



Scope of this document

This document aims to inform resource planning for contact tracing, quarantine and monitoring activities of cases of COVID-19 in the European Union/ European Economic Area (EU/EEA) Member States as a response to the request from the Directorate General for Health and Food Safety, Crisis management and Preparedness in Health (Ref. Ares (2020) 1028377-18/02/2020). To answer this request, ECDC has considered relevant information on this topic. The methods used in the estimations are described in the Annex.

Background

Summary of strategic analysis

ECDC's strategic analysis identifies four scenarios, briefly described below.

Scenario 1- ongoing containment: Multiple introductions and limited human-to-human transmission in Europe. The number of introductions remains limited. No sustained transmission (only second-generation cases observed in Europe or transmission within sporadic contained clusters with known epidemiological links).

Scenario 2- sustained but sporadic community spread: Multiple introductions and increasing number of local reports of human-to-human transmission (second-generation cases outside of sporadic contained clusters with known epidemiological links). High number of introduced or second-generation cases.

Scenario 3 - widespread sustained transmission and increasing pressure on health care system: Localised outbreaks start to merge, become indistinct. Sustained human-to-human transmission in Europe (second-generation cases outside of sporadic contained clusters with known epi links). Increasing pressure on healthcare services.

Scenario 4 - widespread sustained transmission with healthcare system unable to cope: Overburden of healthcare systems (e.g., overflowing emergency rooms; strained intensive care unit (ICU) capacity; health care workers (HCW) overworked; lack of personal protective equipment (PPE), lack of testing kits).

Contact tracing is a risk management option for scenarios 1 and 2, while in scenarios 3 and 4 it is considered not worth the resource investment, and resources are better spent on mitigation measures. Therefore, the resource estimate presented below is applicable to contact tracing under scenarios 1 and 2.

Definitions

As specified in the ECDC technical document 'Public health management of persons, including healthcare workers, having had contact with COVID-19 cases in the European Union' [1], a contact of a COVID-19 case is a person not presenting symptoms, who has or may have been in contact with a COVID-19 case. The classification of contacts as high-risk or low-risk exposure is based on the associated risk of infection that in turn determines the type of monitoring. Contacts can also be healthcare workers as outlined in more detail in the technical document.

The definition of a contact applies to both probable and confirmed cases. A probable case is a suspected case for whom testing for COVID-19 is inconclusive. Countries may decide to start contact investigation for confirmed cases and, on an individual basis, for probable cases.

Quarantine refers to the separation and restriction of movement of contacts, i.e. people who were potentially exposed to COVID-19. In general, quarantine can be either voluntary or mandatory at home, in hospital or in dedicated facilities.

The term 'isolation' refers to the separation of people who are symptomatic.

Monitoring is used here to refer to the process whereby identified contacts are either actively followed up or passively, through so-called self-monitoring, over a pre-defined period.

Resource estimation for contact tracing, quarantine and monitoring activities

The proposed resource estimation considers a preparation phase (describing set-up needs) and an operational phase (describing resources needed per case).

The total amount of resources needed is the sum of different components:

- In the preparation phase:
 - Coordination teams set-up, such as the establishment of local, regional or national coordination teams;
 - Resources needed for set-up, for example, a one-time investment to assure access to the equipment, tools and infrastructure needed to manage the outbreak;
- In the operational phase:
 - Resources needed for contact tracing, quarantine and monitoring per case and their contacts.
 - Coordination activities continue throughout the whole duration of the operational phase.

Preparation phase

A preparation phase with the set-up of coordination teams and physical resources is foreseen so that contact tracing can start immediately when a case is identified. The availability of resources and the extent to which preparatory activities are needed will vary from country to country.

Coordination activities

National, regional and local coordination teams ideally should be established prior to introduction of the virus in EU/EEA countries. These coordination teams are expected to be operational during the complete duration of the outbreak.

It is likely that contact tracing will require coordination across several local or regional public health jurisdictions, as cases and contacts may be geographically dispersed.

The national team, the size of which will vary by the size of the country and – later on – by the number of cases and contacts, provides coordinated contact tracing activities across the country and produces guidance protocols, questionnaires, databases and data analysis.

International coordination may also be required if a case, or its contacts, have travelled within or outside Europe.

The local team coordinates the contact tracing activities at local level. The number of local teams, will increase with the spread of the outbreak.

Similarly, it is likely that if the number of cases rises, more staff at national or regional level will be needed as the complexity of the contact tracing activities increases.

Resources needed for set-up

In the preparation phase, resources need to be invested to obtain the equipment, tools and infrastructure to start contact tracing, quarantine and monitoring.

The availability of resources varies from country to country and in some cases, the set-up is minimal because some procedures are already in place.

Examples of resources required:

- Training of staff: Staff at national and local level would need to be trained, e.g. training on how to conduct a phone interview of cases/contacts, or training on the use of PPE for people testing symptomatic contacts. It is estimated that for each training the following is needed: a trainer working eight hours to prepare the training material, an administrative staff working four hours to organise the logistics, and four hours of both the trainer and the participants for the training delivery.
- Set-up of call centres: a call centre with staff for contact tracing activities and available to the contacts if they become symptomatic (e.g. two phones and three staff working on shifts to cover weekends and evenings);
- Stocking and positioning PPE.
- Validated protocols and questionnaires for data collection (during phone interviews, for example).
- Set-up of a database to collect, collate and analyse all data obtained.

Operational phase

Contact identification

The resources needed at the operational level are proportional to the numbers of cases investigated and contacts traced. Table 1 provides an overview of human resources (hours per professional profile) and material per activity.

Table 1. Estimated resources needed for contact tracing

Activity	Human Resources			Material
	Staff profile	Number of staff	Time (per staff)	
Interview case (*)	HCW/public health staff	One	Two hours	<ul style="list-style-type: none"> • Phone • Questionnaire • Translation services (if necessary)
Create contact list and retrieve personal information. This may require collaboration with other entities, including transport authorities, companies, and hospitals.	Administrative or other services	One	Six hours	
Enter interview in the system (e.g. electronic information system or excel file)	HCW/ public health staff	One	One hour	<ul style="list-style-type: none"> • Database
Classification of contacts as high or low-risk exposure; including prioritisation of whom to contact.	Two HCW/ public health staff One Administrative or other services	Three	Two hours	
Initial interview by phone with contacts. Through this interview, the HCW will establish the contacts' level of exposure, ask about symptoms and other personal information. HCW will also provide information about infection control measures, symptom monitoring and other precautionary measures.	HCW/ public health staff	One	45 min.	<ul style="list-style-type: none"> • Phone • Questionnaire
Enter information from interview into database	HCW/ public health staff	One	15 min.	<ul style="list-style-type: none"> • Database

HCW= health care worker; min= minutes.

** Of note, confirmed cases of COVID-19 may be hospitalised, isolated and possibly in a critical condition. This could pose a particular challenge for interviewing cases as it could be challenging to set-up a phone call or visit the case. Infection and prevention control (IPC) staff at the hospital could assist by conducting the interview, if provided with a questionnaire by the contact tracing team. However, IPC staff are not always available in all settings. Additionally, if hospital staff carries out the interview with the case, the information gained during the interview has to be transferred to the contact tracing team in some manner. In estimating staff time, only the time needed for the actual interview by a HCW is included, whether this HCW is part of the contact tracing team or hospital staff. Friends or family members could assist in determining contacts of cases in critical condition.*

Quarantine and monitoring

Resources needed for implementation of quarantine and monitoring measures have been estimated separately for contacts with high-risk exposure (Table 2) and with low-risk exposure (Table 3). No resources are needed for self-quarantine, although some benefit can be provided e.g. delivery of food or medication (see 'optional supplementary activities & resources' section for more details).

Table 2. Estimated resources needed for monitoring of close contacts with high-risk exposure

Activity	Human Resources			Material
	Staff profile	Number of staff	Time (per staff)	
Daily call to monitor contact for duration of follow-up (up to 14 days).	HCW/ public health staff	One	10 min	<ul style="list-style-type: none"> • Phone • Questionnaire • Translation services if necessary
Daily database update on contact's health status for duration of follow-up (up to 14 days).	HCW/ public health staff	One	10 min	<ul style="list-style-type: none"> • Database

HCW= health care worker; min= minutes.

Table 3. Estimated resources needed for monitoring of close contacts with low-risk exposure

Activity	Human Resources			Material
	Staff profile	Number of staff	Time (per staff)	
Self-monitoring and reporting possible onset of symptoms	HCW/ public health staff			<ul style="list-style-type: none"> • Call centre in case of questions

HCW= health care worker

Table 4 indicates the estimated resource need for testing of contacts who develop symptoms during the monitoring period. Contacts may develop symptoms due to COVID-19 infection, or due to other infections such as seasonal influenza or the common cold – the likelihood of which will vary depending on time of year and setting. The proportion of contacts who will develop symptoms and who need to be evaluated and tested is unknown. The estimate below refers to the resources needed to evaluate one symptomatic contact.

Table 4. Estimated resources needed to test one symptomatic contact*

Activity	Human Resources			Material
	Staff profile	Number of staff	Time (per staff)	
Incoming call from symptomatic contact (situation assessment)	HCW	One	30 min.	<ul style="list-style-type: none"> • Call centre
Ambulance/car for travel to symptomatic contact's home for testing	Driver (optional)	One	Three hours	<ul style="list-style-type: none"> • Dedicated vehicle (or ambulance if the case needs transport to hospital).
Home testing (travel to house and conducting the test)	HCW	One	Three hours	<ul style="list-style-type: none"> • One PPE [2], alcoholic solution, test, package for shipment, one extra pair of gloves for packaging test. • Courier transport for shipment of test • Laboratory services for testing

HCW= healthcare worker; min= minutes; PPE = personal protective equipment.

**Some countries may also decide to bring symptomatic contacts into healthcare facilities for testing. This would need similar resources in terms of transport, staff time and testing, except that more than one HCW may be involved in a healthcare facility and may need PPE.*

If a contact tests positive for COVID-19, they become a case and a new round of contact tracing with associated resources starts all over for that case.

Summary of resources

An overview of the resources needed for contact tracing and follow-up of contacts is presented in Table 5. The resources needed for the operational phase have been calculated with the assumption that the median number of contacts exposed to each case is 90 and that, on average, 36 are high-risk exposure contacts [3]. Note that the number of contacts can be highly variable per case.

Table 5. Summary of estimated resources needed

Activity	Human Resources	Material/ infrastructure	Comments
Preparation phase - throughout outbreak and scalable as cases increase			
Coordination activities	National team	International and national coordination, guidance, protocols, questionnaires, databases and data analysis	Size of national team will likely be larger in bigger countries and also increase as complexity of outbreak increases with number of cases and contacts
	Local teams	Lead contact tracing activities locally	Number of local teams will increase as locations with cases and contacts increase

RESTRICTED

COVID-19 -Resource estimation for contact tracing, quarantine and monitoring activities in the EU/EEA

Table 5. Cont.

Activity	Human Resources		Material/ infrastructure	Comments
Preparation phase – Set-up investment at the beginning				
Training	Training of staff at national and local level	Trainer: eight hours (prepare the training material) An administrative staff: four hours (organise logistic) Trainer and participants: four hours (training delivery)		
Set-up of call centres			A call centre with staff for contact tracing and available to the contacts if they become symptomatic	
Data collection instruments			Validated protocols and questionnaires for data collection.	
Database			A database to collect, collate and analyse all data obtained.	Ideally, database accessible from all regions involved to manage contacts across locations.
PPE			Stocking and positioning PPE	
Operational phase - scalable as cases increase				
Contact identification	Six to seven HCW/ public health staff and/or administrative or other services (over a 48 hour time period)	HCW/ public health staff /administrative or other services: eight hours HCW/ public health staff: 97 hours	Phones Questionnaire Translation services Database	Assumption that the number of contacts exposed to each case is 90 [3]
High-risk exposure (close) contacts isolation and monitoring	Two HCW	Two HCW/public health staff working on average six hours a day for up to 14 days.	Phones Questionnaire Translation services Database	Assumption that each case has on average 36 high-risk exposure contacts [3]
Low-risk exposure contacts isolation and monitoring	HCW administrative or other services (Same staff as those working with monitoring of high-exposure contacts)	Staff time at call centre if contacts have questions (five to ten minutes per call)	Phones Questionnaire Translation services Database	It is not possible to estimate the proportion of contacts who will call for questions. However, since the expected proportion is low, the staff could be the same as those monitoring the high-exposure contacts
Testing of symptomatic contacts	One HCW One driver	One HCW for three and a half hours One driver for three hours	Call centre Dedicated vehicle PPE Test Packaging Courier transport Laboratory services	This is an estimate of the needs for one symptomatic contact. It is not possible to estimate the proportion of contacts who are likely to become symptomatic

HCW= health care worker; PPE = personal protective equipment.

Options for higher-transmission scenarios

Scenario 2: Sustained but sporadic community spread

In a scenario of 'sustained but sporadic community spread', it will become increasingly challenging to trace all contacts of cases. Contact tracing alone is unlikely to control the outbreak and additional measures will be necessary [4] - please refer to the ECDC guideline on non-pharmaceutical measures [5]. The point at which extensive contact tracing becomes unsustainable due to limited resources will vary between different countries in the EU/EEA. It must be emphasised, however, that **there is still value in tracing contacts even if not all contacts are traced**. This will help slow the spread of infection and if less than one new case arises from each case the outbreak can be contained [3, 4]. In such a scenario, contact tracing and follow-up can be prioritised first to the highest-risk exposure contacts, which are usually the easiest to find, and then to a random subgroup of the low-risk exposure contacts. It may also be possible to use well-trained junior or non-technical staff instead of HCW and public health specialists for some of the contact tracing activities to extend capacity. HCW and public health specialists may be better used elsewhere in the outbreak response. Other measures that may help save resources include switching to self-monitoring for close contacts instead of daily calls, or to use an app or other online tool for monitoring.

The resources needed for contact tracing, quarantine and monitoring in scenario 2 are as described above. However, additional resources will be needed due to increased complexity of coordination, management of increasing numbers of people presenting with symptoms to healthcare facilities. This includes use of additional PPE for staff, and possible societal costs associated with quarantine of large numbers of contacts, such as costs related to businesses losses or to the implications of closing healthcare facilities.

Furthermore, some countries may decide to invest more resources in testing the highest-risk exposure contacts e.g. family members, children, and risk groups or to set-up hotlines to provide guidance and information to the general public.

All these resources have not been estimated here and go beyond the scope of this evaluation, which has only focussed on contact tracing and management of contacts.

Considerations

Contact tracing efforts may have to be scaled up very quickly if the number of identified cases becomes large in a short period of time as has been seen in some locations in this COVID-19 outbreak. This could happen if several new cases are introduced simultaneously, or if there is a delay before cases are identified and isolated and community transmission has gone on for some time.

Modelling has shown that the probability of containing the outbreak with contact tracing, quarantine and monitoring alone is lower the higher the number of initial cases introduced, and the longer the time between symptom onset in new cases and their isolation.[4]

Scenarios 3 and 4: Widespread sustained transmission

In these scenarios, contact tracing is likely not worth the resource investment, and resources are better spent on mitigation measures. Please refer to the ECDC guideline on non-

pharmaceutical measures to delay and mitigate the impact of COVID-19 for more information on measures to undertake during the mitigation phase [5].

Optional supplementary activities & resources

A number of activities were identified that may not be essential to the process but could be considered if resources are available:

- For contacts with high likelihood of being infected, organised quarantine can be considered. This could be applied for example when a group of people are repatriated from areas with high prevalence or after spending an extended period together in a closed environment (e.g. this was done in France where several people stayed together in a chalet with a case. Some later tested positive and the remaining people were hospitalised as a precaution [6]).
- Very high-risk exposure contacts could be tested before developing symptoms. This could be considered for family members for example. Additionally, testing of self-isolated contacts may also be considered (e.g. swab test every three days).
- Provision of thermometers for contacts in order to measure their temperature.
- For people in quarantine:
 - Financial compensation for lost income.
 - Delivery of food and other essential items such as medication.
- Testing of asymptomatic contacts to gain knowledge about transmission dynamics, severity and clinical spectrum. This would not be for the purpose of containment but to inform the response. WHO has developed a protocol for testing the contacts of the 'first few cases' [7].

References

1. European Centre for Disease Prevention and Control (ECDC). Public health management of persons having had contact with novel coronavirus cases in the European Union. Stockholm: ECDC; 2020 [updated January 2020]. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/Public-health-management-contact-novel-coronavirus-cases-EU_0.pdf
2. European Centre for Disease Prevention and Control (ECDC). Personal protective equipment (PPE) needs in healthcare settings for the care of patients with suspected or confirmed novel coronavirus (2019-nCoV). Stockholm: ECDC; 2020. Available from: <https://www.ecdc.europa.eu/sites/default/files/documents/novel-coronavirus-personal-protective-equipment-needs-healthcare-settings.pdf>
3. Keeling M.J., Hollingsworth, T.D., and Jonathan M Read. The Efficacy of Contact Tracing for the Containment of the 2019 Novel Coronavirus (COVID-19).[Unpublished article] Preprint available from: <https://www.medrxiv.org/content/10.1101/2020.02.14.20023036v1>

4. Hellewell J., Abbott S., Gimma A., Bosse N., Jarvis C., Russell T., et al. Feasibility of controlling 2019-nCoV outbreaks by isolation of cases and contacts. Preprint available from: <https://doi.org/10.1101/2020.02.08.20021162>
5. European Centre for Disease Prevention and Control (ECDC). Guidelines for the use of non-pharmaceutical measures to delay and mitigate the impact of 2019-nCoV. Stockholm: ECDC; 2020. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/novel-coronavirus-guidelines-non-pharmaceutical-measures_0.pdf
6. Bernard Stoecklin S., Rolland P., Silue Y., Mailles A. , Campese C., et al. First cases of coronavirus disease 2019 (COVID-19) in France: surveillance, investigations and control measures, January 2020. Euro Surveill. 2020;25(6):pii=2000094. Available from: <https://doi.org/10.2807/1560-7917.ES.2020.25.6.2000094>
7. World Health Organization. The First Few X (FFX) Cases and contact investigation protocol for 2019-novel coronavirus (2019-nCoV) infection. [https://www.who.int/publications-detail/the-first-few-x-\(ffx\)-cases-and-contact-investigation-protocol-for-2019-novel-coronavirus-\(2019-ncov\)-infection](https://www.who.int/publications-detail/the-first-few-x-(ffx)-cases-and-contact-investigation-protocol-for-2019-novel-coronavirus-(2019-ncov)-infection)

Annex 1 – Methods

The following methods were used to identify relevant activities during contract tracing, isolation and management of COVID-19 cases:

- **Desk review** of existing guidance documents, protocols, and peer-reviewed publications on contact tracing related to COVID-19 or previous epidemics such as SARS, Ebola or pandemic influenza. Sources include ECDC, WHO, US CDC and some EU/EEA countries.
- **Consultations with country-level experts** in person or via email to obtain information on country-specific activities and resources needed.
- **Consultation with ECDC experts** with experience of contact tracing.

As result of this process, the following types of activities were identified:

1. Preparation.
2. Contact identification.
3. Isolation and monitoring of contacts with either high-risk or low-risk exposure to the index case.
4. Testing of symptomatic contacts.
5. Overall coordination of the response at local, national and international levels.

These activities were grouped in three categories:

- Coordination and management (ongoing through the whole duration of the outbreak);
- Initial set-up (one-time investment at the beginning of the outbreak management);
and
- Contact tracing, quarantine, monitoring, and testing of symptomatic contacts for each index case and its contacts.

After identification of activities, we estimated the resources needed, informed by existing guidance documents and the expert consultation.