Robert Koch Institute (RKI), which is the German authority in charge of sharing cross-border CT data through EWRS. The EWRS focal point at RKI shared the relevant CT data with EU/EEA countries through the EWRS selective exchange platform. Data was transmitted by secure email via the IHR national focal point in DE to WHO non-EU member states. Personal data was transmitted to non-EU countries by means of an encrypted exchange server (Cryptshare).

In NL, data about index cases and their contacts were first registered and stored in the main case management systems (HP-zone and GGD Contact) used by the 25 local public health services situated throughout the country. The data was conveyed to the authority in charge of sharing cross-border CT data, the National Institute for Public Health and the Environment (RIVM) in the Netherlands, by secure email. This authority in NL then shared this information through the EWRS selective exchange platform with relevant EU countries and by secure email to non-EU countries. More country profiles on how cross-border CT was conducted was developed based on the data obtained from the surveys and interviews in this study.

Infectious diseases can also be transmitted during the journey by collective transportation means (plane, train, ferry, cruise ship). To carry out CT involving such cases, countries may utilise different approaches depending on their national legislation. At EU-level, CT for international flights could be facilitated with the use of national dPLFs, or through the EUdPLF. Countries may also have used data obtained from carriers for international travel, such as airlines. The data can be in the form of Advance Passenger Information (API) (for passengers coming from countries outside the Schengen area) and Passenger Name Record (PNR) (for passengers from within the Schengen area) which are used to collect passenger data before boarding (by air, water, or ground).

Various scenarios are possible when it comes to countries needing to exchange data about index cases and their contacts who are at risk. Countries also conduct this process in different ways. A typical cross-border CT process can be visualised with steps 0-4 in Figure 2.

Figure 2. Dataflow of cross-border CT between EU/EEA countries and the relevant organisations involved



A brief description of steps in one typical scenario is as follows:

- 1:** A traveller from country B tests positive in country A.
- 2:** The health services conducting CT in Country A share the index case's data with the PHA conducting cross-border data exchange in country A. These health services also notify the index case's contacts in country A who may have been exposed.
- 3:** The PHA conducting cross-border data-exchange in country A, shares the data of the index case via the EWRS selective exchange platform with the PHA conducting cross-border data exchange in country B.
- 4:** The PHA conducting cross-border data exchange in country B shares the data of the index case (including exposed contacts) with health services conducting CT in country B. These health services conducting CT in country B, notify the contacts who were exposed to the index case before his/her departure and if necessary, instruct them to quarantine and monitor their symptoms. Contacts are asked to test if they have symptoms, and if positive, to go into isolation for a set period of time.

Step 0 applies to countries where procedures using national dPLFs or the EUdPLF are in place.

- 0:** Passengers from country B who are going to country A by a collective mode of transport (e.g., by airplane, ship, bus or train) complete a dPLF (national or EUdPLF) before departure. This information is stored by the relevant health authority in the country of arrival (country A) for a set period of time, pre-determined by country A. If a passenger tests positive after arrival to country A, this data can be shared automatically through the PLF exchange platform (ePLF) with the relevant health authorities in other countries. Passengers who have possibly been exposed to the index case during the journey are identified, notified of their risk, and provided with instructions on further steps to take (e.g., to quarantine, monitor their own symptoms and possibly get tested).

In the literature, there are large gaps in knowledge on how national CT was conducted in EU/EEA countries during the COVID-19 pandemic since 2021, how cross-border CT was carried out in most EU/EEA countries and on the digital technology that was used for CT in general. Most literature on digital CT tools covers legislation and ethical issues associated with proximity-based apps, and not the digital technology in scope for this study. The surveys that have been completed by EU/EEA countries and the interviews have provided more insight into these gaps.

2.5 Potential factors influencing cross-border CT: legal requirement, ability, and national priorities

There are potential challenges that may impact the effective sharing of CT data across borders, including legislation, governance, ethics, political environment, technology, capacity and resources. Based on our findings from the literature and the discussions, we have divided these potential influencing factors into three general categories **obligation**, **ability**, and **national priorities** (Table 2.) Obligation factors include international and national laws that countries are expected to abide by. Ability factors include the resources, technology, governance, and legislation that are available in a country. National priorities refer to factors that countries may consider in their own risk assessments and priority setting while making decisions on the sharing of data for cross-border CT.

Table 2. Factors that may impact the effective sharing and processing of cross-border CT data for incoming and outgoing requests.

Obligation	Ability	National priorities
- International law: International Health Regulations (IHR 2005) - EU legislation: Decision 1082/2013/EU which has been replaced by Regulation EU 2022/2371, Commission Recommendation (EU) 2017/1140 - National law and specific policies - Emergency legislation	Resources - Human resources - Financing - Logistics - Organisation, efficiency, and effectiveness of CT at national level (Digital) mechanisms - Digitalisation capacity - Interoperability and compatibility between digital platforms and software - Internet connectivity - Technology user-friendliness - Extent of training in using this technology Governance	- Decision-making processes, based on risk-assessments considering, among others: - the characteristics of the infectious agent - tests and vaccines (availability and population coverage) - country situation (e.g., war/poverty) - what countries consider a health threat, requiring CT - Ethical considerations - Concerns about privacy - Bottlenecks in receiving other countries' CT data - Delays - missing/incomplete/unclear data

Obligation	Ability	National priorities
	- Travel restrictions/ implementation of PLFs - Extent and quality of government involvement and leadership - Political environment Legislation - Data protection and privacy regulations - Legal infrastructure to support implementation of legal obligations	- Fears about implementing new technology - Levels of (dis)trust - in national authorities of own and/or other country - in technology - in how other countries collect and use CT data

2.5.1 Examples of challenges faced by countries using digital technology for CT

The German study examining the first months of the pandemic, reported having technical problems and delays with using email and the encrypted platform when sharing data with non-EU countries⁽³⁾. There were issues with incomplete data, such as the number of contacts per COVID-19 case and whether they were high or low-risk contacts. The study also reported there being no standard procedures to collect passenger data from conveyance and tour operators, resulting in high costs in terms of time and human resources.

As cross-border CT largely depends on the digital technology used at the national level to collect CT data, barriers to using digital tools to collect CT data at the national level could influence the quality of cross-border CT. Barriers have been reported, for example, in using the outbreak investigation tool Go.Data⁽⁸⁾ in several countries (Argentina, Guatemala and the U.S. (Texas)). These included fears of new technology, too few human resources, lack of trust in disclosing personal data, technological interoperability issues and inefficient internet connectivity⁽²⁵⁾.

2.5.2 Legal barriers

Although EU countries are legally obligated to adhere to the WHO and EU regulations, certain aspects may be subject to national interpretation and application within the bounds of national law, especially from a data protection point of view. Countries faced a sudden onset and high volume of data, including personal data for CT to be processed, which in combination with the deployment of new technologies, interoperability requirements and data linkage posed some legal challenges.

2.5.3 Privacy and ethics

National emergency laws in various fields, including public health, civil and criminal law may not only influence a country's motivation to collaborate legally, but also present ethical challenges. Privacy and ethical considerations linked to and rooted in national policies that apply in cross-border health threats might have an impact on the willingness of MS to share personal data for CT purposes across the borders. In addition, the GDPR has not been interpreted in a uniform manner across all MS, and incorporates national level legislation which may vary significantly between MS. Articles in the literature have centred on the need to protect the individual privacy versus the need to protect public health^(26, 27, 28). The focus of these discussions has been regarding the use of proximity-based CT apps (not within the scope of this study), which were developed in many countries early in the pandemic.

2.6 Summary of gaps in knowledge on cross-border CT

The literature review (which methods are described in chapter 3) revealed that there are still large gaps of knowledge regarding the way that cross-border CT was carried out in each EU country, with respect to the underlying legislation, digitalisation and the experienced barriers, facilitators and needs in cross-border CT. Information is still lacking with respect to the following points:

2.6.1 Legislation

- National legal frameworks of EU/EEA countries in terms of regular and emergency measures in relation to COVID-19 pandemic and other outbreaks;
- The extent to which countries might limit protection of individuals' rights and introduce measures that relate to the public health laws;
- Possible ethical considerations in EU/EEA countries that could prevent data sharing;
- How the EU's General Data Protection Regulation No 2016/679 (GDPR) and related national legislation were applied by EU/EEA countries during the COVID pandemic, and what plans regarding this legislation may support preparations for future cross-border health threats;
- Legal barriers in some countries when it comes to using dPLFs (especially regarding the requirement for a minimal amount of personal data);
- The national legal basis for countries using passenger information (API/PNR) obtained from airlines for national CT (as there is no legal basis at EU-level).

2.6.2 Digitalisation

- The digital technology (not including proximity-based apps) that countries use to provide data for cross-border data exchange;
- Countries' experiences when it comes to using the EWRS selective exchange module;
- Countries' experiences regarding the implementation of digital tools, such as dPLFs, and their integration with EWRS;
- How countries can be supported in linking their digital tools to the EWRS platform.

2.6.3 Cross-border CT

- The experiences and current plans of countries regarding cross-border CT in Europe, in particular
 - the barriers and facilitators regarding more effective cross-border CT in relation to digital technology, governance, and legislation;
 - countries' needs on EU-level support and potential action to improve cross-border CT.

3. Methods

As previously mentioned in the introduction (Chapter 1), the EUHealthSupport Consortium has collected data by means of the following: (1) a detailed literature review, (2) a survey for EU/EEA countries, (3) semi-structured interviews with relevant MS delegates, and (4) two webinars with participants from various EU/EEA countries (including members of the Health Security Committee, Joint Controllers Group on EWRS and ePLF, relevant networks of the ECDC, experts from DG SANTE and ECDC, and other experts on CT practices and legislation).

This chapter describes the various methods used to conduct this study, and then briefly introduces the study population in terms of the respondents of the survey and interviews, and the participants of the webinars.

3.1. Methods of the study

3.1.1 Literature review

The scoping review aimed to gain insight into the use of digital CT tools and applications for enhancing cross-border CT during the COVID-19 pandemic. We also investigated CT practices and actors involved in the execution of national and cross-border CT in EU/EEA countries. Additionally, due to the ongoing monkeypox (Mpox) outbreak in Europe, Mpox was included in the review. The review was guided by the methodology of an extensive scoping review, which included: (1) identifying the scope and approach, (2) searching for relevant literature (scientific and grey), (3) selecting literature (164 publications included), (4) analysis of the literature, and (5) synthesis of the report.

The scope and approach were identified in the inception phase of the study, as reflected in the introduction and background chapters (chapters 1 and 2). Although the proximity-based apps were not part of the main scope of the study, relevant publications were included to give insight on legal and ethical aspects. A summary of literature review study methods is presented in Appendix C. The results were presented in the 'Literature Review Report' deliverable of the study in November 2022.

3.1.2 Surveys

The survey for EU/EEA countries consisted of a mix of open-ended and closed-ended questions. The respondents (see section 3.2.1) started the survey by answering open questions about what country they were representing, and what their current role was in the organisation. The following topics were covered in 51 questions:

- Challenges encountered and solutions implemented during the COVID-19 pandemic;
- National and cross-border CT actors and practices in each country;
- Digital technology used for national and cross-border CT in each country and the challenges and facilitators experienced with these tools;
- Legislation associated with CT and the use of digital tools;
- Lessons learned from the COVID-19 pandemic;
- CT practices for other communicable diseases including Mpox;
- Future strategies and EU-level support needs.

The digital technology examined in the survey study included platforms and tools that provide data for cross-border CT and involve public health authorities (PHAs). Digital technology that does not contribute directly to the CT process conducted by PHAs, such as proximity-based apps and tools used solely for surveillance, was excluded from the survey study.

Responses were analysed qualitatively and quantitatively with the aid of the tools excel and MAXQDA (2022). Countries' actors, CT practices and digital technologies were aggregated and mapped

in country tables. For the qualitative analysis of the open-ended questions, thematic analyses were conducted. First open coding was conducted, where codes were assigned to fragments of raw data. Similar codes were then clustered into categories, and similar categories were then organised into more interpretative themes. These themes were described and illustrated by the various responses provided by countries. Comprehensive results were presented in the 'Draft Survey Report' deliverable of the study in April 2023. For more details on the survey questions, please see Appendix D. Please note that although the majority of questions in the survey were analysed, a few questions that were deemed less relevant for this study on hindsight were excluded from this final report.

3.1.3 Interviews

Interviews were conducted with nine EU/EEA (AT, CZ, DE, ES, FI, FR, LV, MT, NL) and two non-EU countries (CH, UK) to investigate what national and international level barriers or facilitators impacted countries' ability, willingness, or obligation to conduct international travel-related CT. Countries were selected in such a way that they could be as representative as possible. The selection of EU/EEA countries was based on key country characteristics, data from the literature review, data from a parallel study for the EC regarding digital tools used by MS at citizen-to-citizen level, EU-level data on EWRS and EUdPLF use, and on data from an EU-level survey regarding the EUdPLF. Selection of non-EU countries was based on their relevance to EU countries in terms of international travel. Selected countries' NFPs were contacted by DG SANTE by email requesting their participation with an invitation to be forwarded to experts on relevant areas.

Relevant topics discussed during the interviews were COVID-19 experiences, subsequent developments and future plans for national and international CT systems, practices, digital tools (including the EWRS and EUdPLF), governance and legislation.

Interviews were conducted via MS teams and were recorded after participants had given their informed consent. A short summary of the key components was sent to the participants for their review (member check). The interview recordings were pseudonymised and then transcribed. The analysis of the transcripts was done using open coding followed by thematic analysis, using MAXQDA (2022). Codes were analysed and grouped into categories. Categories were then analysed for overlap and merged where possible to create key themes and subthemes. Interview findings are integrated into the findings of this report. A summary of the interview study methods is presented in Appendix E.

3.1.4 Webinars

The invitation emails for the webinars were sent out by DG SANTE and ECDC to relevant groups and networks, such as the Health Security Committee, Joint Controllers Group on EWRS and ePLF, and relevant networks of the ECDC. Participants included these groups, as well as experts from DG SANTE and ECDC, and other experts on CT practices and legislation. The invited countries could register via an online event link (which was included in the invitation email). Webinars were held online via the online meeting program 'Webex Meetings'. Introductory presentations were provided by DG SANTE and the EUHealthSupport Consortium, followed by interactive discussions in plenary and breakout sessions. The questions that were addressed during each webinar were asked via a live polling program 'Slido', which presented the responses of the participants as word-clouds or poll results. Please see Appendix F for the topics that were discussed during the webinars.

3.2 Study population

This section gives a brief description of the participants who provided data for this study by partaking in the surveys, interviews, and webinars. Within the text of the report, the country codes are used to indicate the countries of participants who responded to the questions in the various study components, in particular in relation to factual and operational issues (see the list of abbreviations on

page 6 for country codes used). The information on challenges, facilitators and lessons learned are presented in an aggregated level, without reference to specific countries. When relevant, quotes from interviews and survey responses are presented to illustrate the perspectives of EU/EEA countries, without referring to specific countries.

When reading the report, it should be noted that country codes reflect information collected via surveys, interviews, and webinars, which may have been provided by different people from the same country at different times throughout the data collection period (December 2022 - April 2023). Furthermore, Regulation (EU) 2022/2371 came into force in December 2022 replacing Decision 1082/2013/EU, which might also have influenced answers in relation to applicable legal provisions. As pandemic preparedness is a fast-moving field involving various actors in countries, factors mentioned above may have led to (minor) discrepancies in the findings, despite all the efforts of the study team to avoid them.

3.2.1 Surveys

The surveys were sent out to the 30 EU/EEA countries and completed by representatives of 23 countries (77%) within the period of December 2022 to January 2023. The respondents came from 20 different EU countries (AT, CY, CZ, DE, DK, ES, FI, FR, HR, HU, IE, IT, LT, LU, MT, NL, RO, SE, SI, SK) and the three EEA countries (IS, LI, NO). Nine respondents (39%) had a profession within the Ministry of Health (MoH) or worked in their NFP. Four of the respondents (17%) had a profession in public health at a national level. Three of the respondents (13%) were epidemiologists and two (9%) of the respondents had an advisory role. Four of the respondents (17%) had other professions, i.e., officials working with regular and/or cross-border CT in different departments.

3.2.2 Interviews

For the interview study, participants represented nine EU countries (AT, CZ, DE, ES, FI, FR, LV, MT, NL) and two non-EU countries (CH, UK), and the interviews took place from January 2023 to March 2023 online through MS TEAMS, except for the interview with ES. ES provided written responses to all of the interview questions. NL participated in the online interview but also provided written responses to questions on legal issues.

Interview respondents included people with knowledge on the organisation of CT at the national level, legal frameworks for regular CT and international travel related CT, and digital technologies for CT. Overall, the number of participants per interview ranged from one to five.

3.2.3 Webinars

The first webinar took place on the 6th of March 2023 and the second webinar on the 21st of April 2023. In total, 102 and 74 participants attended webinars 1 and 2 respectively, with 29 EU/non-EU countries represented in the first webinar and 28 EU/non-EU countries in the second webinar (see Table 3). A third webinar is planned for June 2023 to present the final study findings described in this final report.

Table 3. Participants attending webinars 1 and 2

Participants	Webinar 1 (Monday 6 th March 2023: 11-13.00 hrs CET)	Webinar 2 (Friday 21 April 2023, 14.00-16.00 hrs CET)
Total number of participants	102	74
Number of participants representing EU/non-EU countries	84	59
Number of participants from other organisations (EC, ECDC, EUHealthSupport Consortium)	18	15
Number of different EU countries	26 (AT, BE, CY, CZ, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IT, LT, LU, LV, MT, NL, PL, PT, RO, SE, SI, SK)	25 (AT, BE, CY, CZ, DE, DK, EE, ES, FI, FR, HR, HU, IE, IT, LI, LT, LU, LV, MT, NL, PL, PT, SE, SI, SK)
Number of different non-EU countries	3 (IS, LI, NO)	3 (CH, IS, NO)

4. National and cross-border CT practices and digital technology in EU/EEA countries in relation to COVID-19: findings

This section presents various aspects of regular and cross-border CT practices and digital technology used in EU/EEA countries during the COVID-19 pandemic: legal background for cross-border CT, overview of organisation of CT and digital technology used in EU/EEA countries, impact of COVID-19 on national and cross-border CT, challenges, and facilitators with regard to digital technology, data protection and ethical challenges, and national and cross-border CT in other communicable diseases. This information was collected from the surveys, interviews, and webinars.

4.1 Legal basis for cross-border CT data sharing and processing

The data on legal basis for cross-border CT was mainly obtained by the surveys in which 22 countries responded to legal questions in varying degrees of detail. These findings were complemented by information obtained from the interviews and the discussions in webinars. Due to the limitations of the data collected, the analysis below does not provide an exhaustive list of national legal provisions.

4.1.1 Lawful basis for cross-border sharing CT data

In terms of lawful basis for sharing CT data across borders, the study sought to identify which laws/regulation/policies were in place across MS to implement cross-border CT sharing obligations under IHR 2005⁽¹⁹⁾, specifically to non-EU/EEA countries. Twenty-two countries responded to the relevant questions in the survey (96%) and all confirmed that law is in place underpinning CT obligations. It is evident that there is a wide range of national laws, regulations and policies facilitating non-EU/EEA cross-border sharing. There are in excess of 66 different laws, policies and regulations across MS revealing a complex legal web. A dynamic legal picture also emerged with additional legal notices and laws required particularly during COVID-19. This adds complexity in relation to data sharing.

Regarding the lawful basis for sharing within the EU/EEA, all countries relied on Decision 1082/2013/EU^(17, 18) which had direct effect at national level, and which has now been replaced with Regulation (EU) 2022/2371⁽¹⁶⁾, which is also directly applicable in each MS, meaning that no further action is needed at MS level to implement it into national law. This does not mean however that national or regional level guidelines as not adopted to support stakeholders in carrying out their duties that arise under the Regulation.

4.1.2 GDPR compliance – lawful basis for CT data processing, compliance with Article 5 principles and transfer tools

Having established that each MS had a lawful basis for CT data sharing, the study then went on to examine the data protection lawful basis for processing under Articles 6 and 9 GDPR. Additionally, compliance with Article 5 GDPR⁽²⁹⁾ principles both within and outside the EU/EEA when carrying out cross-border CT was examined. Countries were also asked to describe their legal approach in relation to third countries in the absence of GDPR adequacy decision which would allow for data sharing with a third country on the same legal bases as GDPR. This was explored further in the second webinar. For the legal provisions, please refer to Appendix B.

Lawful Basis

An important finding was that all countries that responded to the survey reported using one of the legal bases for processing personal data cross-border under Articles 6 and 9 GDPR when sharing both within the EU/EEA and outside the EU/EEA. The lawful basis remained consistent.

Of the 20 responses, eight gave further detail on which specific bases in articles 6 and 9 GDPR they relied upon. All eight (DK, FR, IE, LU, NL, SE, SK and NO) cited Article 6(1)(e), which allows for processing necessary for the performance of a task in the public interest or in the exercise of official authority. LU and SK also cited Article 6(1)(d) which allows for processing of data when to do so is in the vital interests of the data subject; and SK also mentioned Article 6(1)(c) which refers to processing in compliance with a legal obligation. This was a surprising finding as at the outset of the study it was expected most countries would rely on Article 6(1)(c) in compliance with their legal obligations under IHR 2005 and Regulation (EU) 2022/2371.

More differences were found between countries when it came to lawful basis for processing under Article 9 of GDPR. Note that when sensitive data such as health related data are processed, the processing must be based on a legal provision in Article 6 as well as one found in Article 9 GDPR. All countries that responded sharing such level of detail (DK, FR, IE, LU, NL, SE, SK and NO) to the survey indicated they rely on Article 9(2)(i) which is the public health basis for processing. DK and SK also listed two additional lawful bases: Article 9(2)(b), which allows for compliance with a legal obligation and 9(2)(g) which allows for processing of sensitive data where there is a substantial public interest to do so. NO was the only country that listed 9(2)(h), which allows for processing which is necessary for the provision of healthcare and management of the healthcare system. It is important to note however that the legal basis in Article 9(2)(h)(i) and (j) all require the MS to rely on EU law or national law which permits the data processing in question.

There was an unexpected amount of unity between countries in relation to the application of GDPR for CT both within EU/EEA and outside. On the whole, the same Article 6 and 9 lawful basis is used by MS which indicates GDPR is robust despite wide margin of manoeuvrability available to countries. It also helps to facilitate the free movement of data and interoperability between EU countries.

GDPR Principles

Countries were asked about compliance with Article 5 GDPR principles of lawfulness, fairness, transparency, purpose limitation, data minimisation, accuracy, storage limitation, security and accountability (20 responses).

Most countries in the survey gave the same or very similar replies within the context of CT with third countries as well as EU/EEA countries. The answers listed below represent examples of GDPR compliance measures that some countries had in place.

CY, DK, LU, SE and NO stated that GDPR compliance documentation, routines, policies are in place. IE referred to a data protection impact assessment (DPIA) having been undertaken. LU indicated that data protection officers review data sharing processes before they are applied. CY requires approval of the local GDPR commissioner. FR said there were limitations to processing strictly necessary data, storage period applied, and security measures implemented. LU stated that, only data relevant for the protection of public health would be shared. ES, FR, IT, MT, and SK referred to EWRS as a tool that provides a GDPR compatible solution.

Data sharing agreements were not common. Encryption and data minimisation were identified as important along with use of secure platforms for sharing such as EWRS. Only one country mentioned transparency. Only IE and NL stated that data sharing agreements in place when necessary. NO stated that there are no specific data sharing agreements in place, other than the provisions provided by the EC through EWRS, EU legislation and national legislation.

In general, the findings of the survey, interviews and webinars data protection problems relating to cross-border CT seem to show that issues specific to COVID-19, such as high volume of data, new technologies, interoperability and data linkage were the primary cause of concern for

respondents. It was indicated in the surveys and webinars that guidance from national data protection authorities along with the European Data Protection Board (EDPB)⁽³⁰⁾ was required during COVID-19, as there was uncertainty as to the application of GDPR into the pandemic which created an initial hesitance to share data. Many countries also required new laws/regulations/guidance during COVID-19 to facilitate new methods of CT data sharing such as specific law for dPLF. It is important to note that most of these laws have now expired.

Data transfer to third countries tool

The GDPR allows for transfer of data to third countries which have received an Adequacy Decision from the EU, which in practice means their national legislation is equivalent to GDPR. At present adequacy decisions have been issued for Andorra, Argentina, Canada (commercial organisations), Faroe Islands, Guernsey, Israel, Isle of Man, Japan, Jersey, New Zealand, Republic of Korea, Switzerland, the United Kingdom and Uruguay. Where an adequacy decision does not exist, Article 46 GDPR provides that data may be transferred if appropriate safeguards have been adopted which are reflected in binding corporate rules or standard data protection clauses. Article 49 GDPR allows that in specific situations where an adequacy decision does not exist and the specific measures of Article 46 have not been adopted, a MS may still transfer data to a third country under certain specific circumstances. One such circumstance is that provide for in Article 49(1)(d) which allows for transfers necessary for important reasons of public interest. All countries that referenced a transfer tool in the survey (6 out of 15 responses, 40%), rely on Article 49(1)(d). It should be noted however that Article 49(1)(d) requires that the public interest must recognise Union or MS law. Furthermore, the derogation shall not become “the rule” in practice but need to be restricted to specific situations and each data exporter needs to ensure that the transfer meets the strict necessity test. None of the respondents cited the relevant national law, although it is possible that they found the legal justification in the IHR to which they are subject.

Only one country was the only country who noted the possible use of both Article 46 and 49. It specified that Article 49 can be used in the absence of appropriate Article 46 safeguards. In the survey another country indicated it is currently having internal discussions about the lawfulness of CT based on Article 46 GDPR. It stated that based on a practical approach, Standard Contractual Clauses are not the most practical means due to the fact they have to be closed with all participating members of the IHR.

Further exploration of transfers utilising Article 49 took place during the webinars, in particular if safeguards were in place. One country has a basis assessment of privacy impact, but indicted bilateral agreements are not feasible. Another country mention that they do not have agreements with third countries and that transfer of data outside of EU/EEA is very cautious. Reflecting the findings of the survey they mentioned that a discussion is needed on whether Article 49 can apply to special medical data. One country state that an extra ruling EU/or national law is needed on this point.

4.1.3 Regulation (EU) 2022/2371

During the study Regulation (EU) 2022/2371 was introduced replacing Decision 1082/2013/EU. Questions relating to how the Regulation could facilitate CT and the operations of EWRS separate to were raised during the interviews and Webinars.

When asked about the new regulation, understanding of the effects of its implementation were quite vague across MS. Some participants were unaware of the regulation or the specifics of the regulation. The main comment regarding countries ideas for how the regulation may change or aid them in conducting cross-border CT was their hope for it to incentivise or improve digitalisation of CT, either by new technologies or developments to or integration of existing ones. A discussion on the implementation of this legislation amongst MS has also been brought up.

4.2 Overview of organisation of CT and digital technology implemented in EU/EEA countries

This section provides an overview, as reported by countries, on the various actors involved in CT, how the CT data flowed between organisations, and the types of digital technology that were used by each country for both national and cross-border CT during the COVID-19 pandemic. The data is mainly obtained by the surveys; all 23 countries provided varying levels of information on these topics. These findings were complemented by information obtained from the interviews and webinars.

4.2.1 Organisation of CT in EU/EEA countries

The execution of CT during the COVID-19 pandemic varied greatly between countries, as well as with regard to the actors involved. The primary actors and the relationships between these actors have been identified during the literature review. Generally, governments, public health institutes or agencies and private organisations have been part of the CT process, but also the military, universities and telephone companies are actors that have been entangled with this process, according to the literature. Notably, the literature covering the COVID-19 pandemic, was not clear regarding the digital technology used for CT (such as outbreak investigation and management tools, digital CT tools where citizens can share data with/receive data from the PHA, citizen-to-citizen warning and tracing apps (mainly proximity-based apps) and CT data transmission tools; see Table 1 for classification), as well as how CT data was shared between actors. Therefore, we asked countries in the surveys and interviews about the actors involved in conducting CT, their CT practices, and the digital technology they used for CT during the COVID-19 pandemic. The main findings are described in this chapter.

Actors involved with CT, CT practices, and flow of data for CT in EU/EEA countries

All 23 countries provided answers to the questions on actors, CT practices, and flow of data in the survey, as well as all of the countries in the interviews. Below, a summary of the findings is presented.

1. Actors

Most countries mentioned that, during COVID-19, public health institutes or agencies were responsible for the execution of cross-border CT and national CT, whereas the regional/local health authorities were responsible for CT at the sub-national level. In four countries, the MoH had the most responsibilities when it comes to CT. See Table 4 below for an overview of the specific countries.

Table 4. Execution of CT at different levels for actors that countries indicated

Countries where Ministries of Health (MoH) had most responsibilities when it comes to CT	CY, CZ, ES, IT
Countries where public health institutes/agencies were responsible for execution of cross-border CT	FI, HR, IE, LT, LU, MT, NL, RO, SI, SE, SK and IS, LI, NO
Countries where public health institutes/agencies were responsible for organizing/executing national CT	CZ, DK, ES, HR, FI, IE, LT, LU, MT, RO, SE, SI, SK and IS, LI, NO
Countries where regional/ local health authorities were responsible for organizing/executing CT in subnational level	AT, CZ, DE, DK, ES, FI, FR, HR, HU, IE, IT, NL, RO, SE, SK and NO
Countries where MoH was responsible for decisions on guidelines and policies for national and cross-border CT	AT, CY, CZ, DE, ES, FI, FR, HR, IT, LT, MT, RO, SK, SI and IS, LI, NO

Other actors that are mentioned by countries include the following: border sanitary inspection (HR), (border) police (HR, RO), university (CY, FI), ministries other than MoH (CY, CZ, FI and LI), health insurance agency (FR) and hospitals/health care institutes (IE, SE).

There was a wide variety in types of actors involved in CT processes. To illustrate, six countries had more than five different actors/organisations that play a role in CT (FI, FR, HR, IE, NL, RO) and only one country had a single actor/organisation involved in the whole CT process (IS). This is also related to the size of the country, as there are fewer actors/ organisations that are involved in smaller countries.

During the COVID-19 pandemic, five countries set up a special crisis/emergency centre or team for COVID-19 CT (ES, FR, HR, IE, LU). Other data controlling functions¹ for various actors that countries indicated were organised into different levels of CT (i.e., cross-border, national and subnational). See Table 5 below for an overview of data controlling functions for actors at the different levels.

Table 5. Data controlling functions¹ at different levels of CT activities

	Cross-border level	National level	Subnational level
Ministry of Health	AT, CY, CZ, ES, FR, HR, IT	CY, CZ, ES, FR, HR and IS	ES, FR, HR and IS
Public health institutes/ agencies	FI, HU, LT, MT, RO, SI, SE, SK and IS, LI, NO	CZ, DE, FI, HU, IT, LT, MT, NL, RO, SE, SI, SK and IS, LI, NO	HU, IT, LT and IS
Regional/local authorities	FI, FR, IE	AT, FR, IE, SE	AT, CZ, DE, DK, ES, FI, FR, IE, RO, SE, SK and NO

Overall, we see that most countries had a decentralised organisation of CT, where subnational actors had the most prominent role and hosted and managed the digital tools, with the exception of smaller countries where one centralised organisation was in charge of the execution of CT. Nevertheless, the guidance almost always and policy on when and how to conduct CT often came from national authorities.

2. CT practices/flow of data for CT

Data about cases/contact persons were almost always gathered via phone, online forms, information systems or email. See Table 6 for an overview of these different ways and country specific data gathering approaches.

Table 6. Countries' ways to gather data about cases/contact persons

Phone	AT, CY, DK, ES, FI, FR, HR, HU, IE, IT, MT, NL, RO, SE, SI, SK and IS, NO
Online forms	AT, FR, IE, SE
Information systems	CY, DE, FR, LU
Email	CZ and IS

Countries did not always provide a clear description about how the data really 'flows' from one actor/system/level to another. The organisations between which the data flows, depends on the roles of the different actors/organisations involved in CT.

3. Centralisation and decentralisation

The majority of the countries' organisation of CT was categorised as decentralised meaning that subnational actors carried out CT in line with the subsidiarity principle. Digital systems are also often organised at the subnational level. Data is often stored at this level and can be accessed only by the

¹ **Data Controller** within the meaning of Article 4 of GDPR refers to the natural or legal person, public authority, agency, or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data. E.g., which agency, authority of body decides "why" and "how" CT data is processed.

relevant subnational actors. Eight countries are categorised to have a centralised organisation of CT where CT responsibilities mainly lied on central actors, and one country is considered to have a combination. See Table 7 below for an overview of the different countries' organisation of CT.

Table 7. Countries' organisation of CT

Decentralised	AT, CZ, DE, DK, ES, FI, HR, HU, IT, NL, RO, SE, SK and NO
Centralised	CY, IE, LT, LU, MT, SI and IS, LI
Combination	FR

It is observed that countries with a centralised system are mostly small countries that have a population size smaller than three million, with the exception of IE that has a population of five million. Considering the total population the countries represent, the organisation of CT in EU/EEA appears to be predominantly decentralised, with the exception of smaller countries. This means that the EWRS operator in charge of cross-border CT is not close to the CT authority, with several steps in between them. The data also indicated that the EWRS operator in charge of cross-border CT often does not have direct access to digital CT systems. CT data is frequently exchanged between the EWRS operator at the national/cross-border level and CT authorities at the subnational level through secure email, encrypted systems or an online form, which are separate from the national system of CT data. Only in smaller countries with a relatively centralised organisation of CT, the EWRS operator can obtain CT data from the (national) digital CT system. Unlike the organisation of CT, guidance on when and how to conduct CT mostly comes from national authorities.

4.2.2 Overview of digital technology implemented in EU/EEA countries

Countries were asked in the survey to provide information regarding the digital technology used in their own countries for CT. For each digital tool, they were asked to provide the name and the type of tool, the actors or organisations that use the tool, a brief description of the tool, and to indicate whether the tool was used for national and/or cross-border CT. We have divided this technology reported by countries into the four different types of tools (also see chapter 2, table 1):

- (1) Outbreak investigation and management tools (including digital CT case management systems, in which cases and their contacts are registered);
- (2) Digital CT tools where citizens share data with/obtain data from PHAs;
- (3) Citizen-to-citizen warning and tracing apps (mainly proximity-based apps), and;
- (4) CT data transmission tools.

Many countries also provided information about any future plans they had regarding the development of digital tools, in particular CT case management tools. Twenty-two countries completed the questions regarding their digital technology for CT. Additional information obtained from the interviews and webinars has been added to this section. An overview of general observations regarding these digital tools is provided below.

General findings regarding the reported digital CT technology

Outbreak investigation and management tools

EU/EEA countries reported large variations in the number and types of CT digital technology (Table 8). Two countries reported having no digital CT case management systems (HU, RO) and several reported various case management systems in different regions (DE, ES, FR, and NO). Over half of all countries reported having one main national case management system, although this data was generally not accessible to those working in cross-border CT. Countries generally all made use of their own types of CT case management systems. A few of the more commonly known case management systems are

presented in Table 8. Go.Data was reported by three countries, either as being used in some regions, or for a limited time at the start of the pandemic. Four countries reported SORMAS, as either their main case management system, as only being used in some regions of their country, or as a tool the country was planning to switch to. Just one EU/EEA country (NO) reported the use of DHIS2, as one of three different case management systems used in their country, the other two being their own case management systems. Five countries reported that excel sheets were used either as a main system to register CT data, or just in some regions of their country, or at the start of the pandemic, before a CT case management system had been developed.

Table 8. Some well-known tools used for outbreak investigation and management

Go.Data 3 countries	ES: Go.Data only used in some regions FR: Used either Go.Data (at the beginning of the pandemic) or SORMAS MT: started with Go.Data, moved on to another system (Dynamics) later to handle the large outbreak size
SORMAS 4 countries	DE: SORMAS used in some regions (information obtained from interview) FR: used either SORMAS or Go.Data LI: SORMAS was main case management system LU: are planning to switch from CarePlus to SORMAS
DHIS2 1 country	NO: one of three case management systems used in different regions
Excel Spreadsheets 5 countries	CY: to collect and store COVID-19 cases and their contacts information ES: used multiple methods to collect data, including excel sheets IS: started with excel sheets to collect data, they also sent excel sheet questionnaires to cases for them to fill in their own contacts IT: to gather CT data LI: used excel sheets until SORMAS was available

Future suggestions/plans regarding digital technology for CT

When countries were asked if their country had any plans to move to another type of software and platform for CT, nine countries indicated there were no such plans, eight countries indicated they were considering switching to another type of CT software or platform and three countries indicated there were plans to switch to other CT software or platform. For several countries that had been using different types of systems in different regions, the focus of future plans was mainly to create one national integrated system, so that data could be shared easily between regions. Two countries also expressed the need to integrate data from different systems monitoring other CT-relevant medical data pertaining to cases and their contacts. Seven countries reported that the focus of future plans was mainly to develop a new generic system to accommodate CT for multiple infectious diseases, as their CT case management system had been too specific to COVID-19. The status of these plans/suggestions varied, with some only being suggested by the survey respondent as being a good idea to some plans currently being in consideration for the future and others already being at the start-up phase of implementation.

CT data transmission tools

Transmitting data to other EU/EEA and non-EU/EEA countries

All EU/EEA countries reported using the EWRS, selective exchange module to transmit data to other EU/EEA countries. Besides the EWRS, 12 countries (AT, CY, FI, FR, IT, LT, LU, RO, SE, SI, and LI, NO) reported also using secure mail to transmit data to other EU/EEA countries. When asked why secure email was used between EU/EEA countries in the second webinar, one country expressed that sometimes the structured format of EWRS was more of a practical barrier and it was easier to transmit the desired information to other countries using the more unstructured format of secure mail. Other platforms mentioned for cross-border CT were EGRESS for exchanging data with the UK, and TECH2,

an intermediate program to extract data for BE, DE and FR. LI reported using various tools for different countries to share CT data with neighbouring countries (AT, DE and CH).

Twenty countries reported using secure mail for transmitting data to third countries (non-EU/EEA) (see Table 9). During the second webinar one country reported some difficulties they had experienced with having to unlock the data sent by secure mail by other countries, often leading to delays in being able to act on the data received.

For travel-related CT, four countries made use of the EUdPLF, and one was connected to the ePLF with their national dPLF; several others expressed interest in joining the EUdPLF once legal barriers are resolved. Many countries used various types of dPLFs for collecting passenger data; these varied in function, preventing or minimising the chance that passengers were infected upon arrival to the country and needed to isolate, to enabling cross-border CT to be conducted with co-passengers, if needed (see Table 9).

Transmitting data from regional health authorities to EWRS operators

In most countries, the cross-border CT organisations using EWRS did not have direct access to CT data collected by regional health authorities. This data was usually transmitted from the regional health authorities to EWRS operators within the country by secure mail, or by telephone. Eleven countries (AT, CZ, DK, FI, FR, HU, IE, IT, NL, SE, and NO) reported using secure mail to transmit this data. Several countries reported other tools including a password-protected online form, secure servers, and a separate online platform accessible to both CT services and EWRS users. Nine countries marked N/A to this question; a reason for this was expressed by some of the smaller countries. They reported that CT health services and EWRS users are the same actors and therefore have access to the same data.

Table 9. Data transmission tools used at the cross-border level

EWRS (23 countries)	All EU countries reported having used the EWRS
EUdPLF (4 countries)	Four countries implemented the EUdPLF: IT (May 2021 live); MT (connected with ePLF July 2021); SI (Aug 2021 live); FR (Dec 2021 live) DE (and LT) are on the verge of onboarding to EUdPLF
ePLF (1 country)	ES : the only country to have sent data via the ePLF
National dPLFs used for CT and/or other purposes (e.g. travel related isolation/quarantine)	○ Pre-Travel-Clearance Data (AT) ○ National PLF (developed for COVID-19) and linked to ISIN (CZ) ○ Finentry & Lapland Entry (FI) ○ Digitale Einreiseanmeldung (DEA): contact details of travellers transmitted directly to the competent authority (DE). ○ Health Declaration forms (NL) ○ National PLFs: IE, LT, CY, CZ, RO and IS (passenger questionnaires) ○ dPLF connected to ePLF (ES) ○ Flight information forwarded by Switzerland to LI ○ eHranica (eBorder): for the registration of people who cross the state border (SK)
Secure mail	○ 12 countries reported using secure mail for transmitting data to other EU/EEA countries (AT, CY, FI, FR, IT, LT, LU, RO, SE, SI, and LI, NO) ○ 20 countries reported using secure email for transmitting data to non- EU/EEA countries (AT, CY, CZ, DK, ES, FI, FR, HR, HU, IE, IT, LU, NL, RO, SE, SI, SK, and IS, LI, NO)
Other	○ EGRESS for data-exchange with the UK ○ TECH2: intermediate program to extract data for BE, DE, and FR (used by LU)

Data transmission between regional (subnational) CT authorities and EWRS operator	○ Secure mail: reported by 11 countries (AT, CZ, DK, FI, FR, HU, IE, IT, NL, SE, and NO) to transmit data between regional CT authorities and EWRS operators (AT moved to using online forms for data-transmission in December 2021) ○ Telephone calls: reported by 6 countries to transmit data (besides email) between regional CT authorities and EWRS operators (FI, IE, SE, SI, SK, and NO) ○ Online form, using a standardised data set (AT) ○ Secure servers and file sharing platforms; within the MoH where the different central authorities can share information (DK) or among national and subnational health authorities (DE). ○ Regional level share data with the national level through the platform of the National Network for Surveillance (ES). ○ 4 countries report that contact tracers and EWRS operators have access to the same data (CY, LU, MT, and IS).
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4.3 Impact of COVID-19 on national and cross-border CT policy

This section presents the findings reported by countries regarding the strategies they applied when the number of infectious cases surged, as well as other challenges they encountered during the COVID-19 pandemic and the solutions that they implemented. This data was mainly obtained from the survey; all 23 countries responded in various levels of detail to the main questions on the challenges experienced and the strategies/solutions they had implemented.

4.3.1 Challenges experienced during the COVID-19 pandemic and solutions implemented

The SARS-CoV-2 virus was unprecedented in its ability to spread rapidly and easily, making it necessary at times for health services to conduct CT at enormous scales. Countries reported the challenges they had experienced mainly due to the surges in infectious cases during the COVID-19 pandemic, as well as solutions and strategies they had implemented to counter or mitigate these challenges. These challenges are summarised in the themes below. See Table 15 in Appendix G for more details.

(1) Recruiting and retaining sufficient human resources

The surges in case numbers led to countries having to hire new people from a range of medical and non-medical fields to assist with CT. The new human resources most frequently mentioned by countries were students, medical doctors, public health workers and volunteers. Several countries mentioned recruiting members of their military force for CT and police staff, staff from other organisations such as the MoH and aviation companies, and citizens with other non-medical professions. To retain more staff, a few countries reported solutions such as lowering qualification requirements, offering flexible working hours and relatively high salaries, as well as efforts supporting the health and wellbeing of staff. Continually having to train staff to be able to conduct CT throughout the evolving pandemic was very time-consuming. Limited staff led to being more selective about the type of CT data to collect, and to focusing CT activities more on high-risk index cases and their contacts.

(2) Difficulties collaborating with the general public

Countries described issues that they encountered with the public, such as not always wanting to pass on their contact details. Countries reported difficulties in obtaining accurate, relevant, and complete information from citizens, regarding their contacts. One country mentioned technological literacy issues in citizens, particularly in older people. Other issues were not wanting to isolate or quarantine and general pandemic fatigue. One country mentioned having lawsuits from citizens who felt wronged at being obligated to quarantine. A few countries mentioned trying to communicate with the public to make them more aware of the importance of CT and the necessary measures such as quarantining. One country also mentioned carrying out extra evaluations to ensure that the contacts identified in

the CT process, really were at risk. One country reported that quarantine frustrations only stopped when quarantine was no longer required.

(3) Obtaining relevant data for CT was time consuming and difficult

Besides the difficulties reported in obtaining data from citizens, countries mentioned other issues that could make CT time-consuming and difficult, including the collection of contact details from large gatherings of people, receiving the lab results of testing too late, missing information and delays in cross-border CT, and not knowing which countries passengers had travelled to. Some solutions mentioned were advising or requiring organisers of large events or cafes to keep guest lists and digital processes being set up for receiving lab results. As case numbers increased, countries reported shifting to methods and tools to allow the self-service of citizens to support CT. These reduced lengthy periods of time spent on phone calls by contact tracers to retrieve this information. One country describes a 'List your contacts' portal, for example, for citizens to fill in relevant data including their contacts' details. SMS messages were also sent to contacts with instructions, instead of calling them by phone.

(4) Different regions within countries have their own policies, CT processes and technology

Many countries mentioned that there was a lack of integration of CT processes and technology among regions, even if policies were similar, making it difficult to share data or agree on guidelines. Countries also expressed a need for different systems related to CT, such as systems containing vaccination and lab data to have their data integrated. Solutions mentioned by countries included the linkages of different databases, by for example, the creation of a unique COVID-ID, and the establishment of organisations that identified best practices and implemented common strategies or national guidelines to be used across regions within a country. One country, for example, reported that national guidelines were published, and regular meetings were held with contact tracers in the 21 different regions to try to align CT processes throughout the pandemic.

(5) Constantly needing to adjust their CT processes, guidelines, and technology

The dynamic nature of the pandemic meant that countries constantly needed to update their CT processes, guidelines, digital technology, and their legislation. New CT units, working space and materials were created to accommodate surges in cases. Special organisations were designated to do technical reviews and provide advice and recommendations. CT procedures were standardised as much as possible in some countries to increase the efficiency of CT.

(6) Other challenges

Other challenges mentioned were the lack of legislation readiness and GDPR obstacles and the lack of units dedicated to analysis and research. Solutions mentioned were the strengthening of legislation and improvement of surveillance due to better COVID-19 CT systems and other scientific studies such as wastewater monitoring.

4.3.2 Legal challenges and solutions developed during COVID-19

This section investigates some key aspects of the legal frameworks that countries had in place prior to the COVID-19 pandemic to address challenges that may arise during cross-border health threats, especially regarding large scale CT, as well as solutions that have been implemented during the pandemic. Analysis is primarily based on the survey with various degrees of response rate per topic.

Legal frameworks to declare a public health emergency

The majority of the countries (80% of the survey respondents, n=18/22) had legal frameworks in place to declare a public health emergency, while only five countries reported not having such laws in place. Respondents explained in mixed level of granularity how, based on these laws, public health

emergency can be declared and what measures can be implemented in such extraordinary circumstances.

Sufficiency of pre-pandemic legal frameworks

Countries can be categorised by their approach to tackling the legal challenges during the pandemic, more specifically, by establishing if they introduced new law(s) and whether these laws are still in place or were time limited by applying sunset clauses. An overwhelming majority of the countries (82% of the survey respondents, n=19/23) introduced new law(s) to manage the scale of CT that was required during the pandemic, with most of them (56% of the survey respondents, n=13/23) using sunset clauses for legislative acts, meaning that many are no longer in place. Only four countries indicated that it was not necessary to introduce new laws. See Table 10 for an overview.

Table 10. Sufficiency of the pre-pandemic legal frameworks to manage large scale CT

Sufficiency of the pre-pandemic legal frameworks to manage large scale CT	
1. It was not necessary to introduce new law(s).	4 countries (CZ, HR, RO, SE)
2. It was necessary to introduce new law(s). It is still in place.	6 countries (AT, CY, DK, SI, SK and LI)
3. It was necessary to introduce new law(s). It is not in place now. It was time limited.	13 countries (DE, ES, FI, FR, HU, IE, IT, LT, LU, MT, NL, and IS and NO)

(1) It was not necessary to introduce new law(s). (4: CZ, HR, RO, SE)

Among countries that did not introduce new laws, in some cases, it was still necessary to update certain legislative acts. One country explained that national legal framework gave the relevant actors the necessary legal mandate and therefore laws were not adopted to large scale CT, however, a special investigator is currently reviewing if there is a need for new provisions for the future.

(2) It was necessary to introduce new law(s). It is still in place. (6: AT, CY, DK, SI, SK and LI)

Updating public health and data protection laws have been named as the main drivers to introduce new laws among the group of countries that reported these laws still being effective (at the time of data collection).

In relation to public health laws, two countries reported that COVID-19 had to be included on the list of notifiable diseases, whereas others described in general terms the need to create new provisions to protect public health. Furthermore, introduction or refinement of competences for various authorities have been mentioned as well.

In relation to data protection, GDPR compliance for travel related documents and anonymisation and sharing of sensitive data were provided as justification for new legal provisions.

(3) It was necessary to introduce new law(s). It is not in place now. It was time limited. (13: DE, ES, FI, FR, HU, IE, IT, LT, LU, MT, NL, and IS and NO)

Sunset clauses have been applied to laws by countries to allow the introduction of dPLFs, to support epidemiological surveillance as well as data collection and sharing, to clarify responsibilities, to make use of digital CT tools, or to justify the restriction of fundamental rights, such as access to certain locations with proof of a negative test. Some countries gave a generic answer by implying that there have been gaps in public health laws that needed to be addressed. The sunset clauses have now entered into force, meaning that the legislation is no longer applicable. Of note, some countries reported various type of laws being introduced during the pandemic with some having sunset clauses and some being permanent, therefore the distinction between groups 2 and 3 is not a definite black or white question. Also, there is also a wide range among countries who applied sunset clauses when it comes to the timeframe of the legislation with most of them being limited to 2020- mid-2022 and others just recently being repealed (in December 2022 or January 2023).

When countries were asked whether their legal frameworks were sufficiently robust to manage the scale of CT required during the COVID-19 pandemic overall, overwhelming majority reported that their legal frameworks were sufficiently robust (78% of the survey respondents, n=18/23) with only five countries admitting that it was not the case. However, this finding does not correspond to new legislation being introduced, suggesting that “sufficient robustness” is subjective and can be interpreted different ways within the meaning of applicability of legal frameworks that provide room for emergency or subsidiary legislation.

National professional codes of practice and ethics

Most of the countries (71% of the survey respondents, n=15/21) reported that national codes of practice and ethics were adequate during COVID-19. The rest of the countries had to introduce amendments to these codes primarily to support access to and sharing of sensitive personal data.

Countries pointed out the need to allow sharing of medical information, for instance to access CT data bases in general term, or to share medical data in an ethical way, or in case of one country, share medical data with the police. The other major driver was to enable non-healthcare professional, such as in the hospitality industry, to process health related data, or at the border crossings to arrange for accommodation for foreigners who were infected.

Data protection challenges raised by COVID-19

During the course of this study, various aspects of data protection have been examined within the context of data processing for CT purposes. In this section data protection challenges that arose during COVID-19 are discussed as well as questions addressed in other sections, such as legal basis for data sharing (section 4.1), data protection barriers related to cross-border data sharing, and ethical reasons for not to share CT data (section 4.5).

Most countries (59% of the survey respondents, n=13/22) reported data protection challenges in relation to COVID-19 and gave insights into how these were overcome. The most common reasons were related to establishing data protection rules when setting up IT-systems for large scale CT data processing. Countries were primarily concerned with their national CT systems and processes, with only a few mentioning issues in relation to cross-border aspects. Within this context, no concerns were raised about applicability of GDPR provisions, with the exception of raising awareness about how labour-intensive it is to ensure necessary agreements and documentations are in place.

For further insights: in relation to establishing data protection rules and practices when setting up IT-systems, especially under time pressure, country responses shed light on challenges such as organisational data protection when data controller receives assistance from other authorities, legal analysis of the proportionality and sensitivity of the networks, consideration of the balance between individual rights and public interest, legality and necessity of CT tools, taking into account the limitation it could impose on fundamental rights as well as use of databases and linkage of different information among them and use of mobile apps.

Data collection and processing of personal data on a massive scale posed a major challenge for most countries. To overcome this challenge, countries reported solutions such as legal frameworks with safeguards required by GDPR such as data minimisation, specified data retention periods, limitation on recipients, specific controls, or updating IT systems to ensure that access was restricted based on the need for the different CT services. For personnel carrying out CT, trainings were organised on GDPR, or non-disclosure agreements were signed.

4.4 Challenges and facilitators with regard to digital technology

Countries were asked in the surveys to state the main practical challenges and facilitators that they had experienced with digital CT for COVID-19 within their country and with digital cross-border CT with other countries. Twenty countries (87%) provided responses to the question on challenges and facilitators of digital tools within their country and 21 countries (91%) responded to the question on

challenges and facilitators of digital tools with other countries. Additional information obtained from the interviews and webinars has also been incorporated into these findings. Challenges that were expressed will be discussed below, followed by some of the facilitators of digital tools that were mentioned by countries. Please see Tables 16 and 17 in Appendix G for more details.

4.4.1 National (regular) CT: Challenges and facilitators of digital CT within the country

Challenges

At the start of the pandemic, most countries reported a lack of digital technology for CT, leading to a lot of manual work. Digital technology had to develop extremely quickly, and constantly adapted to the pandemic, while taking scientific, medical, and legal aspects into account. One country in which different regions had been using excel sheets to register data, reported that there had been no time to discuss the development of a new tool or to implement it. Technological issues were reported due to the overload of index cases and users of the digital tools. A few countries reported a lack of funding for digital technology.

Different regions often had different CT case management systems that were not compatible; data therefore could not be shared across or accessed by other regions. It was also not possible in every country to identify individuals across different systems necessary for CT, due to the lack of a unique ID identifier. Various databases relevant for contact tracing such as those that register vaccine status and test results were often not linked to the cases registered in the CT case management systems. Different data sources also varied in quality and standards, making it difficult to integrate them.

Certain CT tools, such as proximity-based apps, were not widely adopted by the public, mainly due to privacy concerns. The Bluetooth signal of proximity-based apps was also reported to be limited, leading to low use by citizens. Some countries reported no challenges with digital tools, mainly because they were not used in their countries; one country reported that there was no need for a digital CT system.

Facilitators

Countries reported various digital tools for CT to be facilitators during the pandemic. Existing digital systems were upgraded to be able to monitor vaccination and lab data quickly, and new systems were developed, such as CT case management systems and passenger locator forms. Although countries generally mentioned their proximity-based apps were not widely adopted, several countries referred to their proximity-based apps as a positive solution in helping to curb the infection. Many countries reported having their central CT database accessible to multiple actors to be a facilitator.

Contact with citizens was facilitated with SMS messages, and digital tools enabling the self-service of citizens were considered a facilitator to relieve the burden on PHAs conducting CT. Citizens were directed to a website, for example, to record their own contacts as well as inform them of their exposure risk. This information was then often transmitted to regional health authorities, saving them many and lengthy phone calls. Other facilitators mentioned were the customs treaty for joining efforts in implementing SORMAS between an EU and non-EU country and the strong legal requirement in another country to conduct CT in all cases.

4.4.2 Cross-border CT: Challenges and facilitators of digital CT with other countries

Challenges

Several countries reported experiencing an overload of work, especially manual work, when conducting cross-border CT during peak times. Besides causing extra work, this manual work was also prone to errors. When they were overwhelmed with cases at the national level, cross-border CT was de-prioritised. Most countries also reported issues with missing data and incorrect data, when it came to important details such as addresses or telephone numbers. There were frequent delays in receiving

data from other countries as well as from airlines, to the point that nothing could be done with the data received. Some countries reported to having received no or a late response from other countries on the cross-border data that were exchanged, so they did not always know if the data were well received or how the data were handled.

Some countries reported not being aligned with other countries in how to conduct cross-border CT, for example, with respect to the type of data that should be prioritised and shared between countries and with policy decisions regarding when to discontinue with or resume cross-border CT. This meant that the data received or sent may not be acted upon. During the second webinar one country mentioned challenges due to countries having different definitions of concepts, such as 'close contacts'. As their definition was broader than that of other countries, this meant they may send data to other countries who may not act upon the data, due to them not defining the contacts as being 'close'. One country mentioned in the survey they did not register citizens becoming infected abroad in non-EU/EEA countries, so nothing was done with those incoming notifications.

Various countries mentioned that the different tools countries had used for cross-border CT had compatibility issues, as well as differing degrees of security. Although they did not specify the exact tools they were referring to, it is possible that proximity-based apps were meant or issues with encrypted information sent by secure mail. One country mentioned in the survey that not all countries were able to use the encryption tools. During the second webinar, one country reported that it sometimes took days to be able to unlock the encrypted cross-border CT information.

For travel-related CT, there were also difficulties in having access to passenger data from airlines, and airlines often provided this data too late. The EUdPLF passenger data was sometimes also lacking in completeness and quality. Several countries questioned the added value of cross-border CT in general, particularly when it came to collecting airline passenger data. They expressed that cross-border CT made the most sense at the start of the pandemic when the numbers were still very low and community level transmission had not started.

Facilitators

For cross-border CT, nine countries mentioned the EWRS as being a facilitator. It was regarded as being safer (GDPR compliant), faster and easier to use, than having to send password protected or encrypted emails. The EUdPLF was also reported to be one solution to the lack of interoperability of digital tools. A few countries mentioned bilateral communication and assistance between specific countries as being functional and beneficial. Policy decisions like limiting cross-border CT only to certain conditions during the pandemic were also considered facilitators.

4.5 Data protection and ethical challenges

4.5.1 Data protection

Countries were asked if they had experienced any data protection barriers when sharing CT data both within EU/EEA and also to third countries under IHRs obligation. Again, the majority of barriers experienced were during COVID-19 as discussed in section 4.1 and 4.3.

Only five countries noted specific barriers outside of the pandemic situation. For instance, one country pointed out that transfer of personal information could only be in accordance with national and European legislation, meaning that data should be minimised and not to be ascribed to individuals unless necessary. Another explanation revealed that national law as a condition of sharing outside the EU/EEA stating that sharing data should be necessary or desirable for the prevention of spread or the removal of conditions favourable to such infection, but this was not raised particularly as a barrier. In case of one particular country, disclosures of health information always require patient's consent but that this is due to be reformed with the introduction of new legislation.

The issue of proportionality of prospectively gathering citizens data for CT purposes has been mentioned on various occasions, highlighting the importance of balancing the right to privacy against the public interest of protecting public health:

“....it was accepted to keep out the first patient, but in later stages it was seen as unproportionate to start register personal information and send it cross-border. This is a GDPR issue. Common sense is needed to do this or not if not necessary.”

4.5.2 Ethical Challenges

Countries were asked if a decision not to share CT data be taken. Context was given to clarify that a decision might be made where an ethical or fundamental rights concern arises, such as punitive or criminal sanctions for non-adherence to quarantine laws or sexual orientation. In these circumstances most countries prefer the application of a balancing test on a case-by-case basis with the disclosure indicating an anonymous direct contact with the affected person.

Specifically relating to sexually transmissible diseases or Mpox, one country pointed out that in their case, NFPs can decide not to share CT data and indicated that this situation has arisen. Some countries apply a balancing test where a balance of interest can always be done between protecting public health and data protection. In the event that sharing CT data could pose a threat to a person's wellbeing it could be decided that CT data are not shared, at least not the personal part of the data. As said above, however, with more sensitive data (like with the Mpox outbreak), direct contact with the person is preferred.

It has been noted that if cross-border sharing may have significant implications for a person, risk assessment against the public health implications would be required. If formal CT through the NFP was not considered safe, if possible, informal communication would be encouraged from the index case to the contact to inform them so as they are aware to seek care if needed.

Other practices included case-by-case basis assessment, as well as keeping participation in CT voluntary in order to maintain trust and ensure validity of data. It was explained that data supplied is shared as a general rule, but in theory, very specific concerns regarding an infected person could entail data not being shared. For instance, if it is known that sharing of CT data can impose a substantial risk for the data subject, the choice can be made not to share this CT data.

In case of another country which has a different legal approach, the legal basis obliges citizens to share personal data if asked by the authority and the authority is free to decide whether or not the sharing of data is necessary and adequate to the possible risks for the data subjects. Therefore, the risks can be addressed in each case individually.

The interesting finding from this section is the importance of scope at individual MS level to make an assessment on whether to share CT data or not in these types of circumstances. It can be deduced that many MS see a greater public interest in ensuring that affected individuals are not dis-incentivised from, firstly seeking proper medical attention out of fear of having their health status disclosed because of stigma or criminal sanctions attached to their sexual orientation and secondly ensuring that people are not dis-incentivised from being honest about their sexual partners or practices out fear of the implications such a disclosure may have.

4.6 National and cross-border CT in other communicable diseases and countries' future directions

Contact tracing is an integral part of infectious disease control methods for various diseases. While this study focused mainly on COVID-19, open questions were posed in survey to obtain better understanding on CT practices in relation to other infectious disease (ID) outbreaks. In total, 22 countries (96%) responded to these questions, providing the basis of the subsection below. These findings were also validated in the second webinar with further insights on future plans.

4.6.1 Top 5 Infectious Disease Outbreaks that countries carry out CT for, other than COVID-19

The EU/EEA countries who responded to the survey listed Tuberculosis, Measles, Mpox, Meningococcal Meningitis and various sexually transmitted infections (STIs) as the top 5 disease (groups) for which they carried out regular CT in the last five years, other than COVID-19. The top 5 for cross-border CT is slightly different, in particular for STIs. Both rankings are shown in the tables below.

Table 11. Top 5 other infectious diseases countries carry out regular CT and cross-border CT for

Top 5 other infectious diseases countries carry out regular CT for (N=22)	Top 5 infectious diseases countries carry out cross-border CT for (%**)
• Tuberculosis (N=18)	1. Measles (100%)
• Measles (N=13)	2. Monkeypox (Mpox) (79%)
• Monkeypox (Mpox) (N=14)	3. Tuberculosis (78%)
• Meningococcal Meningitis (N=13)	4. Meningococcal Meningitis (77%)
• Sexually transmitted infections (STIs), including HIV, Chlamydia, Gonorrhoea, Hepatitis, Shigella* (N=11)	5. STIs (36%)

* Not an STI but can be transmitted during sex and has been reported among STIs by two countries

** % of countries that carry out cross-border CT for the infectious disease they also mention in the top 5 for regular CT

4.6.2 Countries' future directions for CT in cases of different ID scenarios

To report CT practices of countries for ID other than COVID-19, a distinction has been made between 'CT' and 'cross-border CT'. National CT covers both regular (peace time) CT and CT during large outbreaks. Additionally, two categories have been made within other ID: 1) ID with respiratory transmission, such as Tuberculosis, Measles and Meningococcal Meningitis, and 2) STIs and ID that are transmitted through close contact and shared environment, such as Mpox².

National CT in the country and future outbreaks

In terms of regular national CT, seven countries indicated that they used no different CT-system for COVID-19 compared to Mpox or other ID (AT, ES, FI, HR, IT, MT, RO). On the contrary, 10 countries (CY, DK, IE, LT, LU, MT, NL, SE, SI, and NO) used or developed a different CT-systems for COVID-19. Two countries, however, mentioned that legislation hampers the use of the COVID-19 system for other ID. Two countries stated that they do not have, or do not use, CT-systems for other ID than COVID-19 at all. There was not much specific information provided on the difference between national CT-systems or cross-border CT systems, but when countries mentioned a 'different system used for CT' they meant their national CT-system, unless specifically described otherwise.

Only five countries mentioned having a digital CT tool being under construction for other ID (based on the system used during the COVID-19 pandemic). Almost half of the 22 countries stated that they have learned from COVID-19 in a way that they (would like to) use their knowledge and system-developments for other ID as well. For example, using EUdPLF, and SORMAS for other ID as well.

² Mpox is not classified as an STI. It is transmitted in humans through close contact with someone who is infectious or contact with contaminated materials. However, due to the level of close contact required for transmission of Mpox, majority of the Mpox cases during the outbreak in 2022 were infected during sexual activity. Nevertheless, other routes of transmission were also reported, such as non-sexual close contact or, less frequently, through fomites.

In the survey, countries were asked to compare their CT approaches for Mpox in comparison to COVID-19. They described the following main differences:

- Countries could handle the number of cases during Mpox, during COVID-19 this number was too high to handle;
- During Mpox, it was possible to handle the cases case-by-case;
- During Mpox, there was no need for use of additional (digital) CT systems, since CT was conducted via phone and/or email and executed manually.

In the survey, as well as during interviews, countries were specifically asked about their strategies and future plans for CT, in particular in relation to digital tools, which were reported in section 4.6.2. Nevertheless, the answers did not yield further concrete future plans. During interviews, which were mainly held in January-February 2023, it was stated that countries were investigating future directions and digital solutions, however, did not yet have concrete plans that could be shared. Therefore, countries' future plans in the case of different ID outbreak scenarios (i.e., ID with respiratory transmission, and STIs and ID transmitted through close contact or shared environments) were brought to the second webinar as a breakout room discussion on 23 April 2023. During this breakout room discussion at the second webinar, countries were asked about their future plans for CT for ID with respiratory transmission during new outbreaks. As a response, two countries stated that they would re-activate digital CT tools. Specifically, one country mentioned to digitalise outbreak investigation on contacts and the systems for the managements of contact persons. The use of proximity-based apps was not something that countries foresee during other outbreaks of respiratory diseases. The reasons given for this were constraints related to legislation, acceptability issues among the general public, and unclarities about the efficacy of such an app. Furthermore, ID with respiratory transmission require different objectives for CT compared to others. Digital citizen-to-citizen CT tools can be useful when there is need for massive CT or large-scale contact warning due to very high numbers of cases but relatively little consequences of the infection (e.g., COVID-19).

During this breakout session at the second webinar, countries were also asked about their current and future plans for the use of anonymous digital partner notification for STIs and diseases that are transmitted through close contact. No country indicated the use of such platforms or plans to develop them, and some mentioned various difficulties with using them. Difficulties that were mentioned included not being able to ensure perfect confidentiality, fears related to data protection and privacy, STIs being too sensitive to notify digitally and the risk of discrimination for individuals in some countries, contact persons not always being known, and difficulties in convincing the public to participate digitally. Some countries reported having anonymised notification systems in place through STI clinics, which notify the contacts about their risk of infection and also provide recommendations to get tested.

Cross-border CT

Table 11 indicates that only 36% of the countries who reported carrying out regular CT for STIs included STIs in the top five ID for cross-border CT. In terms of cross-border CT, most of the countries (n=18) reported no information about cross-border CT for STIs. Four of these explicitly mentioned not to conduct cross-border CT for STIs at all. During the second webinar, one country also mentioned not doing cross-border CT for STIs and diseases that are transmitted through close contact. In addition, 10 countries did not (yet) conduct or mention cross-border CT for Mpox. Of those countries, three explicitly stated that they do not conduct cross-border CT for Mpox.

When the reasons for the discrepancy between regular and cross-border CT for STIs were asked in the second webinar, the answers indicated that CT for STIs were carried out through STI clinics, GPs or other relevant physicians, and not through regular public health services. CT relies heavily on cases informing their contact persons themselves. After evaluating the risk, the professionals may contact partners directly, even if the partners are situated across borders. Thus, they do not necessarily follow the route for CT for ID through the EWRS.

When countries were asked in the survey whether there could be a decision not to share CT data, two countries indicated that such a situation had already arisen in relation to STIs. One country explained further that in such a case when handling more sensitive data (e.g., with the Mpox outbreak), direct contact with the person is preferred. During the second webinar, further information was given that a risk assessment is made to determine which notification mechanism to use (notification via the index case or anonymous notification) and only in high-risk situations, the existing notification mechanisms would be used to share the CT information with another country.

To obtain more insights on decision-making with regard to cross-border CT in the second webinar, countries were asked via an online poll: “*What factors do you consider when deciding which diseases to do regular CT for in your country?*”. They were asked to mark their top 3. The most important factors were hospitalisation and/or case fatality rate (67%), transmission level (sporadic cases, clusters of cases, community transmission) (67%) and availability of post exposure prophylaxis (67%). Incubation period (52%) and attack rate (52%) were chosen thereafter and ethical issues (19%) and ‘other’ (19%) last. Societal acceptability was not chosen by any country as a relevant factor.

When countries were asked about their future plans for cross-border CT for ID with respiratory transmission, it was apparent that the current systems and procedures (including the use of EWRS) work well and countries do not have any plans to change their approach.

Legal aspects for other ID

In terms of legal aspects, a majority of countries have indicated laws put in place during COVID-19 have proven useful for other ID. Nevertheless, several of these laws have possibly been temporary for COVID-19.

During the second webinar, two countries mentioned having plans to enforce or adapt the legal regulations on new (urgent) outbreak responses to be able to make use of digital tools for CT in other ID as well.

Some countries state that ethical concerns can arise in relation to sharing data that may lead to a risk to the rights and freedoms of the data subject particularly where it may relate to the individual's sexual orientation. A risk benefit approach is often taken on a case-by-case basis in these circumstances. These were both findings from the survey as well as from the second webinar.

4.7 Overall lessons learned from COVID-19 on regular and cross-border CT

Countries were asked in the survey to list the main lessons learned in relation to cross-border CT, for peak times as well as for the future. Twenty-one (91%) countries provided responses to these questions in the survey. Additional information from interviews and webinars were also added to these analyses. These lessons were combined and categorised into the following themes. Please see Table 18 in Appendix G for more examples.

(1) The necessary CT digital technology should already be in place

For the future, digital solutions were mentioned as important for various purposes: to be able to share CT data across regions within countries; to enable the efficient sharing of data between regional health authorities and cross-border CT authorities, as these now were separate systems; to connect other systems relevant to CT within the country (e.g. databases containing vaccination status and testing results); to increase the speed of CT, by replacing the manual work conducted at the cross-border level; to be able to upscale CT activities when needed; and to increase the speed of receiving cross-border data (regarding passengers as well as cases and their contacts in other countries).

(2) Review if and when cross-border CT is effective

Countries often expressed that conducting cross-border CT, in particular collecting passenger data, may not actually contribute to bringing the pandemic under control. Several countries (five) expressed the lack of evidence of its effectiveness, in particular when cases have increased in number and there

are high incidences of cases in all countries. During times that countries were already struggling to carry out CT at the national level, conducting CT at the international level, seemed less of a priority. As cross-border CT is time-consuming and labour-intensive, and can get in the way of other necessary work, several countries advised reviewing the recommendations when to conduct cross-border CT. During the second webinar, when the participants were asked in what areas the EU could provide the most support, aside from technological assistance, the option 'Evidence of the effectiveness in conducting cross-border CT' was the most frequently chosen. One opinion shared was that it was important to ensure that cross-border CT should be carried out when necessary, and based on scientific evidence, to avoid becoming a political instrument.

(3) Ensure there is sufficient human resource support

Many countries mentioned it being important to have sufficient human resources in place, trained and readily deployable if needed.

(4) Good CT practices are needed to increase efficiency and reduce delay

Most countries mentioned specific challenges encountered in CT that needed to be addressed. Delays (in data received from the EWRS and from passenger data) were considered a common obstacle to conducting CT on time. Needs were expressed such as facilitating the collaboration with the international public transport, placing more focus on fragile and vulnerable populations and addressing technical problems with regard to registering foreign cases without the ID of the country.

(5) Clear agreements are needed on what cross-border CT information is needed

Countries often appeared to be misaligned regarding expectations of the type of data to share with each other. It was also unclear what was done with the data that they shared with other countries, and they also did not always conduct CT with the data they had received from other countries. One country expressed that they would appreciate an obligation by countries to act upon requests sent through the EWRS on time. A need was expressed for clear agreements on what is needed and what is expected from countries, in terms of what data to share and when to share this data. During the second webinar it was suggested that risk assessments are needed to determine the criteria for when to make use of dPLFs. One participant suggested the option of developing an algorithm to determine when cross-border CT should be conducted. The need for CT could be different per country and be based on geographical factors (e.g., islands may need to be stricter with incoming travellers) or on the epidemiological situation or vaccination coverage of each country. Such a risk-based approach tailored to countries' needs could be more useful instead of activating/deactivating cross-border CT in a uniform way across EU. What was less clear to the participants, was who should carry out these risk assessments.

(6) Good collaboration with cross-border countries and regions is needed

Several countries mentioned the importance of establishing good relationships early on with other neighbouring countries and regions, to ensure smooth cross-border CT.

(7) Action plans and procedures should be in place.

Countries mentioned the importance of investing in health infrastructure, with the necessary human resources and other facilities, as well as cross-border action plans and procedures already in place.

5. Future of cross-border CT in EU/EEA countries: findings

5.1 EWRS selective exchange module and integration of national tools

Despite being generally an efficient platform, during peak times of a COVID-19, EWRS was experienced as less efficient as it could create a labour-intensive process (see section 4.4.2). This was particularly tough for small countries or countries with limited human resources to allocate to EWRS. Furthermore, countries had different policies and priorities on cross-border CT and sometimes received delayed, missing or incomplete data through EWRS (see section 4.3.1).

This section investigates how the EWRS selective exchange module can be improved with adoption of new features and explores possibilities on the integration of national digital technologies.

5.1.1 Perspectives on adoption of new features on EWRS selective exchange

In this section, the perspectives on the adoption of new features on EWRS selective exchange are discussed. These are based on the results from the survey (87% of the EU/EEA countries responded, n=20), interviews (all EU/EEA countries interviewed, n=11) and webinars 1 and 2.

Definition of the minimum data required for CT as part of EWRS contact tracing

The survey and interview data indicate that the majority of the respondent countries (65%) shared positive perspectives on the adoption of minimum data requirement. There is a clear need for EU alignment on definition of minimum required data for CT. This can improve quality (completeness, accuracy and timeliness) of data exchange via EWRS, while improving efficiency and reducing strain on human resources.

“National CT systems, which have parameters in IT systems, should also be to send the variables to EWRS (without having to retype). They prefer a copy/paste-function. If data would be standardised in EWRS, the risk on forgetting data would also decline. This is more efficient because MS do not have to send messages if things are missing.”

Some of the responses noted the following considerations when adopting this feature:

- Definition of minimum data required should not be adopted in a too restrictive way. This could prevent relevant data from being sent, especially in cases of emerging infectious diseases, as can be seen during the Mpox outbreak. Even limited information can be useful to signal and help understand the spread.
- CT data as part of EWRS selective exchange needs to be suited to a varied range of diseases for which cross-border CT is conducted.
- It might be the case that not all of the required variables are collected during regular CT of the country. One country mentioned that national legislations might need to be changed in order to collect the required data.

Of note, adoption of the definition of the minimum data required for CT as part of EWRS contact tracing is currently being undertaken at the EC level by defining the variables that can be exchanged for cross-border CT, replacing the Commission Recommendation (EU) 2017/1140⁽¹⁸⁾ on personal data that may be exchanged through the Early Warning and Response System (see Appendix A for details).

Structured cross-border CT data as part of EWRS selective exchange

The survey and interview data indicate that the majority of the respondent countries (65%) shared positive perspectives for adoption of structured cross-border CT data as part of EWRS selective

exchange. Discussions and poll responses of the first webinar also resonated with these findings. According to the responses, there is a clear need for adoption of standardised and structured cross-border CT data to optimise CT through EWRS. This also meets the need to use EWRS selective exchange as a single platform used only for cross-border CT and no other purposes (e.g., MEDEVAC). During peak times of COVID-19, the selective exchange module was used very heavily, leading to an overload of messages for some countries. There were times that they were not able to keep up with the new exchanges received. Countries agreed that the adoption of structured cross-border CT data could prevent such situations by enhancing information sharing and streamlining data formatting, leading to improved efficiency.

“Would be nice to have ‘selective exchange’ not full of CT like during COVID-19.”

Some of the responses noted the following considerations when adopting this feature:

- In relation to applicability, this feature needs to be suited to a varied range of diseases for which cross-border CT is conducted.
- Usefulness of adoption of structured cross-border CT data as part of EWRS can be investigated on a scientific basis.
- In-depth analysis on legal aspects might be necessary.

Of note, a new EWRS architecture is currently being explored through another study to make selective exchange for contact tracing an independent module, which will provide the ability to separate data access to specific users and for different purposes, e.g., MEDEVAC (see Appendix A for details).

Inclusion of data from EU or national dPLFs as part of EWRS selective exchange

During COVID-19, the EUdPLF or national dPLFs (via the ePLF) were sometimes used to exchange data between countries. This meant having two separate platforms for exchanging CT data for countries: ePLF and EWRS. Exchanging EU or national dPLFs through EWRS can simplify cross-border CT during pandemic situations by providing a single platform to exchange data. In terms of the data types within this context, during COVID-19, the countries relied on Commission Recommendation (EU) 2017/1140 which determines what personal data may be exchanged through EWRS. Going forward, Regulation (EU) 2022/2371 delegates the power to the Commission to adopt a delegated act in this respect.

Adoption of inclusion of data from the EU or national dPLFs as part of EWRS selective exchange received positive comments in a quarter of the responses from the survey and the interviews (27%). This relatively low rate is possibly related to the fact that all countries use EWRS, but only a few them used EUdPLF and national dPLFs during COVID-19, to a varying degree. According to responses, inclusion of the EU or national dPLF data as part of EWRS selective exchange could lead to better coordination of sharing data. In particular, the usability will be increased if all countries use (EU)dPLFs and the dPLFs are completely integrated.

“Every EWRS country should use (EU)dPLFs to get the data as smooth as possible into EWRS.”

Some of the responses noted the following considerations when adopting this feature:

- EU or national dPLFs should be analysed by the receiving country and there must be confirmation that a positive case is in the country concerned.
- There might be legal challenges in relation to the inclusion of EU or national dPLFs as part of EWRS selective exchange.
- A few countries provided general reservations on the necessity and cost benefit of using EU or national dPLFs.

Of note, integration of EU or national dPLFs into EWRS selective exchange is currently part of the definition of the minimum data required for CT as part of EWRS contact tracing. This is currently being

undertaken at EC level by defining the variables that can be exchanged for cross-border CT, replacing the Commission Recommendation (EU) 2017/1140⁽¹⁸⁾ on personal data that may be exchanged through the Early Warning and Response System (see Appendix A for details).

Additional features that EWRS could have in the future

Several features and perspectives were brought up as a response to the question in the survey on additional features of EWRS. The following themes emerged as options for new features and issues to be considered:

1. *Useful features to EWRS – improving selective exchange*
 - Adding unique identifiers for each procedure/exchange between countries can improve the efficiency and traceability of CT data.
 - Implementing new selective exchange message types: Implementing permissions for data protection could improve communication by preventing CT efforts being divided into different messages. Separating urgent and general information is also mentioned by one country. Due to high information flow, urgent messages can be missed.
 - One response mentioned that there should be a common file with all countries to increase interactions and see whether actions are being taken after an exchange.
2. *Additional features to EWRS*
 - Connecting national platforms with EWRS
 - Combining EpiPulse and EWRS platforms
 - A separate section for MEDEVAC
 - Registering up to date information of control measures of countries
3. *Identification of new functions and features*
 - The need for a robust governance structure to handle MS's suggestions on EWRS
 - The need for more discussion among countries in relation to useful features of EWRS
 - Keeping EWRS user-friendly
4. *Other topics raised*
 - Two-factor authentication to access EWRS

5.1.2 Opportunities regarding integration of national tools into EWRS selective exchange

In this section the opportunities regarding the integration of national and subnational tools into the EWRS selective exchange module are discussed. This section is based on results from the survey (65% of countries, n=15), interviews (55%, n=6) and webinars 1 and 2.

Several countries indicated their wishes and opportunities to integrate national case management systems and data sources into EWRS. To improve management of data, the unique identifier in the national system (ID) needs to be linked to the unique identifier in EWRS. This would immensely improve the efficiency of cross-border CT.

Nevertheless, there are a number of challenges ahead to integrate national tools into EWRS selective exchange. The first one is the organisation and governance of CT in countries, as indicated in section 4.2. The discussions during interviews and the first webinar indicated that CT is often governed, organised, and conducted at a subnational level in most of the countries, with the exception of smaller countries. In line with the subsidiarity principle of EU law, national or regional health authorities are in charge of how they organise and conduct CT and what digital technologies they use for it. Where countries operate a regionalised healthcare competence, national level CT policy and guidance, almost always exists. Most subnational authorities provide data to the national outbreak response and management systems mainly for surveillance purposes. The EWRS operators in charge of cross-border CT do not appear to have direct access to the CT data and therefore exchange CT data with subnational

levels (or authorities who carry out CT) through platforms such as secured email, online forms or encrypted servers, which are outside the outbreak response and management systems. From a governance perspective, integration of CT technologies used at subnational level to EWRS could be a possibility, but this would require involvement and commitment of several subnational authorities, which reduces the feasibility of linking all of them to EWRS.

Smaller countries (e.g., CY, LT, LU, MT, SI and IS, LI) often have a rather centralised system where contact tracers and EWRS operators are situated in the same organisation and can use the same electronic systems. In addition to smaller countries with centralised systems, integration of national systems to EWRS can potentially be an option in countries where there is one national organisation that organises or supports CT (e.g., FR, National Health Insurance), or countries who are preparing to have CT platforms that can operate in national level (e.g., IE).

Nevertheless, various technical challenges remain with respect to the integration of national or subnational CT technologies into EWRS, as there is a very large variety of outbreak management systems used at national and subnational level, most of which are developed within the country for their specific needs. Internationally known platforms, such as WHO's Go.Data were only briefly used by some countries or regions at the beginning of the COVID-19 (e.g. MT and some regions of ES and FR) but later discontinued and replaced by CT systems developed nationally or sub nationally. Some countries reported having very manual CT methods, which cannot be integrated into EWRS. Having a very large variety of national and subnational outbreak management systems used for CT in EU/EEA countries significantly limits the feasibility of linking them to EWRS.

5.2 International travel-related CT in Europe

Transmission of infectious disease agents can happen during travel using collective transportation between countries, such as airplanes, trains, ferry, etc. To carry out CT involving such cases, countries may utilise different approaches depending on their national legislations, including use of national dPLF or EUdPLF during large outbreaks (pandemic or crisis time), as well as obtaining passenger lists from airlines during large outbreaks and 'peace' time. This section present findings of surveys, interviews and webinars on obtaining passenger lists from airline companies and related legal aspects, and use of the EUdPLF and national dPLFs, based on results from the survey (70% of the respondents of EU/EEA countries who responded the survey (n= 16)) and interviews (all EU/EEA and non-EU/EEA countries interviewed) and webinars 1 and 2.

5.2.1 Use of national and EUdPLF to support cross-border CT

In the absence of having direct access to passenger data, a next best solution to CT for transmissions during journey with collective transportation means is use of dPLFs during large outbreaks which reach epidemic or pandemic scale. As presented in section 4.2.2, EUdPLF was used by four countries during the COVID-19 pandemic and many other countries used dPLFs for collecting passenger data but not always for CT purposes. This section summarises the potential benefits and potential challenges of EU and national dPLFs used for CT purposes, as well as provides an overview of legal aspects on the use of dPLFs.

Potential benefits of EUdPLF

Respondents from several countries shared that the EUdPLF could (potentially) support efficiency through easier and faster execution of CT. This included data collection (e.g., of infected passengers), exchange between stakeholders, finding contacts, reducing workload, automating, and implementing measures for infected people amongst others, depending on the context of the disease outbreak.

“An easier and more rapid data collection and exchange between stakeholders, making CT more effective and efficient if risk areas are declared and using the digital tool will be mandatory for travellers.”

According to some countries, EUdPLF also provided improved data security, accessibility and quality. The handwritten PLFs, for example, were difficult to decipher during the pandemic. EUdPLF was regarded as having the flexibility to adjust to national needs and was available in many European languages. As a common EU tool, EUdPLF could improve interoperability, minimise misunderstandings, and prevent duplications involved in cross-border CT.

A key facilitator mentioned in promoting / encouraging the use of both dPLF / EUdPLF was its use in preventing the need to gather passenger data from airlines for CT. Additionally, it can be linked to the EWRS.

The dPLF was considered a useful tool, particularly in the early phases of the pandemic when transmission levels were low, and in an island setting. This indicated the importance of having national decisions on when to implement dPLFs according to the epidemiologic status and other needs of the country.

During the interviews, several EU/EEA countries stated that they would consider joining (if legal barriers are removed) or were preparing to join the EU dPLF. Although not in the EU, CH also expressed being keen to join the EU dPLF for future pandemic preparedness.

Potential benefits of national dPLFs over EUdPLF

During the pandemic, several countries used their own national dPLF for CT and/or other purposes such as travel-related quarantine. Some countries who used a national dPLF for CT purpose indicated their preference to stay with it, instead of moving to the EUdPLF, as this provided the opportunity to shape the form according to the country's needs and priorities and enabled the country to integrate the dPLF into their national CT case management system.

Potential challenges of national dPLFs and the EU dPLF

For both national dPLFs and the EUdPLF, various challenges were stated. First, collecting data individually from passengers was prone to error and required their compliance, digital literacy and access to relevant digital tools. Countries using the EU dPLF reported issues with data quality, including passengers sometimes deliberately excluding certain data to avoid quarantine. Seat numbers were also often not included in the form, as passengers filled in the form prior to check-in and seat allocation. Overall, the dPLF was considered to be a burdensome procedure for passengers to fill in on a routine basis.

Concerns about data security and potential leakage and the locations where data was stored and managed were also raised. Also, if there was a lack of coordination in relation to how countries should respond and for which communicable diseases these EU digital tools could be applied, there could be a random usage of the tool, depending on the epidemic situation.

“Without a defined list of which communicable diseases this applies to, the system may be exploited or cause an unnecessary burden on the epi service.”

Other challenges mentioned in the survey, interviews, and webinars:

- Legal challenges for using EU digital tools in relation to GDPR, national law, and data protection arrangements
- Evidence of the value, effectiveness, and efficiency of use of dPLFs

- Costs as a barrier to use dPLF (one country)

One country stated not using PLFs directly because they have no entry points by air or sea.

Legal aspect of dPLFs

Out of the 17 countries that used dPLFs, the majority (64%) had adopted new laws allowing the introduction of PLFs, while others (CZ, ES, FI, HR, MT, SI) relied on existing legislation. At the time of data collection, with the exception of four countries (AT, IS, LI, SK) who indicated their newly adopted laws are still in place, it was reported that most national laws (CY, DE, FR, IE, IT, LT, RO) were subject to sunset clauses and are no longer in place, meaning that new legislative acts would be required for the re-introduction of PLFs.

To illustrate compliance, nine countries, about half of those that operated dPLFs, explained that they carried out data protection measures to be in line with the GDPR principles of lawfulness, fairness, transparency, purpose limitation, data minimisation, accuracy, storage limitation, security and accountability. Three countries specifically pointed out that they carried out a DPIA, while others said that they were compliant with GDPR through other measures.

As mentioned above, legal challenges have been noted by countries in relation to PLFs. Some of the concerns shared by countries stem from the need to balance public health protection measures with safeguarding privacy and rights of the individuals. For instance, when PLF is a pre-condition for travel, there should be a solid justification for such CT measure based on evidence that it effectively reduces transmission in order to collect personal data on a large scale and in certain cases, to restrict freedom of movement. Other related challenges, such as the administrative burden on the citizens as well as on public health authorities, including having data protection processes in place have been noted by many as well.

Specifically in relation to EUdPLF, some countries shared hesitancy based on data protection and security concerns due to the location of the EUdPLF servers, as well as the need for further consideration to amend national laws to match the complexity of the decentralised national CT systems or to justify using EUdPLF by demonstrating its real benefits. Retaining autonomy to make national decisions based on the epidemiological situation and national needs plays an important role too. Lack of appropriate agreements with the EU was also reported to be a legal barrier in the case of one of the EEA countries, although there is a clear interest to overcome these due to the Schengen area.

5.2.2 Use of passenger data from airlines

This section covers national practices to obtain passenger data from airlines in order to improve CT of cross-border travellers, the legal base rooted in national laws to support such data sharing, and possible future strategies that countries envision. Findings are based on survey, interview and webinar data with various levels of response rate per topics.

National practices

Although there is no legal base at EU-level to make passenger data held by airlines available for the purpose of CT, 24 countries - all but one respondent indicated receiving passenger data from airlines (AT, CY, CZ, DE, DK, ES, FI, FR, HR, HU, IE, IT, LT, LV, LU, MT, NL, RO, SE, SI and IS, LI, NO, as well as UK).

The majority of the countries (62% of the respondents) did so through the organisation in charge of sharing cross-border CT data via the EWRS, while others received the names through other public administration channels. However, this data often came with delays or were sometimes incomplete or incorrect. The data is available in airlines only for a limited period of time after landing, meaning it is not always available. The quality of the data also varied across airlines, as not all airline offices in all countries were willing or able to cooperate. The cooperation of the PHA was usually good

with the flag carrier airlines as they have a stronger team in that country and better knowledge of national legislation, but this might not be the same for other airlines. Furthermore, the airlines might ask for the identity of the index case from the PHA in order to provide other passengers' data, which was not possible.

"If we don't have ... pandemics ... we can handle this with the semiautomated systems. We can ask from the airline companies ... and there is enough time to do the contact tracing. However, when you have a lot of cases, it's not anymore possible to do that... If we had this kind of structured and valid passenger information available, that would have been more easily, more efficient ..."

Important to note that most countries explained receiving passenger data from airline companies as per request. No country reported routinely receiving passenger lists.

The interviews revealed that obtaining data from airlines for CT was not easy, due to differing priorities of the airlines and PHAs. The PHAs had public health interests in mind, whereas airlines represented the commercial interests of the company and needed to balance that. This made it difficult to establish the cooperation, even in the case of appropriate legal background.

Most answers implied that data sharing was a mandatory obligation for the airline companies based on national legislation, although the success rate of obtaining such information varied, even within countries, depending on the cooperative willingness of airlines. One country specified that they didn't impose obligation and relied on voluntary collaboration. Some countries also shared that their obligations were not specific to airlines, as they requested collaboration from other types of travel operators as well.

By comparing airline data sharing practices with usage of dPLFs, we can conclude that those countries who did not introduce dPLFs seemed to have relied on data from airlines as their main source of passenger data, whereas the others made use of both data sources. In some cases, data from airlines helped to complement incomplete dPLFs.

National legal base to support such data sharing

All 20 countries that provided information on the legal base for receiving passenger data from airlines referred to national rules (AT, CZ, DE, DK, ES, FI, FR, HR, HU, IE, LT, LV, LU, MT, NL, RO, SE, SI, and LI, NO), either by pointing towards national public health laws, – which was the most common answer – or by referring to COVID-19 related emergency legislation. However, some countries phrased their answer in a generic way pointing towards public health reasons. Interestingly, GDPR Article 6.1 e was referenced in one case. Important to note that when describing the national legal context, three countries pointed out that their actions are in accordance with IHRs (2005).

Most countries referred to laws that pre-date the pandemic, while only three countries specifically pointed to enabling legislation adopted as response to COVID-19. Furthermore, four countries mentioned the distinction between pandemic and non-pandemic situations implying data sharing practices that may not have been specific to a cross-border health threat situation, although further research would be needed to establish how national laws apply under different circumstances.

Possible future strategies countries envision

Countries expressed their interest in coming up with a coordinated approach in preparation for future threats, such as the standardisation of data that PHA can request from airlines, or the development of means to rapidly and/or directly access airline data. Nevertheless, due to the current legislative framework within the EU, such suggestions should be addressed at the MS level with the involvement of national security authorities. As an example, one country indicated that they were developing a

system whereby airlines can easily share data with national public health authorities. The legislative framework within the EU includes the following: GDPR restrictions in relation to secondary use of data; the recent EU Court ruling in relation to the PNR Directive⁽³¹⁾; and the EU Directive related to the use of API and PNR⁽³²⁾ which is applicable for security use only. There is a lack of mandate to make passenger data held by airline companies available to public health authorities.

5.3 The need for EU-level support for regular and cross-border CT

Regarding EU/EEA countries, EU-level support is needed to facilitate national (regular) and cross-border CT in various aspects. This section is based on results from the survey (78% of the EU/EEA countries that responded, n=18), interviews (all EU/EEA countries interviewed, n=11) and webinars 1 and 2.

5.3.1 The need for EU-level support in relation to digitalisation of national (regular) and cross-border CT in EU/EEA countries

The survey and interview data and the discussions at the webinars indicated that there are some aspects of CT that need to be tackled at a national level while other aspects can be supported at -EU-level. In the section below, the analysis of these aspects is described by categorising them into national and EU-level.

National level

Some countries responded that there are different CT practices that need to be tackled by national governments and/or at national level. According to the responses, there is a clear need for an increased digitalisation and automatisisation of CT systems, as well as the coordination and/or integration of systems. This would apply to subnational, national, and international level and can improve usefulness and efficiency. Often subnational authorities are in charge of how they organise and conduct CT and what digital technologies they use for it, although guidance and policies come from national authorities. EWRS operators responsible for cross-border CT often do not have direct access to CT data, which makes the exchange of CT data with subnational levels (or authorities performing CT), for example via secure email, online forms or encrypted servers that are outside the outbreak response and management systems, more difficult. Connecting local data resources and allowing national public health authorities to directly access CT data will improve the effectiveness of national CT procedures. However, there is a very wide variety of outbreak management systems used at national and subnational levels. Most of these are developed within the country for their specific needs. This wide variety significantly limits the feasibility of linking them to EWRS.

“The digitalisation has to happen nationally and regionally to be useful and efficient. Integrations to national systems for testing, online questionnaires and personal data needs to be put in place, which makes it difficult to standardise at the EU-level.”

Some of the responses mentioned the following regarding EU-level support on digital CT technologies at national level:

- A platform or app to support CT activities at national and cross-border level including a common database for storage of airline passenger data would be a useful support. In addition, it will be important that EWRS operators in charge of cross-border CT data exchange can have authorisation to access this database for CT purposes.
- Some countries suggested that it might be beneficial to have a common tool for CT to be used at national level in EU/EEA countries, such as Go.Data, for outbreak management and

infectious disease surveillance. This could facilitate exchange of CT data between countries while applying data protection.

- Evaluation frameworks are needed to demonstrate the added value of CT during peak times, especially when public health systems are overwhelmed. One country mentioned that the added value of evaluation frameworks is that it can sustain practices both at local and national level.
- Setting up a legal framework for digitalisation.
- Political awareness that lobby and advocacy is necessary for CT software and platforms at national level.
- Funding of system integration, a standard setting for CT tools, and a standardised and adaptative CT tool.

EU-level

The survey and interview data indicate that the majority of the respondent countries expressed the need for EU alignment and guidance on standardised policy, guidelines, and systems for cross-border CT (n=15). There was a clear need for standards and guidance on what countries should do for pandemic CT preparedness: when to continue/discontinue CT, how to define cases and contacts, what data should be shared, and how to handle pandemics in a more holistic way. This will speed up future responses to cross-border threats and will improve practicality, and systems. “Coordination on when to continue/discontinue cross-border CT during outbreaks” was listed among the top 3 areas the EU could provide the most support for cross-border CT during the second webinar (52% of the participants).

“Protocols could be shared at EU-level, and even better, at the international level with WHO. But for instance, each module dedicated to one disease, we should have make sure that ECDC is on board with the protocol guiding, what should be the contact tracing; incubation period and all those different recommendations, so that every member state can have the same, almost the same strategy and contact tracing... also (during COVID-19) there were different views from different countries of about when to do contact tracing, when to stop and so receive requests for information or information and some countries would use it, some would not. So, when it's harmonised, I think we're also using less time.”

The overall findings indicate that a balance needs to be sought between EU-level coordination and national autonomy. Despite acknowledging the need for standardisation and guidance regarding cross-border CT, some countries emphasised their wish to maintain their autonomy with regards to when to start and stop conducting cross-border CT, according to their national needs and priorities. According to some countries, the aim of the EU should focus on standardising CT data exchange. Nevertheless, countries also indicated that in order to manage their day-to-day operations, they saw a great value in having an overview of all countries' statuses on whether they are following up on the incoming CT data.

One solution recommended at the second webinar was that EU-level coordination could come into place when the countries ask the EC for this role during outbreaks. Another suggested solution was the development of an algorithm for countries to determine when cross-border CT should be conducted according to their geographical situation (e.g., islands may need to be stricter with incoming travellers), or on the epidemiological situation or vaccination coverage. Such a risk-based approach tailored to countries' needs could be more useful instead of activating/deactivating cross-border CT in a uniform way across EU.

Some of the responses mentioned the following considering EU standards and guidance:

- *“Guidance on a platform that could integrate general and disease specific assistance’. For example: ‘rules to apply on collective transportation (especially the number of seats to look for*

next to an index case, and also the impact of mask wearing on CT, the impact of the distribution of meals on board)”.

- Digitisation of tools for airline passenger data so that digital resources are immediately available and to be able to scale up when necessary.
- Improving surveillance and monitoring of infectious diseases to enable better evidence-based policy making.
- Training on new features of EWRS.
- Guidance on standardised policy-making: transparent risk assessment and contact tracing decision making with regard to subsidiarity and proportionality.

The majority of the respondents also expressed the need of having opportunities to exchange best practices with other countries (n=8). In this way, national capacities can be further enriched by the knowledge and expertise gained from other countries. “Exchange of best practices between countries” was also listed among main areas the EU could provide the most support for cross-border CT during the second webinar (43% of the participants).

As reflected in sections 4.7 and 5.1, one of the areas of need for EU-level support is research on the effectiveness of performing cross-border CT, both for potential transmission at departure or destination countries, and potential transmission during international travel with collective transportation means (in particular by planes). During the second webinar, “Evidence of effectiveness in conducting cross-border CT” was listed among the top 3 areas where the EU could provide the most support for cross-border CT (61% of participants). Such research can demonstrate when cross-border CT is beneficial to curb transmissions in a timely way.

Other areas where the EU could provide support for cross-border CT according to countries are as follows:

- Implications of the new Regulation (EU) 2022/2371 for cross-border CT (listed among top 3 areas the EU could provide the most support for cross-border CT during the second webinar (48% of the participants)).
- Improve timeliness of action by countries on sent/received data, communicated via a common file accessed by all EU/EEA countries.
- Define quality standards and monitor effectiveness.

5.3.2 EU support needs in relation to improve contact tracing software and platforms for cross-border CT performance

According to some countries, the aim of the EU should be to standardise and facilitate information exchange across countries, as was the aim with the introduction of dPLFs and the current developments of EWRS on new features (see section 5.1.1). Further opinions were shared on having a coordinated platform where other data, e.g., vaccination status or former test results, could be shared.

With regard to countries’ suggestions for features of EWRS, the importance of direct access of regional public health authorities to EWRS and the linkage of local data sources was indicated.

5.3.3 Policy that can facilitate and/or hinder the integration of data resources for CT

In terms of policies that can facilitate or hinder integration of data resources for CT, some countries responded that they did not have any specific policy that may influence the integration of data resources for CT in their country. However, the majority of the respondent countries shared factors, as described below.

Two countries indicated experiencing challenges with regard to legislation for the integration of data resources for CT, in particular in relation to GDPR and its interpretation. Also, the

understanding of the effect of its implementation were vague across MS according to one country and therefore, a discussion on the implementation of this legislation could be useful.

“One of the main hindrances in the beginning was the reluctance of relevant actors in handing over data, due their strict interpretation of the GDPR and fear of processing data unlawfully by transferring data to the Chief Epidemiologists Office.”

Some of the responses noted the following suggestions on how to deal with challenges in relation to legislation:

- Allow easier use of pseudonymised health (and other non-commercial) data and facilitate exchanges between countries.
- Provide potential incentives to all (health) partners to share data with public health authorities.
- Developing future data privacy frameworks for crisis periods.
- Establish an emergency preparedness register at national level, which allows different actors in the country to access CT data from selected tools that could be linked to other data sources (in a time-limited way).

Another challenge mentioned by countries regarding the integration of CT data resources is the way the current national digital infrastructure is organised. As a result, it is not always possible to link (sub)national CT platforms to each other (either among regions or with laboratory platforms, for example) and to share information between these platforms. This lowers the efficiency of CT practices. In addition, the responsibility for the implementation of CT lies at the regional level, but because the way in which CT is performed is legally determined at the national level, this makes it difficult for countries to take joint decisions.

“Regions are independently responsible for CT and can therefore decide what system/tools they need and want to use. This means that it is difficult to reach consensus to use and develop one CT system. Not all regions see the need or want to spend the resources needed to develop and integrate new systems.”

6. Conclusions and Recommendations

This section presents the conclusions of the study in the form of short answers to the key questions posed in the introduction section. These answers provide a summary of the analysis regarding the feasibility of integration of national digital technologies into the EWRS selective exchange functionality. They also provide information regarding countries' views toward and needs regarding the use of digital CT technology for other ID scenarios, such as respiratory diseases, Mpox and other STIs. Collectively, these answers provide guidance on how to use digital technologies for enhancing cross-border CT in support of health emergency response.

6.1 What are the main challenges and facilitators for carrying out cross-border CT in EU/EEA countries?

6.1.1 Overview of challenges and facilitators from the perspective of organisation of CT and related digital technology

Countries reported large variations in the number and types of digital CT technology they had used during the pandemic. Just over half reported one main CT case management system to register cases and their contacts, several reported using different case management systems in different regions and two did not report having any digital case management system. Data were usually transmitted from regional PHAs to the national public health institute or agency conducting cross-border CT by secure email or telephone.

Due to the enormous COVID-19 case numbers, countries were faced with many challenges that required them to adapt and apply strategies rapidly. Table 12 summarises these challenges that were encountered at the national level as well as some of the strategies implemented.

Table 12. Challenges and strategies reported at the national level during the COVID-19 pandemic

Challenges	Strategies/Solutions
- Recruiting and retaining sufficient human resources - Collaboration issues with the general public, due to pandemic fatigue, privacy concerns and digital illiteracy - Insufficient digital technology, including case management systems being too slow to handle the volume of CT data, and difficulties with linking databases containing lab and vaccination data to cases registered in case management systems - Obtaining relevant data for CT was time-consuming and difficult - Different regions within countries had their own policies, CT processes and digital technology - Needing to constantly adjust CT processes, guidelines and digital technology to the evolving pandemic	- Large numbers were recruited and trained to the CT workforce from various medical and non-medical fields, using various strategies such as flexible working hours to retain them - CT policies shifted toward focusing more on high-risk cases and their contacts - More flexibility was enabled for citizens by shifting more to self-service - Existing digital systems were adjusted and upgraded; new systems were developed to accommodate the rising numbers, and to facilitate data sharing between databases containing relevant CT data - Organisations were established to implement common strategies or national guidelines to be used across the country - In terms of legislation, the overwhelming majority of the countries introduced new law(s) to manage the scale of CT that was required during the pandemic, most of them used sunset clauses for legislative acts, meaning that many are now no longer in place

At the cross-border level, countries were also faced with challenges. These included an additional workload, a large part of which was manual; missing information, errors and delays with the CT data received from other countries, as well as from airlines; and different country guidelines on cross-border CT, with regard to defining relevant CT concepts, as well as when to continue/discontinue with data sharing. Doubts were expressed by several countries as to the added value of cross-border CT after the first stages of the pandemic. Tools such as the EWRS, the EUdPLF and national dPLFs were generally appreciated when it came to facilitating cross-border CT. However, when countries were overwhelmed with cases at the national level, cross-border CT was generally deprioritised. Despite the general recognition of the value of the EWRS and the EUdPLF, over half of the countries also reported using secure email for cross-border CT amongst EU/EEA countries.

6.1.2 Overview, challenges and facilitators from the perspective of legislation and ethics

Several countries reported having to **update public health and data protection laws**, which led to the adoption of new laws. Some of the new laws remain in force while others included a sunset clause which means that many were in effect only temporarily and are now no longer in effect. In general, the laws were adopted to allow the introduction of dPLFs, supporting epidemiological surveillance, as well as CT data collection and sharing, clarifying responsibilities, enabling the use of digital CT tools, and justifying the restriction of fundamental rights.

At EU-level, Regulation (EU) 2022/2371 (which repealed and replaced Decision No 1082/2013/EU) provides for a single lawful basis for sharing CT data across borders within the EU/EEA. When sharing **outside the EU/EEA** a more complex picture emerges, with many national laws implementing IHR 2005; however, as this does not indicate a single lawful basis for sharing CT data, it may act as barrier due to the legal complexity involved.

The **GDPR provided countries with a common data protection framework for CT, both within and outside the EU/EEA, which the countries were generally using appropriately**. Overall, countries used the same legal bases provided for in Article 6 and 9 for cross-border CT with EU/EEA countries. For CT data going to third countries, most countries relied on Article 49(1)(d) as a tool for transfer outside the EU/EEA. This indicates that GDPR was robust despite the wide margin of manoeuvrability available to countries, facilitating the free movement of data and legal interoperability.

Overall, **data protection problems relating to cross-border CT** seemed to be specific to COVID-19, in particular its sudden onset and high volume of data; as well as the new technologies, interoperability and data linkage challenges it posed. The study indicated that in the immediate face of the pandemic, there was a lack guidance from both national data protection authorities and European Data Protection Board (EDPB) on the applicability of GDPR to CT, which resulted in an initial hesitance to share data. Many countries also required new laws/regulations/guidance to facilitate the use of new technologies for CT data sharing, such as new specific laws to accommodate use of dPLF. Furthermore, while the study identified several variations in the way in which countries applied the principles of GDPR, EWRS was identified as a facilitator to GDPR compliant and compatible data sharing for CT.

From an **ethical perspective**, a barrier to sharing CT data arises in situations where CT could pose a risk to individual fundamental rights and freedoms. This may occur where punitive or criminal sanctions for non-adherence to quarantine laws or sexual orientation exist. This can occur both within and outside EU/EEA countries. For STIs and diseases transmitted through close contact, such as Mpox, several countries prefer the application of a balancing test on a case-by-case basis with an anonymous direct contact with the affected person. This highlights the importance of scope at individual MS level to make an assessment on whether to share CT data or not in these types of circumstances. Differences in national professional codes of practice and ethics may also act as a barrier to cross-border CT data sharing. Although most of the countries reported that these codes were adequate during COVID-19, the answers of those who applied amendments indicate that facilitating access to and sharing as well

as processing of sensitive personal data is a key not just for medical professionals but for non-healthcare professionals, such as those working in hospitality industry, or border crossings staff. For example, in some countries, staff working in restaurants, bars and other venues were entitled to process health information such as the certificate of COVID-19 vaccine, negative tests or previous infection as it was a requirement to enter specific public places. In another country, border-crossing staff arranged accommodation for COVID-19 infected foreigners.

6.2 What (national and subnational) digital tools could be integrated into EWRS, and how could they be integrated to allow a more efficient and effective CT across borders?

EWRS selective exchange module was regarded among major facilitators of cross-border CT as a safe, efficient and useful platform. However, during peak times of COVID-19, using selective exchange for CT resulted in a labour-intensive and time-consuming process. In terms of development of EWRS to allow more efficient and effective cross-border CT, two options are considered in the current regulatory background: adoption of new features and integration of national digital technologies into EWRS.

6.2.1 Regulatory background

Regulation (EU) 2022/2371 permits the continuous development of EWRS to allow for the use of new technologies such as new digital mobile apps, artificial intelligence models, or other automated CT technologies. The ECDC, in close cooperation with MS, will facilitate interoperability with national systems for the purposes of EWRS.

The understanding of the effects of the implementation of the Regulation was quite vague across MS and many were unaware of the Regulation or its specifics. Countries hoped the Regulation may change or aid them in conducting cross-border CT and that it would incentivise or improve digitalisation of CT, either by new technologies or developments to or integration of existing ones. Some countries found it hard to envision new technologies being established as a result of the Regulation yet maintained, that they would consider implementation of a new technology if it were deemed useful.

Countries indicated that a discussion on the implementation of this legislation within MS amongst MS could be useful.

6.2.2 Adoption of new features on EWRS selective exchange

As laid out briefly in Chapter 2, after the adoption of the new Regulation in November 2022, the EC proposed three developments EWRS for structured cross-border CT.

(1) Definition of the minimum data required for CT as part of EWRS contact tracing

Adoption of minimum data requirement was mostly positively perceived by the countries. There was a clear need for EU alignment on definition of minimum required data for CT. This could improve quality of data exchange via EWRS in terms of completeness, accuracy, and timeliness, while improving efficiency and reducing strain on human resources.

However, this adoption of minimum data required should not be too restrictive as for some infectious diseases, CT can be conducted with only limited information. When not all required data is available, some cases might be left behind.

(2) Structured cross-border CT data as part of EWRS selective exchange

Adoption of structured cross-border CT as part of EWRS was mostly positively perceived by the countries as there was a clear need for it to prevent overload of EWRS by enhancing the information

sharing and streamline data formatting, leading to improved efficiency. Such a platform would also meet the wish of countries to have a platform only used for cross-border CT, where selective exchange carried out for purposes other than CT (e.g., MEDEVAC) is separated.

When implementing the above mentioned two additional features, the platform should be applicable to a varied range of diseases and not be very restrictive, as different (emerging) diseases have different characteristics and data needs.

(3) Inclusion of data from dPLFs as part of EWRS selective exchange

Adoption of methods for the inclusion of data from dPLFs as part of EWRS selective exchange received positive comments in a quarter of the responses from the survey and the interviews. This relatively low rate was possibly related to the fact that all countries use EWRS, but only a number of them used EUdPLF and national dPLFs during COVID-19, to a varying degree. According to the responses, inclusion of dPLF data as part of EWRS selective exchange could lead to better coordination of sharing data and increase usability. This would be further enhanced if all countries use dPLFs during outbreaks that pose a serious cross-border health threat in Europe and the dPLFs are completely integrated.

6.2.3 Possible integration of different national and subnational digital CT technologies into EWRS selective exchange functionality

Assessment of feasibility

Integration or linkage of national and subnational digital CT technologies into EWRS has a big potential to improve efficiency and effectiveness of cross-border CT. Nevertheless, there are several challenges ahead. To assess the feasibility of this integration, our findings are presented based on three of the four levels of the EU eHealth interoperability framework⁽³³⁾, namely the legal, organisational (including policy), and technical interoperability. The semantic aspect of interoperability is not covered in this study as it is already being covered under the EWRS selective exchange module, including definition of minimum data requirements.

(1) Legal interoperability

The GDPR provides a common legal basis for data protection in the EU. Our finding shows a fair level of unity between countries in relation to application of GDPR for CT. For instance, all eight countries that shared which articles they rely on pointed to Article 6(1)(e), which allows for processing of data necessary for the performance of a task in the public interest or in the exercise of official authority in conjunction with Article 9(2)(i) which is the public health basis for processing. Although additional combinations of using Articles 6 and 9 have also been reported, GDPR is robust despite the wide margin of manoeuvrability available to countries. This helps to facilitate the free movement of data and interoperability among EU/EEA countries. However, in addition to the question of lawful basis, GDPR has further requirements, for instance in terms of compliance with principles, such as data sharing agreements or data protection impact assessment, where there is a wider variance in practice among the countries. Accordingly, some level of practical interoperability of legal and regulatory aspects of data sharing remains to be addressed. Furthermore, the legal interoperability between the governance frameworks of EWRS and national CT tools is also needed. These needs could be well addressed through guidance from national data protection agencies and the EDPB.

(2) Organisational and policy interoperability

Regular CT is organised at a subnational (local or regional) level in most of the countries included in the study. With the exception of smaller countries, subnational authorities are often in charge of how they organise and conduct CT and what digital technologies they use for it, although guidance and policy often come from national authorities. In most countries, a national EWRS operator in charge of cross-border CT does not seem to have direct access to the CT data and therefore they exchange CT data with subnational levels (or authorities who carry out CT) such as via secured email, online forms,

or encrypted servers, which are outside the outbreak response and management systems. Therefore, integration of CT technologies used at subnational level into EWRS would require involvement and commitment of subnational authorities in several countries. This indicates low organisational feasibility due to mainly decentralised organisation of CT in most countries. In smaller countries and a few countries where CT (technology) is relatively centralised or in the process of being centralised, integration of national systems directly with national authorities can be discussed.

(3) Technical interoperability

There is a very large variety of digital outbreak management systems used at national and subnational level, most of which are developed within the country for their specific needs. Internationally known platforms such as WHO's Go.Data and SORMAS were only briefly used by some countries or regions in the beginning of COVID-19 but often discontinued and replaced by CT systems developed according to the (sub)national needs. Having a very large variety of national and subnational outbreak management systems used for CT in EU/EEA countries and limited integration of systems within several countries significantly limits the feasibility of linking them to EWRS.

Future approach to integration of (sub)national digital technologies into EWRS selective exchange functionality

Although the number of countries with centralized outbreak management and case management systems are low and these mostly constitute smaller countries, there are a number of countries who are exploring or preparing to develop national digital systems that integrate subnational ones. Based on these developments and formation of post-COVID CT systems in the level of countries, as well as future technological developments which may facilitate integration of a large variety of different digital technologies, it might be possible to revisit the feasibility of integration of national digital technologies into EWRS selective exchange functionality in the future.

For the time being, an option would be to provide access to subnational actors for those countries who wish to have this. This can help to improve timeliness and efficiency of cross-border CT, in particular for larger countries with a highly decentralised organisation as cross-border CT requires flow of data between several actors nationally and across borders in these cases. Development of EWRS selective exchange in this direction would enable sharing of cross-border CT data between subnational and national actors of different countries and improve coordination across EU-national-subnational levels.

6.3. How do countries envision the future of international travel-related CT?

6.3.1 What are their experiences and views toward using EU dPLFs or national dPLFs integrated with ePLF?

When direct access to passenger data was not an option, using dPLFs (in particular EUdPLF) during large outbreaks such as pandemics was often regarded as the next best solution. In addition to the four countries who used EUdPLF during COVID-19, several countries were preparing to join to the EUdPLF, and others indicated they would consider doing so if legal barriers were removed. Legal challenges specific to EUdPLF highlighted were those related to data storage concerns, as well as need for further considerations to amend national laws. Most countries considered the national dPLF or EUdPLF to increase efficiency and improve data security, accessibility, and quality, but some countries expressed concern about this. Moreover, collecting data individually from passengers could be prone to errors and burdensome for passengers to be done on a routine basis, and required passenger compliance and their access to digital tools. Some countries also questioned the evidence of the value, effectiveness and efficiency, as well as the proportionality of use of dPLFs.

Legal aspects of PLFs

Most of the **countries that used dPLFs have adopted new laws** allowing the introduction of PLFs, mostly subject to sunset clauses and are now no longer in place, meaning that new legislative acts would be required for the re-introduction of dPLFs, while others relied on existing legislation. Several countries that operated dPLFs carried out data protection measures to ensure compliance with the **GDPR** principles of lawfulness, fairness, transparency, purpose limitation, data minimisation, accuracy, storage limitation, security and accountability. A few carried out a DPIA, while others were compliant with GDPR through other measures.

Many respondents pointed out that the collection of travel related data raises challenges to find the right balance between individual rights and public interest, as well as puts administrative burden both on the citizens and on the national authorities. Accordingly, the decision to use dPLFs and under what circumstances is an important national competence.

6.3.2 What are the experiences and views towards using passenger data from airlines?

Although this was not covered among the initial study questions, the interviews, surveys and webinars indicated that obtaining passenger data from airlines was a usual practice among EU/EEA countries during the COVID-19 pandemic. Therefore, this question was added in this conclusion section to summarise the findings.

All but one country reported that during the COVID-19 pandemic, passenger data was obtained from airlines for CT purposes (based on their national (public health) laws or legislation adopted as response to COVID-19). However, these data often came with delays or was sometimes incomplete or incorrect. Several countries mentioned that in an ideal situation, passenger data from airlines would be directly accessible. Currently, European legislation requires data provided by passengers during the process of booking and checking in for a flight to be communicated by the airlines to law enforcement and immigration authorities only for security purposes, which does not include public health reasons. The survey showed that at present countries relied on national legislation to access airline passenger data for CT purposes.

By comparing airline data sharing practices with usage of dPLFs, we can conclude that those countries who did not introduce dPLFs seemed to have relied on data from airlines as their main source of passenger data, whereas the others made use of both data sources. In some cases, data from airlines helped to complement incomplete dPLFs.

Legal and practical aspects of obtaining passenger data from airlines

As noted above, the GDPR legal basis for the re-use of passenger data requires such re-use to be provided for in **national rules**, such as in national public health laws, including implementation of IHRs (2005). Most countries reported having adopted such rules, with many having sunset clauses which mean that they are now no longer in force. On a practical basis, most of the countries replying to the survey reported that they obtained passenger data from airlines through the organisation in charge of sharing cross-border CT data through EWRS, while others through other public administration channels. Most countries explained receiving passenger data from airline companies as per request. No country reported routinely receiving passenger lists, though there is one country who is working towards an automated system. Data sharing was a mandatory obligation for the airline companies in most jurisdictions, whereas only one country specified that they didn't impose obligation and rely on voluntary collaboration.

6.3.3 What are their views towards linking these tools (EUdPLF and ePLF) with the EWRS?

The answer to this question is covered as part of "6.2.3 Possible integration of national and subnational digital CT technologies into EWRS".

6.4 What are countries' future plans regarding use of different digital technologies for CT and their utilisation for other communicable disease scenarios?

Countries' current strategies and future plans regarding the use of digital technologies for CT has been posed within various questions in the survey as well as the interviews. As presented in section 4.6.2, nine countries indicated having no plans to move to another type of software or platform for CT, eight indicated to consider a switch and three indicated they had plans to switch. Some countries indicated plans to make national systems available to integrate data from subnational systems or other CT relevant medical data, such as lab results or vaccination status. Seven countries reported their plans to develop generic systems to accommodate CT for multiple ID, as their systems had been too specific to COVID-19. However, further details or concrete information were limited in surveys and interviews that were mainly held in January-February, possibly due to the fact that the plans were not yet concretized enough to be shared with the EC.

Further information was sought for countries' future plans during the second webinar held on the 21 April 2023, based on two groups of infectious disease scenarios. These scenarios were developed based on the data provided by countries regarding diseases where CT is carried out within the country and across borders: 1) ID with respiratory transmission, such as Tuberculosis, Measles and Meningococcal Meningitis, and 2) STIs and ID that are transmitted through close contact and shared environment, such as Mpox.

The discussions revealed that there are currently no new plans for cross-border digital tools for other ID diseases; the EWRS works well enough for them. They would also need to reactivate their current national CT digital systems. For diseases such as tuberculosis or meningitis, cross-border CT was often not carried out anyway. Making use of proximity-based apps was also not something that countries could foresee during other outbreaks of respiratory diseases in the future, due to constraints related to legislation, acceptability issues among the general public, and unclarities about the efficacy of such apps. Nevertheless, there are plans to digitalise outbreak investigation on contacts and the systems for the managements of contact persons, which relates to the question answered under section 6.2.3.

As for Mpox and other STIs, countries mentioned that cross-border CT was generally not carried out, mainly due to the sensitive nature of these diseases, fears regarding data protection and the risk of discrimination for individuals in some countries. CT for STIs is generally handled by STI clinics, rather than public health services, and the need for CT is decided on a case-by-case basis, in collaboration with the patient. If the names of contacts are known, either the PHP or patient can notify them, or they make use of anonymised notification systems. The use of digital technology at the EU level for STIs and diseases transmitted through close contact does not appear to be a prominent option at the moment and in the near future.

6.5 In what areas would EU-level support be valuable to enhance cross-border CT in relation to digital technologies?

EU-level support would be valuable to enhance cross-border CT in a number of areas.

6.5.1 Potential EU-level action for cross-border CT with particular focus on digital tools

Developing frameworks and examining the evidence for effectiveness of performing cross-border CT: EU-level support is needed to demonstrate the effectiveness of performing cross-border CT, both to reduce transmission at the country of origin or destination, and during journey with a collective transportation means. To demonstrate when cross-border CT is most effective, efficient, and proportionate, an appropriate evaluative framework should consider different factors such as transmission levels (sporadic cases, clusters of cases, and community transmission), burden on passengers and proportionate limitation on individuals' rights, and competing national priorities when

the case numbers are too high. Such evidence can provide a basis for countries for their decisions regarding use of digital tools for cross-border CT, such as dPLFs and EWRS.

Guidance on when to activate/deactivate cross-border CT in EU/EEA countries: There is a need for standardisation and guidance on when to start and stop cross-border CT. Nevertheless, a balance needs to be sought between EU-level coordination and national autonomy when it comes to when to activate/deactivate cross-border CT. The geographic, economic, and social contexts of EU/EEA countries vary greatly. Moreover, during an outbreak, differences on epidemiological status and vaccination levels would also influence any decisions made. Therefore, rather than recommending starting or stopping cross-border CT altogether in the Union, guidance can be developed (e.g., an algorithm or another form) to determine when countries should conduct cross-border CT, with a risk-based approach tailored to the context and needs of the countries.

Guidance on standards for (sub)national CT technologies: As several countries are moving forward with developing national or subnational systems for CT for future outbreaks, it would be beneficial to develop guidance on standards, including system requirements as well as all aspects of interoperability. Of note, with the planned funding under EU4HEALTH, Member States will be able to apply for grants to strengthen their national systems.

6.5.2 Potential developments for EWRS

Facilitating making country-specific and up-to-date CT-relevant measures and policies available: To decide whether to send outgoing cross-border CT requests to other countries during outbreaks or have insight on the incoming requests received, countries wish to be able to see the latest status of CT in each country, including whether they act upon incoming CT requests, case and contact definitions, CT guidelines, measures applied, and others. Making such information available in common platforms such as the EWRS, while allowing countries to dynamically update them would be appreciated during outbreaks. This would support the alignment between countries in cross-border CT (while at the same time retaining country autonomy) on which countries to send outgoing CT requests to during outbreaks, the type of data to share, when to send this data, and in the definitions of CT-relevant concepts, such as ‘close contacts’.

Providing subnational actors’ access to EWRS: As stated earlier, providing access to subnational actors for those countries who wish to have can improve timeliness and efficiency of cross-border CT especially for large countries with decentralised organisation. Development of EWRS selective exchange in this direction would enable sharing of cross-border CT data between subnational and national actors of different countries.

6.5.3 Other potential areas of need

On legal and ethical aspects in relation to digital technologies

Support in the implementation of Regulation (EU) 2022/2371 in the context of digital technologies: Many countries recognise the importance of the new Regulation in supporting the operations of EWRS, in particular the integration of digital technologies. A lack of understanding about how the Regulation can assist in this regard could be supported with EU engagement and discussion with MS.

Guidance on how to apply GDPR to digital technology used for national and cross-border CT: Countries indicated that there was a lack of guidance on the application of GDPR to cross-border CT activities, particularly in the initial throes of COVID-19. Guidance from both national authorities and the European Data Protection Board (EDPB) in the context of digital technology is recommended.

Development of codes of practice: Specific CT codes of practice for ethical CT when using digital technology along with codes to protect the privacy and fundamental rights of citizens can be developed.

Creation of standardised data-sharing templates: Although the GDPR provides the legal basis for CT data sharing, the format for doing this is defined at national and local level. To facilitate easier cross-border CT data sharing, the creation of standardised data sharing templates with the involvement and agreement of the EDPB could help to build acceptance of CT data sharing as a GDPR compliant form of data processing amongst all players.

On collaboration across EU/EEA countries

Exchanging good practices on national and cross-border CT: EU/EEA countries wish to exchange good practices on various aspects of national and cross-border CT, including, among others, organisation of CT with subnational actors, standards of digital CT technologies, collaboration with airlines, and ethical principles in CT for STIs and diseases transmitted through close contact.

On collaboration beyond EU/EEA countries

GDPR compliant platforms for sharing data outside EU/EEA: Within the EU/EEA, the EWRS was recognised as a secure, GDPR compliant, and efficient platform for sharing CT data within the EU/EEA. Countries shared their wish to have a similar centralised platform to exchange CT data with non-EU/EEA countries to improve security and efficiency of international CT.

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 32. DIRECTIVE (EU) 2016/681 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the use of passenger name record (PNR) data for the prevention, detection, investigation and prosecution of terrorist offences and serious crime, (2016).
 33. European Commission Directorate-General for the Information. eHealth European Interoperability Framework : overall executive summary: Publications Office; 2013.

Appendix A: Proposed developments for structured cross-border contact tracing

Information notes as of February 2023

Proposed developments for structured cross-border contact tracing:

After the adoption of the new Regulation in November 2022, the EC proposes to review the variables that can be exchanged for cross-border contact tracing, replacing the Commission Recommendation 2017/1140.

EWRS new architecture will support that the selective exchange for contact tracing will become an independent module, which will provide the ability to separate data access to specific users. The contact tracing officers will be nominated by the Member States Authorities, thus limiting the exposure of the sensitive data.

A dedicated user for “Contact Tracing” can utilise Selective Exchange function to send contacts or to receive information by/from other countries. EWRS user will receive this list attached to a secure Selective Exchange message, which imports the contacts in the database, having first checked for possible duplicates. The system will raise a flag in such case. For the Contact Tracing selective exchange messages, the system will allow sharing with multiple recipient countries and limits actual access only to those involved. The Contact Tracing functionality will consist of the Selective Exchange messaging mechanism, the automated import functionality and three supporting tables. These tables are “Received”, “Sent” and “Archived” list of contacts. “Received” and “Sent” tables are completed by an “Actions” mechanism for bulk and individual management of contacts. The actions supported will be Update Contact Status and Comment, Add and Remove recipient and Update Contact Comment. The designated Contact Tracing user may add manually a contact and also edit the contacts.

At an individual’s contact page, the user can see the history of the contact status. EWRS automatically deletes the contact tracing personal information after a specific retention period, or when the contact reaches a specific status (e.g., archived). The remaining non sensitive contact information is moved into a separate list for statistical purposes. Furthermore, the dedicated user for contact tracing can visualise, comment, and change the statuses of the received contacts, thus allowing for optimised contact management and administration activities accomplishment, the variables that will be collected are listed in the Appendix.

Current state of the EWRS selective exchange functionality for contact tracing:

EWRS guarantee protection of personal data. A security posture strengthened through relevant procedures and redefined periodically through security audits and data protection assessment. At the time of writing, CT messages can be exchanged as described above (the complete functionality is in User Acceptance Testing/UAT phase, ready to be launched for UAT testing from the Member States). In addition, the EWRS managers are considering the integration of EU PLF exchange platform (ePLF) to EWRS selective exchange. The ePLF platform can support the exchange of traveller contact tracing data, collected by the National passenger locator forms (NPLF), including those countries that are linked with the EU digital Passenger Locator forms EUdPLF. The ePLF integration into EWRS would allow that EWRS will receive contacts information from the ePLF system and displays it to the recipient country/countries at EWRS selective exchange functionality.

DG SANTE with support of the ECDC EWRS team has procured a new study (“Assessment of the needs to ensure the alignment of Early Warning and Response System with the Regulation on serious cross-

border threats to health”ⁱⁱⁱ) that will lay the ground for further development and the use for fit-for-purpose emerging technologies.

Contact Tracing import template fields

As mentioned earlier, the EWRS will accept an Excel list and automatically place information into the database. The figure and table below show the fields that are available for a contact. Note that the variables and grouping of fields might change depending on the feedback received from MS after UAT.

Figure 3. Contact Tracing import file example

FileContactId	FirstName	LastName	City	Region/County/State	PostalCode	Phone	Email	Agent	Disease
1	James	Bond	London	United Kingdom		14171 0044123456789, 0044987654321	jamesbond@gmail.com	Coronavirus	Severe Acute Respiratory Syndrome coronavirus

Table 13. Contact Tracing fields

Contact Details Screen	
	Field Type
Contact Details - Mandatory	
Contact ID	Autogenerated
Source	Autogenerated
Reporting Country	Autogenerated
Reporting Date	Autogenerated
First name	Free Text
Last name / Family name	Free Text
Current City	Free Text
Current Region / County / State	Free Text
Current Postal Code	alpha numerical
Telephone number	Numerical
Email address	Free Text
Agent	Dropdown list
Disease	Dropdown list
Index_Case_ID	alpha numerical
Close contact	Dropdown list
Recipient Country	Dropdown list
Transport Type	Dropdown list
Ship name / Flight number	alpha numerical
Seat/Cabin number contact	alpha numerical

iii Assessment of the needs to ensure alignment of the Early Warning and Response System with the Regulation on serious cross-border threats to health study, BEACON-000075 contract, under DIGIT/2020/OP/0005 – BEACON Lot 2.

Date of travel	Date Picker
Origin location	Free text
Destination location	Free text
Last destination	Free text
Contact details	
Nationality	Dropdown list
Date of birth	Date Picker
Sex	Dropdown list
Document Identifier Type	Dropdown list
Issuing Authority	Dropdown list
Person or document identifier	alpha numerical
Current address	Free Text
Additional address	Free Text
Country of Residence	Dropdown list
Residential address	Text
Other means of contact	alpha numerical
Emergency Contact Details	alpha numerical
Case details	
Accompanying_Person_ID	Autogenerated
Date last exposure	Date Picker
Successfully informed	Dropdown list
Case pseudo id	Numerical
Case date symptom onset	Date Picker
Travel details	
Time of Departure	Time Picker
Country of Departure	Dropdown list
Country of Arrival	Dropdown list
Comment	Free text
Visiting details	
Persons/Place of Visit	Free text
Visit date	Date Picker
Visit Addresses	Free text
Visit Telephone	Numerical

Appendix B: List of references in legal sections

Legal references of:

1. International Health Regulations
2. Regulation (EU) 2022/2371 on serious cross-border threats to health
3. Decision No 1082/2013/EU on serious cross-border threats to health (NO LONGER IN FORCE)
4. Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (GDPR)

1. International Health Regulations (2005)

Retrieved from: www.who.int/publications/i/item/9789241580496

The following article referenced in the report:

PART V – PUBLIC HEALTH MEASURES

Chapter I – General provisions

Article 23 Health measures on arrival and departure

1. Subject to applicable international agreements and relevant articles of these Regulations, a State Party may require for public health purposes, on arrival or departure:

(a) with regard to travellers:

- (i) information concerning the traveller's destination so that the traveller may be contacted;
- (ii) information concerning the traveller's itinerary to ascertain if there was any travel in or near an affected area or other possible contacts with infection or contamination prior to arrival, as well as review of the traveller's health documents if they are required under these Regulations; and/or
- (iii) a non-invasive medical examination which is the least intrusive examination that would achieve the public health objective;

(b) inspection of baggage, cargo, containers, conveyances, goods, postal parcels and human remains.

2. Regulation (EU) 2022/2371 of the European Parliament and of the Council of 23 November 2022 on serious cross-border threats to health and repealing Decision No 1082/2013/EU

Retrieved from: www.eur-lex.europa.eu/eli/reg/2022/2371/oj

The following articles are referenced in the report:

Article 18

Early Warning and Response System

1. The EWRS shall enable the Commission, the ECDC, and the competent authorities responsible at national level to be in permanent communication for the purposes of preparedness, early warning and response, alert notifications, assessing public health risks and determining the measures that may be required to protect public health.
2. The management and operational use of the EWRS shall involve the exchange of personal data in specific cases where the relevant legal instruments so provide. Such management and use shall include:
 - (a) the processing of personal data of authorised users of the system; and

- (b) the processing of health data and other personal data when strictly necessary for the purpose for which those data were transmitted, through the EWRS selective messaging functionality, in accordance with Article 28.

Taking into account Member States' opinions, the ECDC shall continuously update the EWRS, allowing for the use of modern technologies such as digital mobile applications, artificial intelligence models, space-enabled applications, or other technologies for automated contact tracing, building upon the contact-tracing technologies developed by the Member States or by the Union and used for the purpose of combatting serious cross-border threats to health. The ECDC, in close cooperation with Member States, shall facilitate interoperability with national systems for the purposes of the EWRS.

The ECDC shall also provide technical assistance to the competent authorities responsible at national level, including training following updates to the EWRS.

3. Each Member State shall designate the competent authority or authorities responsible at national level for notifying alerts and determining the measures required to protect public health, for the purposes of early warning and response in accordance with paragraphs 1 and 2 of this Article, as well as Articles 19 and 20.
4. The Commission shall, by means of implementing acts, adopt procedures concerning the information exchange with other rapid alert systems at Union and international levels, including exchange of personal data, in order to ensure the proper functioning of the EWRS and to avoid the overlapping of activities or conflicting actions with existing structures and mechanisms for preparedness for, monitoring, early warning of and combatting serious cross-border threats to health, in a coordinated One Health approach.

Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 29(2).

Article 19

Alert notification

1. National competent authorities or the Commission shall notify an alert in the EWRS, where the emergence or development of a serious cross-border threat to health fulfils the following criteria:
 - (a) it is unusual or unexpected for the given place and time, it is causing or may cause significant morbidity or mortality in humans, it is growing rapidly or may grow rapidly in scale, or it is exceeding or may exceed national response capacity;
 - (b) it affects or may affect more than one Member State; and
 - (c) it requires or may require a coordinated response at Union level.
2. Where the national competent authorities notify the WHO of events that may constitute public health emergencies of international concern, and in the absence of full interoperability between the WHO notification system and the EWRS, national competent authorities shall simultaneously notify an alert in the EWRS, provided that the threat concerned falls within those referred to in Article 2(1) of this Regulation.
3. When notifying an alert, the national competent authorities and the Commission shall promptly communicate through the EWRS any available relevant information in their possession that may be useful for coordinating the response such as:
 - (a) the type and origin of the agent;
 - (b) the date and place of the incident or outbreak;
 - (c) means of transmission or dissemination;
 - (d) toxicological data;
 - (e) detection and confirmation methods;
 - (f) public health risks;
 - (g) public health measures implemented or intended to be taken at national level;
 - (h) measures other than public health measures, including multi-sectoral measures;

- (i) whether there is an urgent need for or shortage of medical countermeasures;
 - (j) requests and offers for cross-border emergency assistance, such as the medical transfer of patients or provision of healthcare staff by one Member State to another, in particular in cross-border areas in neighbouring regions;
 - (k) personal data necessary for the purpose of contact tracing in accordance with Article 28;
 - (l) any other information relevant to the serious cross-border threat to health in question.
4. The Commission shall make available to the national competent authorities through the EWRS any information that may be useful for coordinating the response referred to in Article 21, including information relating to serious cross-border threats to health and public health measures related to serious cross-border threats to health, already transmitted through rapid alert and information systems established under other provisions of Union law or the Euratom Treaty.
 5. Member States shall update the information referred to in paragraph 3 as new data become available.

Article 28

Protection of personal data concerning the EWRS selective messaging functionality

1. The EWRS shall include a selective messaging functionality allowing personal data, including contact and health data, to be communicated only to the national competent authorities involved in contact-tracing measures and medical evacuation procedures. That selective messaging functionality shall be designed and operated so as to ensure safe and lawful processing of personal data and to link with contact-tracing systems at Union level.
2. Where national competent authorities implementing contact-tracing measures or medical evacuation procedures communicate, through the EWRS, personal data necessary for contact-tracing purposes pursuant to Article 19(3), they shall use the selective messaging functionality referred to in paragraph 1 of this Article and communicate the data only to the other Member States involved in the contact-tracing or medical evacuation measures.
3. When communicating the data referred to in paragraph 2, the national competent authorities shall refer to the alert communicated previously through the EWRS.
4. The selective message functionality shall be used solely for the purpose of contact tracing and medical evacuation. It shall only allow national competent authorities to receive data that were sent to them by other national competent authorities. The ECDC shall only access the data required to ensure the proper functioning of the selective message functionality. Messages containing personal data shall automatically be erased from the selective message functionality 14 days after the date of their posting at the latest.
5. Where necessary for the purpose of contact tracing, personal data may also be exchanged using contact-tracing technologies. The national competent authorities shall not retain the contact data and health data received through the selective message functionality for longer than the retention period applicable in the context of their national contact-tracing activities.
6. The Commission shall adopt delegated acts in accordance with Article 31 to supplement this Regulation by establishing:
 - (a) detailed requirements necessary to ensure that the operation of the EWRS and the processing of data complies with Regulation (EU) 2016/679 and Regulation (EU) 2018/1725, including the respective responsibilities of the national competent authorities and of the ECDC; and
 - (b) a list of the categories of personal data that may be exchanged for the purpose of the coordination of contact-tracing measures.
7. The Commission shall, by means of implementing acts, adopt:
 - (a) procedures for the interlinking of the EWRS with contact-tracing systems at Union and international levels; and

- (b) the modalities for processing contact-tracing technologies and their interoperability, as well as the cases where, and the conditions under which, the third countries may be granted access to contact-tracing interoperability and the practical arrangements for such access, in full compliance with Regulation (EU) 2016/679 and the applicable case law of the Court of Justice of the European Union.

Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 29(2).

3. Decision No 1082/2013/EU of the European Parliament and of the Council of 22 October 2013 on serious cross-border threats to health and repealing Decision No 2119/98/EC (NO LONGER IN FORCE)

Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013D1082>

The following articles are referenced in the report:

Article 9 (NO LONGER IN FORCE)

Alert notification

1. National competent authorities or the Commission shall notify an alert in the EWRS where the emergence or development of a serious cross-border threat to health fulfils the following criteria:
 - (a) it is unusual or unexpected for the given place and time, or it causes or may cause significant morbidity or mortality in humans, or it grows rapidly or may grow rapidly in scale, or it exceeds or may exceed national response capacity; and
 - (b) it affects or may affect more than one Member State; and
 - (c) it requires or may require a coordinated response at Union level.
2. Where the national competent authorities notify the WHO of events that may constitute public health emergencies of international concern in accordance with Article 6 of the IHR, they shall at the latest simultaneously notify an alert in the EWRS, provided that the threat concerned falls within those referred to in Article 2(1) of this Decision.
3. When notifying an alert, the national competent authorities and the Commission shall promptly communicate through the EWRS any available relevant information in their possession that may be useful for coordinating the response such as:
 - (a) the type and origin of the agent;
 - (b) the date and place of the incident or outbreak;
 - (c) means of transmission or dissemination;
 - (d) toxicological data;
 - (e) detection and confirmation methods;
 - (f) public health risks;
 - (g) public health measures implemented or intended to be taken at national level;
 - (h) measures other than public health measures;
 - (i) personal data necessary for the purpose of contact tracing in accordance with Article 16;
 - (j) any other information relevant to the serious cross-border threat to health in question.
4. The Commission shall make available to the national competent authorities through the EWRS any information that may be useful for coordinating the response referred to in Article 11, including information related to serious cross-border threats to health and public health measures related to serious cross-border threats to health transmitted through rapid alert and information systems established under other provisions of Union law or the Euratom Treaty.

Article 16 (NO LONGER IN FORCE)

Protection of personal data

1. In the application of this Decision, personal data shall be processed in accordance with Directive 95/46/EC and Regulation (EC) No 45/2001. In particular, appropriate technical and organisational measures shall be taken to protect such personal data against accidental or illegal destruction, accidental loss, or unauthorised access and against any form of illegal processing.
2. The EWRS shall include a selective messaging functionality allowing personal data to be communicated only to national competent authorities involved in contact tracing measures. That selective messaging functionality shall be designed and operated so as to ensure safe and lawful exchange of personal data.
3. Where competent authorities implementing contact tracing measures communicate personal data necessary for contact tracing purposes through the EWRS pursuant to Article 9(3), they shall use the selective messaging functionality referred to in paragraph 2 of this Article and communicate the data only to the other Member States involved in the contact tracing measures.
4. When circulating the information referred to in paragraph 3, the competent authorities shall refer to the alert communicated previously through the EWRS.
5. Messages containing personal data shall automatically be erased from the selective message functionality 12 months after the date of their posting.
6. Where a competent authority establishes that notification of personal data made by it pursuant to Article 9(3) has subsequently proved to be in breach of Directive 95/46/EC because that notification was unnecessary for the implementation of the contact tracing measures at issue, it shall inform immediately the Member States to which that notification was transmitted.
7. In relation to their responsibilities to notify and rectify personal data through the EWRS, the national competent authorities shall be regarded as controllers within the meaning of point (d) of Article 2 of Directive 95/46/EC.
8. In relation to its responsibilities concerning storage of personal data, the Commission shall be regarded as a controller within the meaning of point (d) of Article 2 of Regulation (EC) No 45/2001.
9. The Commission shall adopt:
 - (a) guidelines aimed at ensuring that the day-by-day operation of the EWRS complies with Directive 95/46/EC and Regulation (EC) No 45/2001;
 - (b) a recommendation providing an indicative list of the personal data that may be exchanged for the purpose of the coordination of contact tracing measures.

4. Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

Retrieved from: <https://eur-lex.europa.eu/eli/reg/2016/679/oj>

The following articles are referenced in the report:

Article 5

Principles relating to processing of personal data

1. Personal data shall be:

- (a) processed lawfully, fairly and in a transparent manner in relation to the data subject ('lawfulness, fairness and transparency');
 - (b) collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes; further processing for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes shall, in accordance with Article 89(1), not be considered to be incompatible with the initial purposes ('purpose limitation');
 - (c) adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed ('data minimisation');
 - (d) accurate and, where necessary, kept up to date; every reasonable step must be taken to ensure that personal data that are inaccurate, having regard to the purposes for which they are processed, are erased or rectified without delay ('accuracy');
 - (e) kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the personal data are processed; personal data may be stored for longer periods insofar as the personal data will be processed solely for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes in accordance with Article 89(1) subject to implementation of the appropriate technical and organisational measures required by this Regulation in order to safeguard the rights and freedoms of the data subject ('storage limitation');
 - (f) processed in a manner that ensures appropriate security of the personal data, including protection against unauthorised or unlawful processing and against accidental loss, destruction or damage, using appropriate technical or organisational measures ('integrity and confidentiality').
2. The controller shall be responsible for, and be able to demonstrate compliance with, paragraph 1 ('accountability').

Article 6

Lawfulness of processing

1. Processing shall be lawful only if and to the extent that at least one of the following applies:
- (a) the data subject has given consent to the processing of his or her personal data for one or more specific purposes;
 - (b) processing is necessary for the performance of a contract to which the data subject is party or in order to take steps at the request of the data subject prior to entering into a contract;
 - (c) processing is necessary for compliance with a legal obligation to which the controller is subject;
 - (d) processing is necessary in order to protect the vital interests of the data subject or of another natural person;
 - (e) processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller;
 - (f) processing is necessary for the purposes of the legitimate interests pursued by the controller or by a third party, except where such interests are overridden by the interests or fundamental rights and freedoms of the data subject which require protection of personal data, in particular where the data subject is a child.

Point (f) of the first subparagraph shall not apply to processing carried out by public authorities in the performance of their tasks.

2. Member States may maintain or introduce more specific provisions to adapt the application of the rules of this Regulation with regard to processing for compliance with points (c) and (e) of paragraph 1 by determining more precisely specific requirements for the processing and other measures to ensure lawful and fair processing including for other specific processing situations as provided for in Chapter IX.

3. The basis for the processing referred to in point (c) and (e) of paragraph 1 shall be laid down by:
 - (a) Union law; or
 - (b) Member State law to which the controller is subject.The purpose of the processing shall be determined in that legal basis or, as regards the processing referred to in point (e) of paragraph 1, shall be necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller. That legal basis may contain specific provisions to adapt the application of rules of this Regulation, inter alia: the general conditions governing the lawfulness of processing by the controller; the types of data which are subject to the processing; the data subjects concerned; the entities to, and the purposes for which, the personal data may be disclosed; the purpose limitation; storage periods; and processing operations and processing procedures, including measures to ensure lawful and fair processing such as those for other specific processing situations as provided for in Chapter IX. The Union or the Member State law shall meet an objective of public interest and be proportionate to the legitimate aim pursued.
4. Where the processing for a purpose other than that for which the personal data have been collected is not based on the data subject's consent or on a Union or Member State law which constitutes a necessary and proportionate measure in a democratic society to safeguard the objectives referred to in Article 23(1), the controller shall, in order to ascertain whether processing for another purpose is compatible with the purpose for which the personal data are initially collected, take into account, inter alia:
 - (a) any link between the purposes for which the personal data have been collected and the purposes of the intended further processing;
 - (b) the context in which the personal data have been collected, in particular regarding the relationship between data subjects and the controller;
 - (c) the nature of the personal data, in particular whether special categories of personal data are processed, pursuant to Article 9, or whether personal data related to criminal convictions and offences are processed, pursuant to Article 10;
 - (d) the possible consequences of the intended further processing for data subjects;
 - (e) the existence of appropriate safeguards, which may include encryption or pseudonymisation.

Article 9

Processing of special categories of personal data

1. Processing of personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation shall be prohibited.
2. Paragraph 1 shall not apply if one of the following applies:
 - (a) the data subject has given explicit consent to the processing of those personal data for one or more specified purposes, except where Union or Member State law provide that the prohibition referred to in paragraph 1 may not be lifted by the data subject;
 - (b) processing is necessary for the purposes of carrying out the obligations and exercising specific rights of the controller or of the data subject in the field of employment and social security and social protection law in so far as it is authorised by Union or Member State law or a collective agreement pursuant to Member State law providing for appropriate safeguards for the fundamental rights and the interests of the data subject;
 - (c) processing is necessary to protect the vital interests of the data subject or of another natural person where the data subject is physically or legally incapable of giving consent;
 - (d) processing is carried out in the course of its legitimate activities with appropriate safeguards by a foundation, association or any other not-for-profit body with a political,

- philosophical, religious or trade union aim and on condition that the processing relates solely to the members or to former members of the body or to persons who have regular contact with it in connection with its purposes and that the personal data are not disclosed outside that body without the consent of the data subjects;
- (e) processing relates to personal data which are manifestly made public by the data subject;
 - (f) processing is necessary for the establishment, exercise or defence of legal claims or whenever courts are acting in their judicial capacity;
 - (g) processing is necessary for reasons of substantial public interest, on the basis of Union or Member State law which shall be proportionate to the aim pursued, respect the essence of the right to data protection and provide for suitable and specific measures to safeguard the fundamental rights and the interests of the data subject;
 - (h) processing is necessary for the purposes of preventive or occupational medicine, for the assessment of the working capacity of the employee, medical diagnosis, the provision of health or social care or treatment or the management of health or social care systems and services on the basis of Union or Member State law or pursuant to contract with a health professional and subject to the conditions and safeguards referred to in paragraph 3;
 - (i) processing is necessary for reasons of public interest in the area of public health, such as protecting against serious cross-border threats to health or ensuring high standards of quality and safety of health care and of medicinal products or medical devices, on the basis of Union or Member State law which provides for suitable and specific measures to safeguard the rights and freedoms of the data subject, in particular professional secrecy;
 - (j) processing is necessary for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes in accordance with Article 89(1) based on Union or Member State law which shall be proportionate to the aim pursued, respect the essence of the right to data protection and provide for suitable and specific measures to safeguard the fundamental rights and the interests of the data subject.
3. Personal data referred to in paragraph 1 may be processed for the purposes referred to in point (h) of paragraph 2 when those data are processed by or under the responsibility of a professional subject to the obligation of professional secrecy under Union or Member State law or rules established by national competent bodies or by another person also subject to an obligation of secrecy under Union or Member State law or rules established by national competent bodies.
 4. Member States may maintain or introduce further conditions, including limitations, with regard to the processing of genetic data, biometric data or data concerning health.

Article 46

Transfers subject to appropriate safeguards

1. In the absence of a decision pursuant to Article 45(3), a controller or processor may transfer personal data to a third country or an international organisation only if the controller or processor has provided appropriate safeguards, and on condition that enforceable data subject rights and effective legal remedies for data subjects are available.
2. The appropriate safeguards referred to in paragraph 1 may be provided for, without requiring any specific authorisation from a supervisory authority, by:
 - (a) a legally binding and enforceable instrument between public authorities or bodies;
 - (b) binding corporate rules in accordance with Article 47;
 - (c) standard data protection clauses adopted by the Commission in accordance with the examination procedure referred to in Article 93(2);
 - (d) standard data protection clauses adopted by a supervisory authority and approved by the Commission pursuant to the examination procedure referred to in Article 93(2);

- (e) an approved code of conduct pursuant to Article 40 together with binding and enforceable commitments of the controller or processor in the third country to apply the appropriate safeguards, including as regards data subjects' rights; or
 - (f) an approved certification mechanism pursuant to Article 42 together with binding and enforceable commitments of the controller or processor in the third country to apply the appropriate safeguards, including as regards data subjects' rights.
3. Subject to the authorisation from the competent supervisory authority, the appropriate safeguards referred to in paragraph 1 may also be provided for, in particular, by:
 - (a) contractual clauses between the controller or processor and the controller, processor or the recipient of the personal data in the third country or international organisation; or
 - (b) provisions to be inserted into administrative arrangements between public authorities or bodies which include enforceable and effective data subject rights.
 4. The supervisory authority shall apply the consistency mechanism referred to in Article 63 in the cases referred to in paragraph 3 of this Article.
 5. Authorisations by a Member State or supervisory authority on the basis of Article 26(2) of Directive 95/46/EC shall remain valid until amended, replaced or repealed, if necessary, by that supervisory authority. Decisions adopted by the Commission on the basis of Article 26(4) of Directive 95/46/EC shall remain in force until amended, replaced or repealed, if necessary, by a Commission Decision adopted in accordance with paragraph 2 of this Article.

Article 49

Derogations for specific situations

1. In the absence of an adequacy decision pursuant to Article 45(3), or of appropriate safeguards pursuant to Article 46, including binding corporate rules, a transfer or a set of transfers of personal data to a third country or an international organisation shall take place only on one of the following conditions:
 - (a) the data subject has explicitly consented to the proposed transfer, after having been informed of the possible risks of such transfers for the data subject due to the absence of an adequacy decision and appropriate safeguards;
 - (b) the transfer is necessary for the performance of a contract between the data subject and the controller or the implementation of pre-contractual measures taken at the data subject's request;
 - (c) the transfer is necessary for the conclusion or performance of a contract concluded in the interest of the data subject between the controller and another natural or legal person;
 - (d) the transfer is necessary for important reasons of public interest;
 - (e) the transfer is necessary for the establishment, exercise or defence of legal claims;
 - (f) the transfer is necessary in order to protect the vital interests of the data subject or of other persons, where the data subject is physically or legally incapable of giving consent;
 - (g) the transfer is made from a register which according to Union or Member State law is intended to provide information to the public and which is open to consultation either by the public in general or by any person who can demonstrate a legitimate interest, but only to the extent that the conditions laid down by Union or Member State law for consultation are fulfilled in the particular case.

Where a transfer could not be based on a provision in Article 45 or 46, including the provisions on binding corporate rules, and none of the derogations for a specific situation referred to in the first subparagraph of this paragraph is applicable, a transfer to a third country or an international organisation may take place only if the transfer is not repetitive, concerns only a limited number of data subjects, is necessary for the purposes of compelling legitimate interests pursued by the controller which are not overridden by the interests or rights and freedoms of the data subject, and the controller has assessed all the circumstances surrounding the data transfer and has on the basis of that assessment provided suitable

safeguards with regard to the protection of personal data. The controller shall inform the supervisory authority of the transfer. The controller shall, in addition to providing the information referred to in Articles 13 and 14, inform the data subject of the transfer and on the compelling legitimate interests pursued.

2. A transfer pursuant to point (g) of the first subparagraph of paragraph 1 shall not involve the entirety of the personal data or entire categories of the personal data contained in the register. Where the register is intended for consultation by persons having a legitimate interest, the transfer shall be made only at the request of those persons or if they are to be the recipients.
3. Points (a), (b) and (c) of the first subparagraph of paragraph 1 and the second subparagraph thereof shall not apply to activities carried out by public authorities in the exercise of their public powers.
4. The public interest referred to in point (d) of the first subparagraph of paragraph 1 shall be recognised in Union law or in the law of the Member State to which the controller is subject.
5. In the absence of an adequacy decision, Union or Member State law may, for important reasons of public interest, expressly set limits to the transfer of specific categories of personal data to a third country or an international organisation. Member States shall notify such provisions to the Commission.
6. The controller or processor shall document the assessment as well as the suitable safeguards referred to in the second subparagraph of paragraph 1 of this Article in the records referred to in Article 30.

Appendix C: Summary of the literature review study methods

The review was guided by the methodology of a (systematic) scoping review, which included: (1) identifying the scope and approach, (2) searching for relevant literature (scientific and grey), (3) selecting literature, (4) analysis of the literature, and (5) synthesis of the report.

1. Identifying the scope and approach

The scope and approach were identified in the inception phase of the study. The approach and resulting inclusion criteria and methods for the review were pre-specified in a protocol. During the study more insights were gained on the topic and minor deviations have been made to the initial protocol to meet the study objectives in a better way. These are stated in the methods section below with the justifications.

2. Searching for relevant literature

We searched for literature that focused on digital CT tools and applications as well as national and cross-border CT practices (for both COVID-19 and Mpox), and actors involved in the execution of national and cross-border CT of MS. The literature search was divided into a scientific and grey literature search.

Scientific literature search

Scientific studies were identified by computerised searches of Embase and PubMed. The search strategies were developed by an experienced information scientist with input from members of the project team. Four separate search strategies were set up:

- i. Digital CT (COVID-19)
- ii. Cross-border CT (COVID -19)
- iii. Legal aspects of CT (COVID-19)
- iv. CT for Mpox

On top of the search strategies, the Eurosurveillance journal was specifically searched during the course of the study to identify and include additional relevant articles.

Grey literature search

We identified reports/other documentation applying the following strategy:

1. A web-based search in specific databases:
 - World Health Organization (WHO) IRIS Library
 - Publications Office of the European Union
2. A search to build upon prior work and knowledge of others:
 - Publications provided by the EC
 - Documents on other, previous relevant EC-projects
 - Publications provided by the expert taskforces of RIVM on CT and international travel, who keep track of relevant documents shared by authorities such as the WHO and ECDC

In addition, the COVID-19 Health System Response Monitor (HSRM) platform of the European Observatory on Health Systems and Policies was used to extract data on MS CT practices and how they increased surge capacity in human resources for CT.

3. Selecting literature

The scientific literature was first assessed and thereafter the grey literature. The literature identified (n=3148) through the various search strategies were imported into Endnote bibliographic software

(v.20.3) and duplicates were removed. After assessment, a process for inclusion/selection of relevant articles was performed, including a scientific literature and a grey literature assessment. In total, we included 120 publications for the general search, and 52 for the legal analysis (ten publications had overlap). Four publications identified through Eurosurveillance were additionally included.

Regarding “contact tracing”, we included literature related to identifying, notifying, and monitoring of index cases and their contacts by PHAs or organisations responsible for the execution of CT. It includes the exchange of information between, (1) citizens and PHAs, (2) PHA and other PHAs in the same country, and (3) EU-NFPs and non-EU-NFPs, i.e., cross-border CT.

Regarding “digital tools and applications for CT”, we included literature related to tools and applications used by citizens to support PHAs by collecting, storing, or sharing information that PHAs use for CT as well as receive information from PHAs; and tools and applications used by PHAs to in their outbreak investigation and response. We specifically excluded warning and proximity apps.

4. Analysis of literature

Three frameworks were used as a base and structure for coding and reporting the data from the literature: one on digital tools and applications, one on how national CT relates to cross-border CT, and one on legal aspects.

Key predefined variables related to the objective of the review structured our data extraction phase and were put into MAXQDA as a start of the coding system. Based on these key codes, selective reading was performed to identify and code the literature documents. We applied a deductive approach, with inductive elements. This allowed us to structure the most important elements of the studies, but also to create new concepts and variables that may arise from the literature but were not yet included in the frameworks. The data synthesis techniques were structured based on the framework and emerging concepts that arose from the literature.

5. Synthesis of the report

The synthesis was initially built on the MAXQDA codes, but later continued with various cross-tabulations of data and hand searching for specific topics within the included set of publications. Additional relevant literature was used as and when necessary to provide background or insights to the topics discussed.

Appendix D: Survey

Questionnaire

Contact tracing digital tools and applications used at national and EU level and integration within EWRS, selective exchange module – November 2022

Dear colleagues,

You are kindly invited to participate in this survey for representatives of EU Member States and EEA countries, conducted by the EUHealthSupport Consortium, on behalf of the European Commission's Directorate-General for Health and Food Safety (DG SANTE).

The aim of this survey is to collect information on national and cross-border Contact Tracing (CT) practices, experiences, digitalisation, and legal frameworks. The results of this survey will be used to assess the feasibility of a linkage between the CT applications data (national CT applications, digital Passenger Locator Form, exchange platform (ePLF and EUdPLF) with the Early Warning and Response System (EWRS).

This survey is part of a larger feasibility study on CT tools and applications used at national and EU level and their integration within EWRS. The study focusses on lessons learnt from the COVID-19 pandemic in relation to CT and strengthening of cross-border CT practices at national, EU and international level.

The survey collects information on national and cross-border CT practices^{iv} with the main focus on cross-border exchange. It is divided into three sections:

- Part 1 : CT operations, practices, and management
- Part 2 : legal perspective in CT
- Part 3 : policy and CT

The questions in the survey will focus on cross-border CT^v within EU and EEA countries^{vi}. A few questions will cover how CT is conducted at international level with other countries, i.e. non-EU/EEA countries.

To provide a full response to the questions below, we kindly ask you to consult other departments and/or authorities involved in national and/or cross-border CT practices, if needed.

We kindly ask you to provide a consolidated response by 23 December 2022 at the latest to contact@euhealthsupport.eu with sante-consult-b2@ec.europa.eu in carbon copy.

^{iv} **Contact tracing** is the process of identifying, assessing, and managing people who have been exposed to an infectious disease to prevent onward transmission. It has been an important public health strategy with the aim of breaking the chain of transmission during the COVID-19 pandemic.

^v **Cross-border CT** is CT that takes place between two or more countries. It involves carrying out CT for incoming requests on contacts or index cases identified in another country, who are sent to you for CT in your country and sending outgoing requests to other countries on contacts or index cases identified in your country, who are staying (contacts) or have been infectious (index) in another country.

^{vi} **EU countries:** Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.

EEA countries: Iceland, Liechtenstein, Norway

Your answers will be invaluable in creating an understanding of how MS have conducted and are conducting CT and what is necessary to enhance cross-border CT exchange for COVID-19 and other infectious diseases, as part of preparedness and response at national and EU level.

Regarding the respondents for this survey, it may vary per section who could be the most suitable person to respond to the survey per section or question. Possible respondents could be:

- Part 1: professionals involved in CT operations, practices and management)
- Part 2: professionals involved in legal and policy related topics)
- Part 3: senior level policy-makers or public health managers who plan public health measures.

If you have any questions about the survey or the study, please contact contact@euhealthsupport.eu.

We would like to thank you in advance for your contribution.

Background information

1. Which country are you representing?

2. What is your current role in the organisation?

Part 1: Contact tracing practices and digital tools

Section 1: Organisation and execution of CT in your country for COVID-19

In the first section we focus on how contact tracing (CT) has been organised and executed in your country for COVID-19 response. ***For all questions below, if there have been major changes throughout the pandemic, then we kindly ask if you could indicate the major changes in measures, processes and infrastructures, especially towards the peak of the pandemic, to indicate the current situation and to describe the lessons learned for potential future pandemics.***

3. **a.** Please fill in the actors (organisations, institutes, units, or professionals) who have the main responsibilities for CT activities, as listed below, during the COVID-19 outbreak at three levels:
 - **Cross-border level:** actors who are working on different aspects of cross-border CT^{iv} in your country.
 - **National level:** actors who function at a national level, such as the Ministry of Health, the national public health institute, national agencies, and others.
 - **Sub-national level:** actors who have authority or a function in a certain jurisdiction of the country, such as a region, city, or catchment area. Examples include regional health authorities, regional institutes of public health, local public health units, hospitals, general practitioners, and others.

Please provide names and abbreviations of actors in the original language, and in English, if possible. You may also list full names and abbreviations and then complete the remainder of the table with abbreviations. If there are no actors/ organisations or activities at a given level, you can write N/A.

	Cross-border level	National level	Sub-national level	Other
Decides CT policies and guidelines				
Organises and conducts/ executes CT				
Collects data for case management and surveillance				
Functions as the data controller ^{vii}				
Decides which CT software and platforms (digital tools and applications) are used ^{viii}				
Conducts other relevant tasks, please specify:				

b. Please fill in the table below for specific cross-border CT activities, including any major changes towards the peak of the pandemic and in the current situation.

Note that incoming requests include contacts or index cases identified in another country, who are sent to you for CT in your country. Outgoing requests include contacts or index cases identified in your country, who are staying (contacts) or have been infectious (index) in another country.

Cross-border specific CT ^v activities	Actors / organisations (please provide the full names and abbreviations in the original language and in English, if possible)	N/A
National Focal Point (NFP) who sends and receives CT requests and data to and from other countries through EWRS		

^{vii} **Data Controller** within the meaning of Article 4 of GDPR refers to the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data. E.g. which agency, authority or body decides “why” and “how” CT data is processed.

^{viii} **Digital CT tools** refer to tools and applications that have been used during the COVID-19 pandemic and are directly linked to the CT process conducted by public health authorities or organisations responsible for the execution of CT.

Cross-border specific CT ^v activities	Actors / organisations (please provide the full names and abbreviations in the original language and in English, if possible)	N/A
Incoming CT: Actors who receive CT requests and data from the NFP and carry out CT		
Outgoing CT: Actors who send CT requests and data to the NFP to be shared with other countries		

4. What strategies have been used to upscale CT during COVID-19 peak times, or to increase efficiency? For example, using methods to increase human resources. (volunteers, medical students, etc.), and/or adjust the execution of CT, based on pandemic pressure).

5. a. Please describe the three main challenges you have experienced during CT for COVID-19 in the box below:

1. 2. 3.

- b. Please describe any solutions you implemented to meet these challenges in the box below:

6. Have the CT practices in the context of COVID-19 been monitored and evaluated? If yes, please describe what were the main outcomes (how, what, where). If there are existing reports (published or unpublished), materials or websites that provide more information on the monitoring and evaluation of CT practices, then please share the link or send them via e-mail as attachment.

- ☐ Yes
☐ No (please go to the next section)

7. What were the main lessons learned in relation to cross border CT from COVID-19? Please provide answers in the box below:

a. During peak time: b. For the future:
--

Section 2: Contact tracing software and platforms (Digital CT tools)

We would like to obtain further insight into the software and platforms (Digital CT tools) used for CT during COVID-19 outbreak. These refer to **outbreak investigation tools** (e.g., Go.Data and SORMAS) and other digital tools that are directly linked to the CT process conducted by public health authorities or organisations that were assigned to carry out CT (e.g. excel), as described in the box below.

Software and platforms for CT (digital CT tools): Public health agencies (PHA) use different types of software or platforms/systems to support the digitalisation and streamlining of case investigation and CT. Such tools also include Excel or others. PHA or other organisations use these systems as both databases and to aid work processes by employing standardised workflows (e.g. transferring cases to other jurisdictions, managing attempts to reach contacts, guiding staff through interviews, etc.) and gathering information to support the core tasks of CT (e.g. identities of potential contacts, details of disease progression, requests for additional resources, etc.). These systems may have been developed to streamline the labour-intensive process of conventional public health CT, a necessity given the exceptional volume of cases during the COVID-19 pandemic.

8. What software and platforms have been used in your country during the COVID-19 outbreak to conduct CT and/or share CT data? Please specify them below, with the name of the tools and the actors who use that/those tool(s). If available, you can provide a link to the website, report or documentation that provide background information on the digital tool(s).

Name and type of digital platform and/or tool (Add links to tool, reports, etc)	Actors who use it	Brief explanation on the platform/tool and why it was chosen	CT system used for (sub)national CT	CT system used to provide data for cross border CT
Example: ...	Example: Public Health Authority (PHA) at local level	Example: System used for the collection and storage of CT information. It was already in place before the pandemic	☐ Yes ☐ No ☐ Other:...	☐ Yes ☐ No ☐ Other:...
			☐ Yes ☐ No ☐ Other:...	☐ Yes ☐ No ☐ Other:...
			☐ Yes ☐ No ☐ Other:...	☐ Yes ☐ No ☐ Other:...
			☐ Yes ☐ No ☐ Other:...	☐ Yes ☐ No ☐ Other:...

9. a. Does your country have any plans to move to another type of software and platform for CT?

- ☐ Yes
- ☐ Not yet, but considering to switch to another type in the future
- ☐ No
- ☐ Don't know
- ☐ Not applicable

b. If yes or considering/exploring, please elaborate in the box below:

Which alternative are you preparing / considering?
What are the reasons for (possibly) switching to this other system?

10. Can you describe in the box below how CT data is shared between actors within your country? In your answer, if available, you can present a graphic or a (flow) chart showing how CT data flows from the actor that collected it towards other actors, eventually reaching the organisation in charge of sharing cross-border CT data through EWRS.

For example: In the Netherlands, contact tracers collect information from citizens mainly through phone calls. The CT information is stored in the so-called HPZone system of the PHA at the local level. There are 25 PHA at local level and they all use the HPZone system to collect CT information. These systems of the PHA are not connected to each other, nor does the organisation in charge of sharing cross-border CT data through EWRS, i.e. RIVM, have access to it. Therefore, they communicate through phone/secured mail when necessary.

11. In some countries, the organisation(s) in charge of sharing cross-border CT data through EWRS may not have access to regular CT data, but only have access to data for cross-border CT.

a. If this is the case in your country, what specific systems are in place for (sub)national actors such as local PHA, to share data with the EWRS user in charge of sharing cross-border CT data for international travel?

- ☐ E-mail (secured); please specify between which actors:
- ☐ Online form; please specify between which actors:
- ☐ Not applicable
- ☐ Do not know
- ☐ Other, please specify which system and between which actors

b. Are there specific conditions that need to be met for the use of such systems?

- c. What are the national regulations that allow the sharing of this data, including application of GDPR for the exchange of personal data, and others?

12. What were the main practical challenges you have experienced in relation to (digital) CT for COVID-19 within your country? And what were the main drivers or facilitators of using digital tools for CT for COVID-19 within your country?

- a. Practical challenges:

b. Main drivers or facilitators:

Section 3: Specific questions on cross-border CT for COVID-19

In the questions below, we want to obtain a better understanding specifically of the cross-border CT carried out within EU/EEA countries during the COVID-19 outbreak, as well as with countries outside the EU/EEA.

13. What were the main practical challenges you have experienced in relation to cross-border (digital) CT for COVID-19 with other countries? And what were the main drivers or facilitators of using digital tools for CT for COVID-19 with other countries?

- a. Practical challenges:

b. Main drivers or facilitators:

14. What software or platform(s) has your country used through their national focal points (NFPs) to enable cross-border data-exchange of CT data for COVID-19 with EU/EEA countries? Multiple options are possible.

- ☐ E-mail (secured)
- ☐ Excel
- ☐ Early Warning and Response System (EWRS)
- ☐ Event Information Site (EIS)
- ☐ Digital Passenger Locator Form (EUdPLF)
- ☐ Exchange platform (ePLF)
- ☐ No software or platform(s)
- ☐ Other, please specify

15. What software or platform(s) has your country used through their national focal points (NFPs) to enable cross-border data-exchange of CT data for COVID-19 with countries that are not EU/EEA members? Multiple options are possible.

- ☐ E-mail (secured)

- ☐ Excel
☐ Early Warning and Response System (EWRS) (if yes, please specific which countries:)
☐ Event Information Site (EIS)
☐ Digital Passenger Locator Form (EUdPLF)
☐ Exchange platform (ePLF)
☐ No software or platform(s)
☐ Other, please specify

16. What were the challenges of using the above-mentioned system(s) (if applicable)?

17. Please provide the (maximum) top 3 benefits and drawbacks in using existing EU digital tools (EUdPLF and ePLF) to support CT of other communicable diseases?

Possible benefits	1.	N/A ☐
	2.	
	3.	
Possible drawbacks	1.	N/A ☐
	2.	
	3.	

18. To which non-EU/EEA countries does your country send the most requests/data for outgoing cross-border CT? And from which non-EU/EEA countries does your country receive the most requests/data for incoming cross-border CT? Please provide the top 3 in both columns below.

Top 3 non-EU/EEA countries <u>to which you send</u> most requests/data	Top 3 non-EU/EEA countries <u>from which you receive</u> most requests/data
1.	1.
2.	2.
3.	3.

19. To what extent did you share the CT information regarding COVID-19 with other EU/EEA countries for index cases or contacts identified in your country, who were infectious (index case) or who were staying (contacts) or were in another country (**outgoing CT**)?

	Index cases	Contacts

All/ almost all	☐	☐
Most	☐	☐
Approximately half	☐	☐
Some	☐	☐
Very few	☐	☐
None of the contacts or index cases identified	☐	☐
N/A	☐	☐

20. a. What factor(s) related to your own country (other than the policy on carrying out CT for international travel) influence(s) whether outgoing CT requests are made and CT information is shared with another country? Multiple responses are possible

- ☐ Outbreak/cluster size
- ☐ Epidemiological assessment, based on _____ (please complete)
- ☐ Availability of trained human resources
- ☐ Workload
- ☐ Concerns over the CT policy of the other country
- ☐ Whether the CT data is sufficient
- ☐ Whether CT is still needed (after a delay)
- ☐ Other, please specify:

- b. What factor(s) **related to the other country to which you send the request** influence(s) whether outgoing CT requests are made and CT information is shared with another country? *Multiple responses are possible.*

- ☐ EU/EEA versus non-EU/EEA country (outgoing requests to EU/EEA countries being prioritised)
- ☐ Privacy approach and regulations of the country the request will be sent to
- ☐ Whether the CT information shared will be followed up by that country
- ☐ Responsiveness of the other country
- ☐ Other, please specify:

21. To what extent did your country conduct CT after receiving incoming requests regarding COVID-19 from another EU/EEA country on contacts or index cases who were staying or had been infectious in your country?

- ☐ All / almost all of the CT requests received
- ☐ Most of the CT requests received
- ☐ Approximately half of the CT requests received
- ☐ Some of the CT requests received
- ☐ Very few of the CT requests received
- ☐ None of the CT requests received
- ☐ Other, please specify:

22. a. What factor(s) related to your own country (other than the policy on carrying out CT for international travel) influence(s) whether incoming CT requests are processed for CT in your country? Multiple responses are possible.

- ☐ Outbreak/cluster size
☐ Epidemiological assessment, based on _____
☐ Availability of (trained) workforce
☐ Workload
☐ Other, please specify:

- b. What factors related to the other country which sends you the request influence(s) whether incoming CT requests are processed for CT in your country? *Multiple responses are possible.*

- ☐ Whether the CT data is sufficient
☐ Whether CT is still needed (after a delay)
☐ EU/EEA versus non-EU/EEA country (incoming requests from EU/EEA countries being prioritised)
☐ Working relationships with that country
☐ Other, please specify:

Section 4: CT practices in relation to other infectious disease outbreaks

In the questions below we would like to obtain a better understanding of CT practices in relation to other infectious disease outbreaks. If not relevant, please indicate this with 'N/A'. Please skip those questions and go to the next question.

23. Please provide a list of the top five infectious diseases, other than COVID-19, for which CT has been conducted in your country during the last five years. *Note. This can refer to infectious diseases such as: airborne, vector borne, sexually transmissible diseases or any other infectious diseases transmitted to and/or between humans.*

Top five infectious diseases during the last five years (other than COVID-19)
1.
2.
3.
4.
5.

24. Do any of the five infectious diseases you have listed above prompt cross-border CT? If yes, which ones?

25. In the previous sections we have asked in-depth questions to understand how CT systems operated during COVID-19. We would like to know whether and how operation of CT systems differ for other outbreaks, in particular for Mpox.

a. Is there a difference between CT systems for the Mpox outbreak or for other diseases that prompt cross-border CT, compared to CT systems for COVID-19 in your country?

- ☐ No difference for CT systems in the case of Mpox or other outbreaks compared to COVID-19
- ☐ CT systems do differ in the case of Mpox or other outbreaks compared to COVID-19 (please describe the main differences below)
- ☐ Not applicable
- ☐ Do not know
- ☐ Other, please specify:

b. If there are differences, could you describe **how national and cross-border CT systems** differ for the Mpox outbreak or for other diseases that prompt cross-border CT, compared to COVID-19 in your country?

	The main differences for Monkeypox compared to COVID-19	The main differences for other diseases compared to COVID-19
National CT systems		
Cross-border CT systems		

26. Are CT software and platforms (digital CT tools) developed for COVID-19 potentially helpful for CT of other infectious diseases?

- ☐ Yes, namely (please below describe in what way and provide examples/references of these tools):
- ☐ No
- ☐ N/A

Part 2: Legal Analysis

Section 1: Questions relating to International Health Regulations (IHR) – International Law

The aim of this section is to collect information on the legal frameworks that support CT. While there is some repetition of questions under each of the sections, please note the answers may differ. For example, there may be a different lawful basis for data sharing at national level, within the EU and outside the EU and the governing law may dictate the answer. If the answer is in fact the same, then it is possible to refer to a previous answer.

In the questions below we want to obtain a better understanding of the national legal and policy context in relation to the application of the **IHR and International law**. Specifically:

27. What public health laws/regulations/policies does your country have in place to implement and underpin CT obligations under the IHR 2005? Please outline in the box below and add the link.

28. General Data Protection Regulation 2016 (GDPR)

- a. What is your country's basis for processing under Articles 6^{ix} & 9^x of GDPR, when cross-border sharing personal data in compliance with IHR obligations?

- b. When performing international cross-border sharing of personal data, how are the GDPR principles of lawfulness, fairness, transparency, purpose limitation, data minimisation, accuracy, storage limitation, security & accountability complied with? e.g. are controller agreements, data sharing agreements in place?

- c. In the absence of an adequacy decision, which Article 46 GDPR safeguards are in place enabling cross-border sharing e.g. standard contractual clauses^{xi}. Please specify.

29. Could a decision not to share contact tracing data be taken? Such a decision might be made where an ethical or fundamental rights concern arises, such as punitive or criminal sanctions for non-adherence to quarantine laws or sexual orientation.

☐ Yes

☐ No (please go to the next question)

If yes, please elaborate more in the box below:

30. a. Are there any data protection based legal barriers to cross-border data sharing under IHR for CT purposes.

☐ Yes

☐ No (please go to the next question)

b. If yes, please elaborate more in the box below the following:

a. What are the legal barriers:

b. Are there plans to resolve them and what are these plans:

Section 2: Questions related to Decision 1082 /2013/EU

We also want to obtain a better understanding of the national legal and policy context in relation to *Decision No 1082/2013/EU of the European Parliament and of the Council of 22 October 2013 on serious cross-border threats to health and repealing Decision No 2119/98/EC Text with EEA relevance*.

^{ix} Art 6 GDPR - Lawfulness of processing, <https://gdpr-info.eu/art-6-gdpr/>

^x Article 9 GDPR - Processing of special categories of personal data (Processing of personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation shall be prohibited).

^{xi} [Art. 46 GDPR – Transfers subject to appropriate safeguards - General Data Protection Regulation \(GDPR\) \(gdpr-info.eu\)](#)

Note - If the answers to question 32 are the same as for question 29 above, then it is possible to refer to that answer.

31. General Data Protection Regulation 2016 (GDPR)

- a. What is your country's basis for processing under Articles 6 & 9 of GDPR, when cross-border sharing personal data using EWRS, in compliance with Decision 1082 obligations?

- b. How are the GDPR principles of lawfulness, fairness, transparency, purpose limitation, data minimisation, accuracy, storage limitation, security & accountability complied with in a cross-border context within the EU/EEA? e.g. are controller agreements, data sharing agreements or a data protection impact assessment (DPIA) in place.

32. Are there any data protection based legal barriers to EU/EEA cross-border data sharing for CT purposes?

☐ Yes

☐ No (please go to the next question)

If yes, please elaborate more in the box below the following:

a. What are the legal barriers:

b. Are there plans to resolve them and what are these plans:

33. a. For CT purpose, does the *organisation(s) in charge of sharing cross-border CT data through EWRS* receive passenger data from airline companies?

☐ Yes

☐ No (please go to the next question)

If yes, please elaborate more in the box below :

b. What is the legal basis for receiving personal data from the airline companies, in line with GDPR and other requirements?

Section 3: Questions relating to COVID-19

In the questions below we are looking for additional information relating to CT for COVID-19. If the answer is the same as per the questions above, then you can refer to those answers

34. a. Were legal frameworks sufficiently robust to manage the scale of CT required during the COVID-19 pandemic:

☐ Yes

☐ No

- a. Please elaborate in the box below. If yes, what potential reasons were there? If no, what improvements were or are still needed to support international, EU & national level CT based on the COVID-19 emergency?

- b. Was it necessary to introduce new law(s)?

☐ Yes

☐ No (please go to the next question)

If yes, please describe in the box below:

- c. Is this law still in place or was it time limited?

☐ Yes, this law is still in place.

☐ No, it was time limited for a period from _____ to _____

If no, please specify if the time period has been extended from a previous limited period

Please elaborate on above answer in the box below:

- d. Did the COVID 19 pandemic raise any particular data protection challenges? If yes, how were these overcome?

☐ Yes (please describe in box below)

☐ No (please go to the next question)

If yes, please describe in the box below:

- e. Does your country have a legal framework for declaring a public health emergency?

☐ Yes

☐ No (please go to the next question)

If yes, please describe in the box below:

35. a. Has legislation that was put in place during COVID-19 been helpful for CT of other infectious diseases?

☐ Yes, namely (describe briefly in what ways): [insert text box]

☐ No

☐ N/A

36. Were any amendments made to national professional codes of practice and ethics to allow sharing of medical information during COVID-19?

☐ Yes

☐ No

If yes, please describe in the box below:

Section 4: Legal questions relating to passenger locator forms (PLFs)

In the questions below we are looking for additional information on legal issues relating to the use of digital PLFs. If the answer is the same as per the questions above, then you can refer to those answers.

37. Was a new national level law or regulation needed to allow for the introduction of the national digital PLF?

☐ Yes

☐ No

If yes, please elaborate, and add the link, in the box below:

- a. If yes, is it still in place or will new legislation be required, if digital PLFs become necessary again?

☐ Yes, it is still in place

☐ No, it is not in place and new legislation will be required

☐ Other, _____

Please elaborate in the box below:

38. In the context of digital PLF's, have measures such as DPIA or other data protection measures been used to ensure compliance with the GDPR principles of lawfulness, fairness, transparency, purpose limitation, data minimisation, accuracy, storage limitation, security & accountability?

Part 3: Policy

The aim of this section is to collect information from policy-makers in relation to CT. The topics covered in this section are: CT software and platforms (digital CT tools)^{xii}, finance and resources, national level governance of cross-border CT and policy frameworks that support CT.

^{xii} To support the digitalisation and streamlining of case investigation and CT, public health agencies (PHA) use different types of software platforms/systems. PHA or other organisations use these systems as both database and job aid, employing standardised workflows (e.g. transferring cases to other jurisdictions, managing attempts to reach contacts, guiding staff through interviews, etc.) and gathering information to support the core tasks of CT (e.g. identities of potential contacts, details of disease progression, requests for additional resources, etc.). These systems have been developed to streamline the labour-intensive process of conventional public health CT, a necessity given the exceptional volume of cases during the COVID-19 pandemic.

Section 1: Contact tracing software and platforms (Digital CT tools)

39. Is there any policy (in addition to legal measures as described above) that can facilitate and/or hinder the integration of data resources^{xiii} for CT in your country? Please elaborate in the box below:

40. In what way can the EU support the improvement of cross-border contact tracing performance of communicable diseases at national level by using contact tracing software and platforms?

Please elaborate in the box below:

Section 2: Finance and resources of CT

41. Financial and human resources may play an important role within CT decision making. In this context, we would like to ask:

- a. How are the funds organised for CT practices in your country? Please elaborate in the table below per different levels, type of funds and proportion of total cost.

Type of funds	National level	Subnational level	Proportion (%) of total funds
Human resources			
Funds for communication			
Funds for equipment, digital platforms or IT tools			
Funds for testing			
Other types of funds			

- b. How will current CT practices and funding be sustained, if at all after the pandemic COVID-19 (e.g. during peace time)? Please elaborate in the box below:

- c. Has securing funding/financing been a constraining factor to expand CT activities and/or capacity?

☐ Yes

☐ No

^{xiii} In this survey, integration of data resources refers to the merging/combining of different datasets from different sources for the purpose of CT.

If yes, please elaborate how in the box below:

d. Has securing funding/financing been a constraining factor for development or deployment of digital tools?

☐ Yes

☐ No

If yes, please elaborate how in the box below:

42. Have you experienced staff shortages on CT during peak or other times of an outbreak? If yes, please elaborate on how you coped with this? These could also be lessons learned from the COVID-19 pandemic.

☐ Yes

☐ No

If yes, please elaborate how this was dealt with in the box below:

Section 4: National level governance of cross-border CT

43. What strategies and alternative methods are you considering in terms of regular CT for infectious diseases in the future, and in order to manage CT during high-demand periods **in general**? These could also be lessons learned from the COVID-19 pandemic.

44. What strategies and alternative methods are you considering in **relation to digital systems** for regular CT for infectious diseases in the future, in order to manage CT during high-demand periods? These could also be lessons learned from the COVID-19 pandemic.

45. What are your perspectives on adoption of structured cross-border CT data as part of EWRS selective exchange?

46. What are your perspectives on the adoption of the definition of the minimum data required for CT as part of EWRS selective exchange?

47. What are your perspectives on the adoption of the inclusion of data from dPLFs as part of EWRS selective exchange?

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48. What are your perspectives on additional features that EWRS could have in the future?

--

49. What opportunities do you see for enhanced integration of cross-border CT to improve notification to EWRS?

--

50. What type of support do you need from the EU in relation to digitalisation of **national and cross border** CT practices in your country (e.g. training, recommendations on standards, monitoring and evaluation frameworks, opportunities to exchange best practices and/or any other)?

Please elaborate in the box below:

--

Contact information

Please kindly indicate if you grant permission for your name and contact details to be used for contact purposes for this survey. Your data will be deleted within one month after completion of the study.

- ☐ Yes
☐ No

If you have given permission, then please enter a name and e-mail address in case it is needed to follow up on the survey:

Note. The name and contact details requested are for the sole purpose of contacting the person, if necessary, about the survey. In the reports of the study, respondents will remain anonymous, though the results may be linked to the countries represented. Your data will be deleted within one month of completion of the study.

Name:	
E-mail:	

Thank you for your cooperation.

Appendix E: Summary of the interview study methods

1. Research questions and objectives

The research question(s) were as follows:

1. What are the factors influencing EU/EEA countries current and future plans for international travel related CT?
2. What are the opportunities for EU-level support in order to improve EU/EEA coordination of international travel related CT in preparedness for future pandemics?

The following sub questions have been developed to explore countries:

1. What are countries' experiences and current developments for CT (during and since COVID-19) with a focus on CT systems, digital tools, governance and legislation?
2. What are countries' future directions for CT with a focus on CT systems, digital tools, governance and legislation?
3. What are countries' perspectives on their needs in order to improve international travel related CT within the EU?

These questions feed into the objective of this research, of which was *to investigate EU/EEA countries international travel related CT experiences and future plans with consideration for both national and international CT related systems, practices, digital tools, governance and legislation.*

2. Country selection for interviews

Semi-structured interviews were conducted with a total of 11 countries (9 EU/EEA countries and 2 non-EU/EEA countries). The final list of EU countries selected for interviews were as follows: Austria, Finland, France, Germany, Latvia, Malta, Spain, Czech Republic and The Netherlands. The non-EU countries selected were: United Kingdom and Switzerland.

3. Interview content

1. International travel related CT in the country, with a focus on digital tools, governance aspects and legislation
2. CT systems in the country, with a focus on software's and platforms that provide data to cross-border CT
3. Perspectives on EU-level support needed for the above two themes

The interview guide was constructed to include the following sections:

1. Countries COVID-19 CT experiences and applicability to other diseases
2. Countries current plans and developments since COVID-19
3. Legal aspects
4. Perspectives on countries needs
5. EUdPLF/dPLF use

4. Conducting interviews

Contact persons of countries were informed that participants with knowledge on the following areas would be best suited to this interview: 1) CT system in the country, in particular cross-border CT (or international travel related CT), 2) legal frameworks for CT, 3) use of digital platforms for CT and data protection. Interviews were not limited to a specific number of participants and therefore in order to cover the range of knowledge required to cover all topics some countries nominated multiple participants to adequately represent their country. Overall, the number of participants per interview ranged from 1-5.

Before the interview, participants were provided with an informed consent document describing the handling of their data. Interviews were conducted via Microsoft Teams and lasted for one hour. Interviews were recorded using Microsoft Teams.

After the interview, a short summary of the key components was produced and sent to the participants for their review (i.e., member check). Participants were asked to ensure that this summary of the interview was accurate and to provide any additional missing information where necessary. In some instances, whereby a legal professional was not present during the interview, legal sections of the interview guide were forwarded again to participants with a request for them to forward this to a relevant colleague or contact with legal expertise; relevant participants were asked if this would be feasible during the interview.

5. Interview analyses

Interviews recordings were transcribed by an outsourced organisation. Transcripts were pseudonymised by referring to participants as 'speaker 1,2, etc.' within the transcribed interviews instead of using names. Analysis of transcripts was done using open coding followed by thematic analysis using MAXQDA (v.22.0.0). After open coding, codes were analysed and grouped into categories. Categories were then analysed for overlaps etc. and merged where possible to create key themes and subthemes.

Appendix F: Topics discussed during webinars 1 and 2

Table 14. Topics discussed during webinars 1 and 2

Webinar-1 (Monday 6 th March, 2023: 11-13.00 hrs CET)	Webinar-2 (Friday 21 April 2023, 14.00-16.00 hrs CET)
○ Introduction to the Regulation on serious cross-border threats to health by DG SANTE ○ Presentation on the study by EUHealthSupport ○ Cross-border contact tracing – Barriers, facilitators, and possibilities ○ Feasibility of integration of national CT systems into EWRS to allow more efficient CT across borders. Main questions addressed: • What are the potential benefits of integration of national digital tools / databases / case management systems into EWRS? (Word cloud) • What do you view as the main barriers for the integration of national digital tools / databases / case management systems into EWRS? (e.g., related to CT systems, organisations, digital tools, legislation/governance or other topics) (Word cloud) ○ EU digital Passenger Locator Forms and the future of international related travel CT in Europe. Main question addressed: • What do you view as the main benefits of EU digital Passenger Locator Forms? (Word cloud)	○ Legal arrangements, including their impact and improvements required to allow effective cross-border contact tracing. Main questions addressed: • Do you envisage Regulation (EU) 2022/2371 supporting EWRS operations and integration of national digital CT tools & applications as well as dPLF, ePLF and while at the same time ensuring compliance with GDPR at national and EU-level? • How can Regulation (EU) 2022/2371 be utilised in your country to support EWRS development for cross-border CT independent of national law and policy? ○ EU-level support in relation to, among others, guidance, good practices, and standardisation. Main questions addressed: • How can the EU provide digital technological support ➢ At the national and subnational level? ➢ At the cross-border level? • Besides digital technological assistance, in what other areas could the EU provide support for cross-border CT? • During outbreaks on when to continue/discontinue cross-border CT: What are your opinions regarding the balance between coordination and autonomy on this topic? ○ Contact tracing for infectious diseases (ID) other than COVID-19. Main (sub)questions addressed: • What factors do you consider when deciding which diseases to do regular CT for in your country? • What factors do you consider when deciding which diseases to do cross-border CT for? • What are countries' plans to use digital technology for ID with respiratory transmission? ➢ In particular for digital CT support tools between citizens and PHA & citizen-to-citizen tools?

Webinar-1 (Monday 6 th March, 2023: 11-13.00 hrs CET)	Webinar-2 (Friday 21 April 2023, 14.00-16.00 hrs CET)
	• Any preparations for CT for particular future scenarios, e.g., avian influenza? • What considerations and plans do countries have for cross-border CT for ID with respiratory transmission? ➤ In particular during a journey by collective transportation means • Do you have any experience with digital partner notification tools for STIs or Mpox in your country? - Do you have any plans or developments regarding digital partner notification tools for STIs or similar diseases? ○ Why do some countries choose not to carry out cross-border CT for these diseases? ○ What are your considerations for the future of cross-border CT for STIs and similar diseases? ○ Other constraints for cross-border CT per infectious disease type?

Appendix G: Summary tables on challenges of digital CT within the country and digital cross-border CT, and main lessons learned regarding cross-border CT for COVID-19

Table 15. Challenges experienced during the pandemic and solutions implemented. Data source: survey responses.

Challenges	Solutions
1. Recruiting and retaining sufficient human resources	
- Most countries mentioned a lack of human resources for CT as a main challenge. - There were not only difficulties with recruitment, but also with retention, as CT staff were generally only temporary.	- As mentioned in the strategies used during peak periods, human resources were increased by hiring and training people from various medical and non-medical fields. - One country stated that people were offered flexible working hours and relatively high salaries. Qualification requirements were also reduced in this country and training was based on detailed SOPs (standard operating procedures). A separate CT unit on the federal level was created to assist during peak times. - One country reported several approaches meet challenges in human resources incl. redeploying staff, having operational hours across all 7 days of the week, continually updating SOPs, enhancing efficiency, reducing burnout, supporting the health/wellbeing of staff (including providing isolation facilities for them). Retention during periods of lower activity was managed by providing a work schedule requiring a similar skill set. - One country reported setting up a constitution of a Health care workers crisis workforce (by law).
2. Difficulties in collaborating with the general population	
- Countries mentioned issues with people not wanting to report their contacts, or pass on personal contact details. - Along with a general pandemic fatigue, countries mentioned cases and their contacts were sometimes frustrated about having to isolate or quarantine. - One country mentioned having lawsuits from people who felt wronged at being obligated to quarantine. - One country mentioned an issue with introducing IT solutions was a lack of information technology literacy, for example in older people.	- One country reported that the Commissioner for personal data protection (GDPR) gave them clearance to use the data provided for public health protection actions (such as isolation of cases and their contacts). - One country reported that quarantine frustrations in general stopped when quarantine was no longer required. - One country carried out extra evaluations to ensure the contacts they identified were really at risk, thereby limiting the number of contacts. - One country mentioned they communicated with the public, when pandemic fatigue was leading to people not wanting to quarantine. - One country communicated with the public when there were great fears about COVID-19. - One country reported conducting activities to raise awareness for the importance of CT.
3. Obtaining relevant data for CT was time consuming and difficult	

Challenges	Solutions
• Countries reported the CT process itself to be time consuming and difficult at times • Obtaining contact data from large gatherings of people, such as schools, institutions and other public venues was difficult. • One country mentioned the timely reception of laboratory results as being a challenge. • Several countries mentioned difficulties in cross-border CT, such as missing information on passengers and knowing which countries passengers had gone to. • Several countries also mentioned delays in receiving cross-border data led to the data not being relevant anymore (as the incubation period had passed).	• One country reported that organisers of public events were advised, and restaurants and cafes were required at times to keep guest lists. • One country suggested it would be helpful if labs or test locations collected details to be able to contact people. • One country reported that a digital process was set up for sending lab results • One country concluded that CT cannot be effective, because of transmissions among asymptomatic and mild cases.
4. Different regions within countries have their own policies, CT processes and technology	
• Many countries mentioned a lack of integration of the various types of digital systems. • Several countries mentioned the lack of a single national platform, which limited data sharing and access to CT data. • Data could not be shared easily, for example, between lab systems, appointment and testing systems, vaccination systems and CT systems. • One country also mentioned the lack of unique identifiers to be able to link cases. • One country mentioned that it has been a challenge for their 21 regions with different ideas and resources, to agree on common guidelines, systems and tools. • One country also mentioned heterogeneity of the response to CT at different levels in the country as being a challenge. • The lack of tools and the sharing of data made it difficult to conduct surveillance and obtain an overview of cases and CT data.	• One country reported that permanent working groups identified best practices and implemented common strategies. • One country reported that linkages were created between digital contact tracing tools and vaccine registries and other databases to reduce manual data entry. Interoperability between tools allowed municipalities to share their data more efficiently. • One country reported the creation of a COVID-ID which was a unique identifier to link different digital systems. There was a central CT system, which also integrated data collected from self-service tools which could be used by citizens to support CT. • One country reported that national published guidelines were published, and regular meetings were held with the contact tracers in the 21 regions throughout the pandemic.
5. Lack of digital technology solutions	
• Many countries mentioned there was a lack of digital technology, especially at the start of the pandemic and the challenge of having to adapt the technology to changes in the pandemic. • One country, for example, mentioned there being a lot of manual work, and having to share data by email or telephone. • One country mentioned the lack of interoperable tools for international CT	• Countries reported the upgrade of existing systems and the development of new digital systems. • One country reported that rapid improvements in their systems (e.g., to monitor lab and vaccination information, CT of inflight notifications, health care system capacity) enabled them to receive information on time. • One country reported that passenger questionnaires were developed; one country reported that although their use remained voluntary, several national and regional CT management systems were implemented; and FR mentioned the EUdPLF as one solution to the lack of interoperability of digital tools. • Two countries also reported that SMS messages were sent instead of calling by telephone.

Challenges	Solutions
	• Several countries mention the development and use of digital contact tracing tools (mainly proximity-based apps). • One country mentioned new IT systems to support personnel with less previous training. • Several countries mention IT solutions to be used as self-service by citizens to support CT.
6. Needing to constantly adjust their CT processes and guidelines	
• Several countries mentioned that continual changes in the pandemic led to them having to constantly change and update their CT processes and their guidelines, their digital technology and their legislation.	• Organisations were designated to do technical reviews and provide advice and recommendations. • One country mentioned a dedicated IT manager who set up a new tool for COVID-19 CT and management of cases.
7. Other challenges	
Other challenges mentioned were the following: • Lack of legislation readiness and GDPR obstacles. • Lack of units dedicated to analysis and research. • Demanding phone calls from patients needing help, due to restrictions and patient overload in the general health system.	• One country reported that the relevant legislation was strengthened. • Besides improvement in the systems necessary for COVID-19 (e.g., Lab and vaccination systems), one country reported that surveillance was also improved by work on genomic sequencing and wastewater monitoring.

Table 16. Challenges of digital CT within the country. Data source: surveys responses.

Technical challenges	• At the start of the pandemic, digital tools still needed to be developed and existing tools needed to be updated. • A few countries reported using excel sheets in the beginning to keep track of cases and their contacts. • One country reported different regions using excel sheets, and there being no time to discuss the development of a new tool or to implement it. • Digital tools needed to take scientific, medical, ethical and legal aspects into account. The new and dynamic aspect of the pandemic made it hard to keep up technologically (e.g., CY systems were reported as slowing down, due to being overloaded with data). • Specific challenges were reported with regard to uniquely being able to identify individuals and handling visitors to the country who were not registered. • Some contact tracing tools were reported to contain too many unnecessary variables.
Differing subnational policies and digital tools within countries	• Several countries reported that multiple types of digital CT tools used in different regions limited the sharing of and access to CT data. • One country reported it being a challenge to get its different regions to agree to using one system. • Integrating data from different data sources of varying quality and standards was difficult.
Limited human resources	• Digital tools had to be modified to accommodate huge case numbers. Training contact tracers to use these evolving tools was time consuming and slowed down the work. • Digital tools had to evolve rapidly to manage large outbreak sizes, while at the same time meeting public health requirements. • Despite some digital tools, huge case numbers required large numbers of human resources. • Large case numbers and limited human resources led to limiting the amount of CT data that could be collected and to focusing on more high-risk cases and their contacts.
Challenges with obtaining CT information from citizens	• Difficult to access lists of contacts from public venues. • Citizens often provided missing or incorrect data. • Identifying contacts of cases and obtaining relevant telephone numbers was difficult. • Adherence by the public to provide the contacts that were at risk difficult.
Public distrust of certain tools	• Some digital tools (such as proximity-based apps) were not adopted or accepted widely due to privacy concerns of citizens. • The Bluetooth signal of proximity-based apps was limited, leading to low use by citizens.
Other challenges	• There were a lack of financial resources for digital technology. • One country reported the lack of an initial legal requirement to conduct CT on a large scale. • Some countries reported no challenges with digital tools and one country reported that there was no need for a digital CT system.

Table 17. Challenges of digital cross-border CT with other countries. Data source: survey responses.

Countries use different tools for cross-border CT	- Some countries reported difficulties and a lack of interoperability with cross-border CT tools, as countries were using differing types of tools, with varying degrees of security. - One country reported using various tools for different countries: a special system for non-EU/EEA neighbour country, secured email for neighbouring regions of two EU countries, EWRS for exchange with other countries. - One country reported compatibility and privacy to be challenges in cross-border CT.
Differing country policies on cross-border CT	- There were differences between countries regarding when cross-border CT should be discontinued, leading to unnecessary work sending or receiving messages that would not be used for anything. - There were also differences between countries regarding the type of data that was collected and exchanged. - One country reported not knowing what CT information was of priority to other countries. - One country reported difficulties with issuing certificates for people who were tested in and should have had certificates from neighbouring countries. - Often when countries were provided with CT information, there was no response or a late response. - There were difficulties in knowing when and where to send information regarding infected cases leaving the country.
Delay in receiving cross-border CT information	- Many countries expressed delays in receiving CT information, to the point that conducting CT was no longer relevant. - One country reported delays in airline data especially from low-budget airlines.
Missing or incomplete data for cross-border CT	- Many countries reported that much data necessary for conducting cross-border CT was incomplete or missing. - Important details of exposed contacts, such as addresses, and telephone numbers were not often provided by authorities in other countries. - Some reasons were given, such as the person to be contacted had already left the place, language barriers and errors in data collection. - Passengers do not all fill in the seats on the plane in the passenger questionnaire, making it difficult to isolate them. - Travel companies did not always provide the necessary contact details of passengers in relevant flights.
Additional workload	- Many countries reported that the high number of COVID-19 cases made it difficult to keep up cross-border contact tracing. - Organisations were too overwhelmed at the national level to be able to conduct cross-border CT as well. - The overload of messages at times through the EWRS led to delays in conducting CT. - One country reported having to analyse airplane companies' lists of passengers, which was very time consuming.
Digital technology not in place	- Some countries reported there were no digital solutions in place to be able to conduct cross-border CT effectively, especially at the start of the pandemic. - Some countries reported that digital cross-border contact tracing was not applicable to them or not necessary.
Other challenges	- The value of cross-border CT in open travel for an infectious agent such as the SARS-CoV-2 is sometimes questioned. - One country reported that a close collaboration with neighbouring EU and non-EU countries had to be set up initially.

Table 18. Main lessons learned regarding regular and cross-border CT for COVID-19. Data source: survey responses.

(1) The necessary CT digital technology should already be in place	• Most countries reported the need for IT solutions to be in place for future scenarios, to increase the speed and efficiency of cross-border CT. • For some countries this meant having their national CT systems integrated with their cross-border CT systems, and for other countries they wanted to be able to share national data across regions within their countries. • One country mentioned that faster systems and wider networks are needed for cross-border CT and there should be a European/global framework to share digitalised passenger data. • One country recommended preparing tools in the future that allow the rapid upscale of CT activities. • One country mentioned they established a national unit to contact trace all flights and that this had enabled standardisation as well as the ability to upscale when needed. • Two countries reported a need for cross-border CT to be integrated into the systems set up for national CT, as these were separate. One of these countries mentioned that cross-border CT had led to a lot of manual work and there was a lack of technology in the NFP for them to be able to work efficiently. • One country mentioned that there was little coordination of measures between countries, leading to unconstructive work. A coordinated platform for the whole of Europe in managing a pandemic (not only CT data, but related data pertaining to vaccination status and testing) would facilitate the exchange of data. • One country reported that the EWRS worked well for them, as there was a relatively low number of messages that had to be sent. There were doubts about the usefulness of passenger lists, this country had websites that published flights that were carrying cases. • Two countries reported that EWRS was a good tool to use in the future, one country reported that EWRS and secure email worked fine during 'normal' times. • One country had not made use of any digital tools, they reported that a CT digital tool would be helpful in the future.
(2) Review if and when cross-border CT is effective	• Many countries mentioned that cross-border CT may only be effective at certain stages during the pandemic, mainly at the beginning when the case numbers are still low. Later on in the pandemic, there is not more added value to cross-border CT. • One country mentioned that high volume cross-border CT hindered other work of the NFP. • One country reported that cross-border CT is time-consuming, while its effect on mitigating infectious diseases is unclear. • One country concluded that if CT is not possible at the national level, it will also not be needed at the international level. • One country mentioned there is little evidence for the effectiveness of cross-border CT, especially during peak times, and that the threshold for conducting cross-border CT in the future will likely be higher. • One country concluded that cross-border CT will not affect the course of the pandemic at all during peak times. • Recommendations regarding feasibility and effectiveness of cross-border CT need to be revised.
(3) Ensure there is sufficient human resource support	• Many countries mentioned the importance of having sufficient human resources in place in the future. • Several countries mentioned the importance of having a trained workforce that is readily deployable when the time comes.
(4) Good CT practices are	• Most countries reported the delay in receiving contact tracing whether through the EWRS or through passenger lists as being an obstacle to being able to carry out CT on time.

needed to reduce delay	- On passenger data: countries reported issues around passenger data, there were delays in obtaining passenger data from airlines. When the contacts were finally identified, it was often too late to carry out CT. - One country mentioned that passenger CT is a challenge, as it was not always clear whether the transmission occurred during exposure during the journey. - One country suggested that for the future, the collaboration with international public health transport (airline companies, trains, buses, etc.) should be facilitated. - One country reported that there were technical challenges in accommodating foreigners without Danish citizen-ID into their technical infrastructure. - One country mentioned that for the future, population needs and new threats should be constantly mapped and there should be a greater focus on fragile and vulnerable populations.
(5) Clear agreements are needed on what cross-border CT information is needed	- To increase effectiveness and efficiency of cross-border CT, countries reported the importance of clear agreements on what cross-border CT information is needed. - One country mentioned that the EWRS would ideally be a platform for use, as opposed to solely for sending free texts and excel sheets. - One country stated that a standardised set of data categories for MS, would improve the quality of cross-border CT. - One country mentioned that it was unclear what other countries did with the information they had sent. Likewise, they did not always do anything with information they had received from abroad. - One country stated that they would appreciate an obligation by countries to handle CT data in a timely manner. - One country also recommended a harmonised platform in Europe to facilitate the exchange of all types of data (e.g., vaccination status, test results, etc.). They also recommended implementing common best practices at the regional level.
(6) Good collaboration with cross-border countries and regions is needed	- Several countries underscored the importance of establishing good relationships with other regions and countries. - One country set up notification channels with neighbouring EU countries. Customs treaty allowed exchange of important CT information pertaining to their citizens with a neighbouring non-EU/EEA country. - In one country, a centre was established in their CT management organisation and a MoU (Memorandum of Understanding) was agreed upon with a neighbouring country outside of the EU, leading to smooth cross-border CT.
(7) Action plans and procedures should be in place	- Some countries reported it would be good to invest in health infrastructure, such as trained staff and facilities and to have IT solutions in place. - Two countries mentioned the importance of having cross-border action plans and procedures in place.

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