ECDC TECHNICAL REPORT

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

2 March 2020

Scope of this document

This document aims to inform resource planning for contact tracing, quarantine and monitoring activities forCOVID-19 cases within European Union/European Economic Area (EU/EEA) Member States.

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 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 of close contacts of a person with probable or confirmed infection refers to remaining at home or at a designated setting for a defined period (e.g. for the incubation period) after the last exposure, aiming to reduce virus transmission.

The term 'isolation' refers in this context to the separation of symptomatic contacts from other people, for example at home or in hospital, while being tested for COVID-19 and awaiting the result.

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.

Suggested citation: European Centre for Disease Prevention and Control. Resource estimation for contact tracing, quarantine and monitoring activities for COVID-19 cases in the EU/EEA. ECDC: Stockholm; 2020.

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, the World Health Orgnization (WHO), US Centers for Disease Control and Prevention (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 a result of this process, the following types of activities were identified:

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

These activities were grouped into 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);
- 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 [2-13].

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 contacts resulting from one case.
  - 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 necessary so that contact tracing can start immediately once 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 should ideally be established prior to cases occurring in EU/EEA countries. These coordination teams are then expected to be operational during the entire 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 subsequently by the number of cases and contacts, provides coordinated contact tracing activities across the country. It also 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 regional and local team coordinates the contact tracing activities at regional/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 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

Immediately after a case is confirmed, the case should be interviewed and the contacts listed and classified as high-risk exposure ('close contact') or low-risk exposure contacts. The team then communicates with all contacts to inform and advise. High-risk exposure contacts will be actively monitored by public health authorities, whereas low-risk exposure contacts should self-monitor for symptoms and avoid social contacts. Quarantine, including voluntary quarantine, may be considered for high-risk exposure contacts [14]. If symptoms of illness occur, the contacts should then self-isolate and seek medical advice [1], preferably by phone first.

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	• 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	• 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, staff will establish the contacts' level of exposure, ask about symptoms and other personal information. Staff will also provide information about infection control measures, symptom monitoring and other precautionary measures.	HCW/ public health staff	One	45 min.	• Phone • Questionnaire
Enter information from interview into database	HCW/ public health staff	One	15 min.	• Database

HCW= healthcare 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 and 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	• 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	• Database

HCW= healthcare 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			• Call centre in case of questions

HCW= healthcare worker

Table 4 indicates the estimated resources 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.	• Call centre
Ambulance/car for travel to symptomatic contact's home for testing	Driver (optional)	One	Three hours	• Dedicated vehicle (or ambulance if the case needs transport to hospital).
Home testing (travel to house and conducting the test)	HCW	One	Three hours	• One PPE [15], 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 again 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 [16]. Note that the number of contacts can be highly variable per case.

Table 5. Summary of estimated resources needed

	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
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 [16]
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 [16]
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= healthcare worker; PPE = personal protective equipment.

Options for higher-transmission scenarios

As cases increase it will become increasingly challenging to trace all contacts of cases. Contract tracing alone is unlikely to control the outbreak and additional measures will be necessary [17] (consult ECDC guideline on non-pharmaceutical measures [14]). 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 of each case are traced**. This will help slow the spread of infection and if, on average, less than one new case arises from each case, the outbreak can be contained [16], [17] . In such a scenario, contact tracing and follow-up can be prioritised first to the highest-risk exposure contacts of each case, which are usually the easiest to find, including HCWs or staff working with vulnerable populations, followed by as many as possible of the low-risk exposure contacts. It may also be possible to use well-trained junior or non-technical staff instead of HCWs and public health specialists for some of the contact tracing activities to extend capacity. Healthcare workers 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 a higher transmission scenario are as described above. However, additional resources will be needed due to increased complexity of coordination and 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 business 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 focused 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 during this COVID-19 outbreak. This could happen if several new cases are introduced simultaneously, or if there is a delay in cases being 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 [17].

In a scenario of widespread transmission contact tracing could still contribute to delaying the spread and reducing the pressure on the healthcare system, but may not be feasible. Countries could consider focusing on contacts that are healthcare workers or work with vulnerable populations. Please refer to the ECDC guidelines on non-pharmaceutical measures to delay and mitigate the impact of COVID-19 for more information on measures to undertake during the mitigation phase [14] .

Optional supplementary activities and 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.
- 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' [6] .

Contributing ECDC experts (in alphabetical order)

Cornelia Adlhoch, Agoritsa Baka, Scott Chiossi, Stefania De Angelis, Erika Duffell, Margot Einoder-Moreno, Lina Nerlander, Daniel Palm, Senia Rosales-Klintz.

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 2020 [updated 30 January 2020]. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/Public-health-management-contact-novel-coronavirus-cases-EU_0.pdf.
2. UK Government; Department of Health Pandemic Influenza Preparedness Team. UK Influenza Pandemic Preparedness Strategy 2011 2011 [updated 10 November 2011]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/213717/dh_131040.pdf.
3. French Government; Secrétariat général de la défense et de la sécurité nationale. National influenza oandemic prevention and response plan 2011. Available from: https://solidarites-sante.gouv.fr/IMG/pdf/PlanPandemieGrippale-Version_Anglais.pdf.
4. World Health Organisation (WHO). Home care for patients with suspected novel coronavirus (nCoV) infection presenting with mild symptoms and management of contacts 2020 [updated 4 February 2020]. Available from: https://www.who.int/publications-detail/home-care-for-patients-with-suspected-novel-coronavirus-(ncov)-infection-presenting-with-mild-symptoms-and-management-of-contacts.
5. World Health Organisation (WHO). Household transmission investigation protocol for 2019-novel coronavirus (2019-nCoV) infection 2020 [updated 25 January 2020]. Available from: https://www.who.int/publications-detail/household-transmission-investigation-protocol-for-2019-novel-coronavirus-(2019-ncov)-infection.
6. World Health Organisation (WHO). The First Few X (FFX) Cases and contact investigation protocol for 2019-novel coronavirus (2019-nCoV) infection 2020 [updated 29 January 2020]. Available from: https://www.who.int/publications-detail/the-first-few-x-(ffx)-cases-and-contact-investigation-protocol-for-2019-novel-coronavirus-(2019-ncov)-infection.
7. World Health Organisation (WHO). Implementation and management of contact tracing for Ebola virus disease 2015. Available from: https://www.who.int/csr/resources/publications/ebola/contact-tracing/en/.
8. Centers for Disease Control and Prevention (CDC); Department of Health and Human Services. Public Health Guidance for Community-Level Preparedness and Response to Severe Acute Respiratory Syndrome (SARS) 2004 [updated 8 January 2004]. Available from: https://www.cdc.gov/sars/guidance/b-surveillance/downloads/b-surveillance-full.pdf.
9. Centers for Disease Control and Prevention (CDC); Department of Health and Human Services. Fact Sheet: Isolation and Quarantine 2004 [updated 20 January 2004]. Available from: https://www.cdc.gov/sars/quarantine/fs-isolation.pdf.
10. Centers for Disease Control and Prevention (CDC); Department of Health and Human Services. Coronavirus Disease 2019 (COVID-19) Risk Assessment and Public Health Management Decision Making 2020. Available from: https://www.cdc.gov/coronavirus/2019-ncov/downloads/public-health-management-decision-making.pdf.
11. Spanish Government IdSCI. Procedimento de actuación frente a casos de infección por el nuevo coronavirus (SARS-CoV-2) 2020 [updated 27 February 2020]. Available from: https://www.mscbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCov-China/documentos/Procedimiento_COVID_19.pdf.
12. European Centre for Disease Prevention and Control (ECDC). Health emergency preparedness for imported cases of high-consequence infectious diseases 2019 [updated 22 october 2019]. Available from: https://www.ecdc.europa.eu/en/publications-data/health-emergency-preparedness-imported-cases-high-consequence-infectious-diseases.
13. Stoecklin SB, Rolland P, Silue Y, Mailles A, Campese C, Simondon A, et al. First cases of coronavirus disease 2019 (COVID-19) in France: surveillance, investigations and control measures, January 2020. Eurosurveillance. 2020;25(6):2000094.
14. 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 2020 [updated February 2020]. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/novel-coronavirus-guidelines-non-pharmaceutical-measures_0.pdf.
15. 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) 2020 [updated February 2020]. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/novel-coronavirus-personal-protective-equipment-needs-healthcare-settings.pdf.
16. Keeling MJ, Hollingsworth TD, Read JM. The Efficacy of Contact Tracing for the Containment of the 2019 Novel Coronavirus (COVID-19). medRxiv. 2020.
17. Hellewell J, Abbott S, Gimma A, Bosse NI, Jarvis CI, Russell TW, et al. Feasibility of controlling 2019-nCoV outbreaks by isolation of cases and contacts. medRxiv. 2020.