influenza

Glossary of Terms for Infectious Disease Modelling

A Proposal for Consistent Language

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Mathematical and computational models are useful tools, which can provide important information on key aspects of disease epidemiology and pathogenesis. Increasingly, public health responses are based on such information that often aims to quantify the transmission potential of an infectious disease, and the impact of various intervention strategies. However, model-based outcomes are reliant on assumptions, terms, parameters, and their definitions and inter-relations. Consistent use of terms in modelling can improve applicability of their outcomes in relevant population settings, and will allow public health policymakers to make informed decisions through the evaluation and comparisons of different scenarios. This document aims to provide a glossary of terms with their definitions that can be used to conceptualize and parameterize models consistent with those applied in public health, epidemiology, and clinical settings related to infectious diseases.

The following table summarizes terms that were discussed with respect to their definitions through an online forum consisting of health professionals and modellers. These definitions are based on extensive deliberations amongst the mod4PH group, with the use of various literature and resources. As our understanding of infectious diseases evolves, these definitions may require revisions, and this glossary of terms will be updated accordingly. We hope that these terms will be used more consistently in future modelling studies to improve the uptake, understanding, and potential impact of modelling outcomes in public health policies and programs.

About the Influenza Series

This glossary builds on earlier work focused on the prevention and control of influenza, but lays a groundwork of common language for modelling many infectious diseases.

NCCID has worked to foster increased uptake and improved relevance of modelling for public health decision-making with support of our partners at York University, Pan-InfORM, and other individual collaborators.

Contact nccid@umanitoba.ca with comments on the glossary, or to learn about other products related to the use of modelling research to inform public health practice or policy.

National Collaborating Centre for Infectious Diseases

Centre de collaboration nationale des maladies infectieuses

	Term	Description	Comment
A	**Asymptomatic**	A disease stage in which the infected individual does not and will not exhibit symptoms.	In the asymptomatic stage, the individual is infectious and can transmit the disease to others.
	Attack rate	The attack rate describes the proportion of individuals who experience disease over a period of time.	For diseases in which there is an asymptomatic stage (e.g., influenza), it may be difficult to determine the proportion of infected individuals. For such diseases, it may be more appropriate to calculate the 'clinical attack rate' (which provides the proportion of infected individuals who develop disease symptoms). In epidemiological studies, these individuals may be included in the attack rate calculation through the detection of seroconversion.
B	**Basic reproduction number**	The basic reproduction number (R_0) is defined as the average number of secondary cases caused by a single infectious individual in a totally susceptible population.	If R_0 is less than one, then the disease can be contained; however, if R_0 is larger than one, then the disease is expected to cause an epidemic. There is much debate over the applicability and accuracy of the R_0 that is based on the use of different mathematical and estimation methods.
C	**Control**	Control relates to the strategies implemented to reduce the magnitude, spread, and progression of a disease in a population.	Vaccination and treatment are examples of disease control strategies.
D	**Disease**	A term used in epidemiology and modelling to describe a physiological failure.	The duration of a disease often coincides with the full recovery of an individual. Furthermore, a disease may cause an illness (defined below).
E	**Elimination**	The term 'elimination' refers to the absence of a disease in a time period or geographic region.	A disease must be eliminated before it can be considered for eradication. A disease that has been eliminated may reappear over time.
	Eradication	Eradication refers to the elimination of a disease which can no longer reappear.	Although a reproduction number (defined below) in disease models is used to indicate the threshold of disease eradication theoretically, this threshold does not necessarily correspond to eradication epidemiologically. A more appropriate use of this term would be to control or eliminate the disease.
	Exposed	The term 'exposed' is used when an individual has encountered a disease causative pathogen. This is necessary for infection or transmission to take place. However, it is not necessarily the case that infection or transmission occurs.	The term 'exposed' does not correspond to 'infected' and should be avoided when modelling diseases. An alternative term to be used in mathematical models is 'latent' (see below).
G	**Generation time**	Generation time is a modelling term describing the time duration from the onset of infectiousness in a primary case to the onset of infectiousness in a secondary case infected by the primary case.	The generation time is a non-observable period which, depending on the disease, may be described by the term 'serial interval.' See 'serial interval' (defined below).

	Term	Description	Comment
I	**Illness**	Illness is a subjective representation of a disease.	It is not advisable to use the term 'illness' or illness related parameters in modelling, as illness is not related to a stage of infectiousness. Furthermore, an illness may be caused by a disease, a mood, beliefs, fears, culture, etc.
	Immunity	Immunity refers to an individual's resistance to infection or re-infection by a causative pathogen.	There are various types of immunity (e.g., naturally acquired or vaccine-induced). Some modellers may not classify the type of immunity, as it relates to an individual's immune system. However, there exist various ways of acquiring immunity, such as 'natural immunity' (immunity conferred by a pathogen), or by other means, such as immunity conferred by a vaccine or maternal antibodies.
	Incidence	Incidence refers to the number of new cases of a disease over a period of time.	In continuous time disease transmission models, the definition of 'incidence' becomes an issue where the incidence is measured at a single time point. Here, it has been suggested that the term 'instantaneous incidence' be used instead.
	Incubation period	The incubation period represents the time period between the occurrence of infection (or transmission) and the onset of disease symptoms.	The incubation period may be the same as the latent period (defined below) if the onset of symptoms is the same as the onset of infectiousness.
	Infected	The term 'infected' refers to an individual who has contracted a disease causative agent and infection (or transmission) has occurred.	An infected individual is not necessarily infectious or capable of transmitting the infection. If it is the intention that infected individuals are considered to be infectious, it should be explicitly stated in the model.
	Infectious	Individuals who are infected and can transmit a pathogen (the cause of an infection) to other individuals.	An infectious individual may not show symptoms (see 'asymptomatic' defined above).
L	**Latent period**	The latent period is defined as the period of time between the occurrence of infection and the onset of infectiousness (when the infected individual becomes infectious).	Individuals in this stage of the disease are said to be infected but not infectious. It has been suggested that the term 'latent period' be substituted for the term 'exposed' in infectious disease models.
P	**Pre-clinical**	The period of time before a diagnostic test is able to detect the presence of disease.	Individuals in the pre-clinical stage may be infectious.
	Pre-symptomatic	A disease stage in which the individual exhibits no symptoms, but is infectious and can transmit the disease.	A disease may be pre-symptomatic and clinical, meaning that it will result in a positive diagnostic test and histopathological changes, however, it shows no symptoms.
	Prevalence	Prevalence is defined as the number of cases of a disease at a specific time point.	In models, the prevalence is the number of infected individuals at any time.

	Term	Description	Comment
P	**Prevention**	The term 'prevention' refers to the lack of disease occurrence despite exposure to, or transmission of a causative disease agent.	Disease prevention strategies may be considered as a subset of disease control strategies (see the definition above).
	Prophylaxis	Prophylaxis refers to a strategy taken to prevent a disease.	There are different types of prophylaxis. These include pre-exposure and post-exposure. Most vaccines are given pre-exposure to increase their effectiveness. Furthermore, the effects of drugs being used as prophylaxis may vary based on the time the drug is administered relative to exposure to the disease.
R	**Recovered**	Recovery refers to a transitional stage from the infectious state to another non-infectious state.	Models generally assume that a recovered individual is not infectious. It should be noted that non-infectious individuals are not necessarily pathogen free.
S	**Serial interval**	Serial interval describes the duration of time between the onset of symptoms in a primary case and the onset of symptoms in a secondary case infected by the primary case.	The serial interval, an observational period of a disease, may be the same as the generation time if the onset of symptoms is the same as the onset of infectiousness.
V	**Vaccine effectiveness**	Vaccine effectiveness measures the effect of a vaccine to prevent disease spread in a population.	Vaccine effectiveness should be used when discussing the protective effects of a vaccine in a population level disease transmission model.
	Vaccine efficacy	Vaccine efficacy refers to the percentage reduction in the attack rate of unvaccinated and vaccinated cohorts as observed in a randomized control trial.	Efficacy studies may be used to measure the safety and tolerability of a vaccine. These studies may also be used to measure the vaccine's ability to protect against infection and clinical outcomes.

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Helping public health practitioners find, understand, and use infectious disease research and evidence.