Technical Report 9

Generating a case definition for COVID-19

Surangi Jayakody[1*], Nuwan Darshana Wickramasinghe[2], Sumudu Avanthi Hewage[3], Shamini Prathapan[1], Carukshi Arambepola[4]

[1] Department of Community Medicine, Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka; [2] Department of Community Medicine, Faculty of Medicine & Allied Sciences, Rajarata University of Sri Lanka; [3] National Programme for Tuberculosis Control and Chest Diseases, Ministry of Health, Sri Lanka; [4] Department of Community Medicine, Faculty of Medicine, University of Colombo, Sri Lanka

[*]Correspondence: surangijayakody@sjp.ac.lk   https://orcid.org/0000-0001-7995-391X

Highlights

- A clear case definition is critical for effective investigation of an outbreak.
- The case definitions in current COVID-19 pandemic differ slightly from region to region   and   also   are revised from time to time.
- Knowing the clinical presentation for a particular country is very important especially in a novel epidemic/pandemic like COVID-19.

Purpose of a case definition

Development of a clear case definition is critical for effective investigation of an outbreak. Use of a common case definition allows for standardization of the cases of interest, both within an ongoing outbreak investigation and possibly between outbreak investigations that differ over time or geographic location (1).

The case definition takes into account both the epidemiology of the virus as well as its clinical presentation. The criteria are usually interim and will be revised as more specific information emerges on the outbreak including characteristics of transmission, incubation and infectious period and geographical spread.

Sensitivity and specificity

Clinical case definitions used for surveillance aim to satisfy two challenging and potentially conflicting needs – sensitivity and specificity. A more sensitive case definition is beneficial in estimating the disease burden in early phases of an outbreak. A highly sensitive case definition will identify a large proportion of true cases, whereas a highly specific

case definition will provide a more accurate description of true cases. Therefore, high specificity is important in assessing the evolution of the epidemiology (2).

Evidence from 2009 H1N1 pandemic

Pandemic H1N1 2009 influenza has created many disputes with regard to case definition all over the world. In Victoria State, initial laboratory testing to confirm a case of swine flu was only done if a symptomatic patient fitted the specific case definition including a recent travel history to Mexico or North America or being a close contact of a proven case. Tests of all other patients who had clinical illness suspected of being swine flu were initially given low priority. However, this case definition was criticized for not being an "accurate model for the swine flu epidemic" and for missing the main target group for determining community spread. Furthermore, it was emphasized that "the case definition should be used to guide clinicians, not the laboratory testing strategy". Otherwise, it does not identify the real extent of disease spread until it is too late (3).

Case definitions used in the current COVID-19 pandemic

The case definitions in current COVID-19 pandemic differ slightly from region to region and are also revised from time to time based on the case series as the epidemiology of SARS-CoV-2 differs from region to region or even from country to country. Therefore, knowing the clinical presentation for a particular country is very important especially in a novel epidemic/pandemic like COVID-19.

Table 1 describes some of the COVID-19 case definitions that are applied worldwide.

Table 1: Case definitions for COVID-19 across countries/organizations

Country /organization	Case definition	Date of revision
WHO (4)	**Suspect Case** A. A patient with acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath), AND a history of travel to or residence in a location reporting community transmission of COVID-19 disease during the 14 days prior to symptom onset; OR B. A patient with any acute respiratory illness AND having been in contact with a confirmed or probable COVID-19 case (see definition of contact) in the last 14 days prior to symptom onset; OR C. A patient with severe acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath; AND requiring hospitalization) AND in the absence of an alternative diagnosis that fully explains the clinical presentation. **Probable Case** A. A suspect case for whom testing for the COVID-19 virus is inconclusive OR B. A suspect case for whom testing could not be performed for any reason.	20.03.2020

	Confirmed Case A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms. **Contact** A contact is a person who experienced any one of the following exposures during the 2 days before and the 14 days after the onset of symptoms of a probable or confirmed case: 1. Face-to-face contact with a probable or confirmed case within 1 meter and for more than 15 minutes; 2. Direct physical contact with a probable or confirmed case; 3. Direct care for a patient with probable or confirmed COVID-19 disease without using proper personal protective equipment; OR 4. Other situations as indicated by local risk assessments. Note: for confirmed asymptomatic cases, the period of contact is measured as the 2 days before through the 14 days after the *date on which the sample was taken* which led to confirmation.	

Sri Lanka (5)	**Clinically Suspected Case**
	
	A. A person with ACUTE RESPIRATORY ILLNESS (with Cough, SOB, Sore throat: one or more of these) with a history of FEVER (at any point of time during this illness), returning to Sri Lanka from ANY COUNTRY within the last 14 days.
	    OR
	
	B. A person with acute respiratory illness AND having been in close-contact* with a confirmed or suspected COVID-19 case during the last 14 days prior to onset of symptoms;
	    Close-contact: A person staying in an enclosed environment for >15 minutes (e.g. same household/workplace/social gatherings/travelling in same vehicle).
	    OR
	
	C. A patient with acute pneumonia (not explainable by any other aetiology) regardless of travel or contact history as decided by the treating Consultant.
	
	Confirmed Case
	
	A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms.
		21.03.2020

Sri Lanka	**Clinically Suspected Case** A. A person with ACUTE RESPIRATORY ILLNESS (with Cough, SOB, Sore throat: one or more of these) with a history of FEVER (at any point of time during this illness), returning to Sri Lanka from ANY COUNTRY within the last 14 days. OR	04.04.2020 (revised)

	B. A person with ACUTE RESPIRATORY ILLNESS (with Cough, SOB, Sore throat: one or more of these) AND having been in **close contact*** with a confirmed or suspected COVID 19 case during the last 14 days prior to onset of symptoms; Close-contact: A person staying in an enclosed environment for >15 minutes (e.g. same household/workplace/social gatherings/travelling in same vehicle) OR who had direct physical contact OR C. A person with ACUTE RESPIRATORY ILLNESS (with cough, SOB, sore throat; one or more of these) with a history of FEVER (at any point of time during this illness), with a history of travel to or a residence in a location designated as an area of high transmission of COVID 19 disease as defined by the Epidemiology unit, MoH, during the 14 days prior to symptom onset. OR D. A patient with acute pneumonia (not explained by any other aetiology) regardless of travel or contact history as decided by the treating consultant. OR E. A patient with fever and **in respiratory distress** as evident by RR>30 per minute, SpO2 <90% on room air, regardless of travel or contact history and **without a definable cause**, as decided by the treating Consultant. F. Any person irrespective of the presence of symptoms, with an epidemiological link to a confirmed COVID-19 case who needs testing, as decided by the Regional Epidemiologist or Central Epidemiology Unit. **Confirmed Case** A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms.	
UK (6)	**Possible Case** A. Patients who meet the following criteria (inpatient definition) • requiring admission to hospital (a hospital practitioner has decided that admission to hospital is required with an expectation that the patient will need to stay at least one night) AND • have either clinical or radiological evidence of pneumonia OR • acute respiratory distress syndrome OR	13.03.2019

	• influenza like illness (fever ≥ 37.8°C and at least one of the following respiratory symptoms, which must be of acute onset: persistent cough (with or without sputum), hoarseness, nasal discharge or congestion, shortness of breath, sore throat, wheezing, sneezing
	
	Note: Clinicians should consider testing inpatients with new respiratory symptoms or fever without another cause or worsening of a pre-existing respiratory condition.
	
	B. Patients who meet the following criteria and are well enough to remain in the community
	
	   • new continuous cough AND/OR
	
	   • high temperature
	
	Individuals with cough or fever should now stay at home. Those staying at home are not prioritised for testing.
	
	Clinicians should be alert to the possibility of atypical presentations in patients who are immuno-compromised.
	
	Alternative clinical diagnoses and epidemiological risk factors should be considered.	

Australia (7)	**Confirmed Case**
	A person who tests positive to a validated specific SARS-CoV-2 nucleic acid test or has the virus identified by electron microscopy or viral culture, at a reference laboratory.
	Probable Case
	
	A. A person with fever (≥ 38°C)1 or history of fever (e.g. night sweats, chills)
	
	   OR
	
	   acute respiratory infection (e.g. cough, shortness of breath, sore throat)
	
	B. AND
	
	   who is a household contact of a confirmed case of COVID-19, where testing has not been conducted.
	
	Suspect Case (current testing advice)
	
	A person who meets the following epidemiological and clinical criteria:
		24.03.2020

New Zealand (8)	**Suspect case** Any acute respiratory infection with at least one of the following symptoms: cough, sore throat, shortness of breath, coryza (runny nose, sneezing, post-nasal drip) anosmia with or without fever. **Probable case** A close contact of a confirmed case that has a high exposure history, meets the clinical criteria and for whom testing cannot be performed, or	15.05.2020

	A close contact of a confirmed case that has a high exposure history, meets the clinical criteria, and has a negative PCR result but it has been more than 7 days since symptom onset before their first negative PCR test was taken. **Confirmed case** A case that has laboratory definitive evidence. **Laboratory definitive evidence requires at least one of the following**: • detection of SARS-CoV-2 from a clinical specimen using a validated NAAT (PCR) • detection of coronavirus from a clinical specimen using pan-coronavirus NAAT (PCR) and confirmation as SARS-CoV-2 by sequencing • significant rise in IgG antibody level to SARS-CoV-2 between paired sera (when serological testing becomes available).	
USA (Centres for Disease Control- CDC) (9)	**Clinical Criteria for Reporting** In outpatient or tele-health settings at least two of the following symptoms: fever (measured or subjective), chills, rigors, myalgia, headache, sore throat, new olfactory and taste disorder(s) OR at least one of the following symptoms: cough, shortness of breath, or difficulty breathing OR Severe respiratory illness with at least one of the following: • Clinical or radiographic evidence of pneumonia or • Acute respiratory distress syndrome (ARDS). AND No alternative more likely diagnosis **Laboratory Criteria for Reporting** • Detection of SARS-CoV-2 RNA in a clinical specimen using a molecular amplification detection test. • Detection of specific antigen in a clinical specimen. • Detection of specific antibody in serum, plasma, or whole blood indicative of a new or recent infection* *serologic methods for diagnosis are currently being defined **Epidemiologic Linkage Criteria for Reporting** • In a person with clinically compatible symptoms with one or more of the following exposures in the 14 days before onset of symptoms: • Travel to or residence in an area with sustained, on-going community transmission of SARS-CoV-2 OR	17.04.2020

	• Close contact** with a person diagnosed with COVID-19 OR • Member of a risk cohort as defined by public health authorities during an outbreak. **Close contact is defined as being within 6 feet for a period of 10 minutes to 30 minutes or more depending upon the exposure. In healthcare settings, this may be defined as exposures of greater than a few minutes or more. Data are insufficient to precisely define the duration of exposure that constitutes prolonged exposure and thus a close contact.	

Epidemiological criteria	Clinical criteria	Action
Very high risk A. Close contact (see Contact definition below) in the 14 days prior to illness onset with a confirmed case B. International travel in the 14 days prior to illness onset C. Cruise ship passengers and crew who have travelled in the 14 days prior to illness onset	Fever (≥38°C)[1] or history of fever OR acute respiratory infection (e.g. cough, shortness of breath, sore throat)	Test[2]

High risk setting
 	
A. Two or more cases of illness clinically consistent with COVID-19 (see clinical criteria) in the following settings:
 	
  1. Aged care and other residential care facilities
 	
  2. Military operational settings
 	
  3. Boarding school
 	
  4. Correctional facilities
 	
  5. Detention centres
 	
  6. Aboriginal rural and remote communities, in consultation with the local PHU
 	
  7. Settings where COVID-19 outbreaks have occurred, in consultation with the local PHU
 	
B. Individual patients with illness clinically consistent with COVID-19 (see clinical criteria) in a geographically localised area with elevated risk of community transmission, as defined by PHUs
	Fever (≥38°C) 1 or history of fever OR acute respiratory infection (e.g. cough, shortness of breath, sore throat)	Test
		(on site for aged care residents, where feasible)

Moderate risk Health care workers, the elderly or residential care workers	Fever (≥38°C) 1 or history of fever OR acute respiratory infection (e.g. cough, shortness of breath, sore throat)	Test
Background risk (No epidemiological risk factors)	Hospitalised patients with fever (≥38°C)[1] AND acute respiratory symptoms (e.g. cough, shortness of breath, sore throat)[3] of an unknown cause	Test

Application to Sri Lankan context

Sri Lanka used the case definition given by the Epidemiology Unit of the Ministry of Health, Sri Lanka, which is based on the WHO case definition in clinical practice early in the outbreak (4). The need for a case definition with high sensitivity based on clinical presentations was raised, since the asymptomatic or pre-symptomatic COVID-19 infection might have critical consequences with regards to uncontrolled spread of the virus in the community. Hence, it was revised and published on 4 April 2020, adding three new scenarios (Parts C, E and F) including atypical presentations based on the Sri Lankan experience. Evidence from international literature has shown that atypical presentations are common and should be considered early in the course of the epidemic (10-11).

Recommendations

- Case definition needs to be revised in an epidemic based on the cases reported so far and should become clinically specific over time.

- Laboratory diagnosis capacity should be strengthened as it plays a critical role in case finding in an early phase of epidemic /pandemic.

- Testing should be scaled up to identify the full extent of the disease spread, so that the accuracy of the proposed case definitions could be confirmed.

- In later phase of the pandemic, a well-constructed case definition based on country specific epidemiological profile should be applied for case management rather than the laboratory confirmation.

- Epidemiology of SARS-CoV-2 in Sri Lankan context should be studied and made available for curative and preventive sector decision-making.

Author Declaration

References

1. Centres for Disease Prevention and Control. *Outbreak case definition.* Centres for Disease Prevention and Control. USA. Available from: https://www.cdc.gov/urdo/downloads/CaseDefinitions.pdf.

2. Penttinen P & Pebody R. Influenza case definitions–optimising sensitivity and specificity. *Eurosurveillance* 2015; 20(22): 21148. Available from:https://www .eurosurveillance.org/ docserver/fulltext/eurosurveillance/20/22/art21148 -en.pdf? expires=1585968424&id =id&accname= guest&checksum=FFE18067E6A37C63C3206BD 0CBCE149E.

3. Grayson ML & Johnson PD. Australia's influenza containment plan and the swine flu epidemic in Victoria. *Medical Journal of Australia* 2009; 191(3): 150. DOI: 10.5694/j.1326-5377.2009.tb02724.x.

4. World Health Organization. *Coronavirus Disease (COVID-19) Technical Guidance: Surveillance and Case Definitions.* World Health Organization 2020. Available from: https://www.who.int/ emergencies /diseases/novel-coronavirus-2019/technical-guidance /surveillance-and-case-definitions. Accessed 10 April 2020.

5. Epidemiology Unit, Ministry of Health, Nutrition and Indigenous Medicine. *Updated Interim Case definition and advice on initial Management.* Epidemiology Unit, Ministry of Health, Nutrition and Indigenous Medicine, Sri Lanka Available from: http://www.epid.gov. lk/web/index.php? lang=en. Accessed 10 April 2020.

6. Public Health England. *Coronavirus disease (COVID-19) guidance and support 2020.* Public Health England, 2020. Available from:https:// www.gov.uk/coronavirus. Accessed 20 April 2020.

7. New South Wales Government Health. *COVID-19: update advice on testing.* New South Wales

Government Health, 2020. Available from: https://www.health.nsw.gov.au/Infectious/diseases/Pages/2019-ncov-case-definition.aspx.Accessed 20 April 2020.

8. Ministry of Health, New Zealand. *Case definition of COVID-19 infection 2020.* Ministry of Health, New Zealand. Available from: https://www. health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-novel-coronavirus-information-specific-audiences/covid-19-novel-coronavirus-resources-health-professionals/case-definition-covid-19-infection. Accessed 15 May 2020.

9. Council of State and Territorial Epidemiologists, Interim-20-ID-01. *Standardized surveillance case definition and national notification for 2019 novel coronavirus disease (COVID-19).* Available from: https://cdn.ymaws. com/ www.cste.org /resource/resmgr/2020ps/Interim-20-ID-01_COVID-19.pdf. Accessed 10 May 2020.

10. Sai Sim & Wiwanitkit Viroj. Uncommon Atypical Presentations of COVID-19: Important and Should Not be Under Recognized! *Journal of Health Science and Medical Research* 2020; 38: 153. DOI: 10.31584/jhsmr.2020733.

11. Fang Y, Zhang H, Xie J, Lin M, Ying L, Pang P, & Ji W. Sensitivity of chest CT for COVID-19: comparison to RT-PCR. *Radiology* 2020; 200432. DOI: 10.1148/radiol.2020200432.