Analysis of the evidence of transmission dynamics of COVID-19

Protocol for a scoping evidence review

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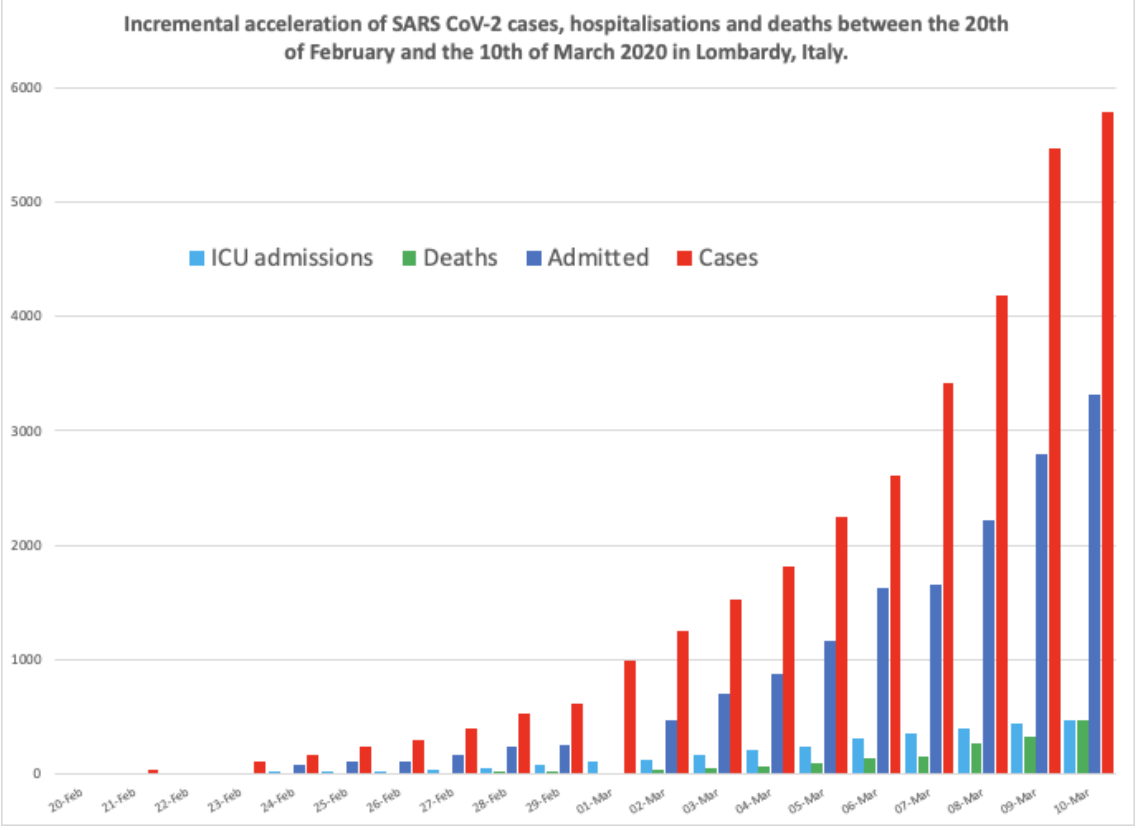
Introduction

In the midst of the COVID-19 pandemic, uncertainty on the characteristics of a novel disease reigns. One of the most important aspects of these uncertainties regard the mode and circumstances of transmission of this newly identified agent.

The table shows the incremental acceleration of SARS CoV-2 cases, hospitalisations and deaths between the 20th of February and the 10th of March 2020 in Lombardy, mainly the provinces of Lodi and Bergamo. These were thought to be the first cases of SARS-CoV 2 in Europe.



The explosive nature of the transmission, initially shown by the number of new cases and later by admissions and deaths, remains unexplained. The age distribution and the speed of transmission does not fit with what is known of “seasonal” coronaviridae (HCoV-OC43, -229E, -NL63 and -HKU1) [1]

Such uncertainties prevent a rational response to the threat and promote extreme actions such as total lockdown of whole countries. This is an economically unsustainable strategy.

One of the principal uncertainties regards the means by which COVID-19 is transmitted, with special regard to the factors which may accelerate or delay its spread, the mode of transmission, the role of asymptomatic infected people, its speed, the possible interactions with wildlife or livestock, urban or rural environments and population density.

Given its novelty, early reliance on models of spread is based on what is known of the dynamics of other respiratory infections especially influenza. We now know these are inapplicable to COVID-19.

The first part of the project will consist of a search of the evidence and description with tabulation of the findings. Again, given the novelty, dynamic theories are likely to be the most frequent studies.

In the second phase, as more information becomes available, it may be possible to either define a mode of transmission or to set out a series of hypotheses to be tested by further work.

Because of the public health importance of this work and its evolving nature, we will publish this protocol on line and post extractions and summaries of included studies with brief comments. Our searches will be updated once a month and the results posted.

Objectives

Methods

An initial search was undertaken using LitCovid, medRxiv and Google Scholar for the search 'Covid-19 and transmission dynamics' with results returned by relevance. Results reviewing was stopped when no new positive results were returned in 40 hits. Articles were then title screened for inclusion and exclusion. When ambiguous results were identified, we read the abstract.

Early key transmission dynamic articles, identified in the initial search, were then used to explore forward citations i.e. which newer papers have cited these key papers. Searches will be updated each month

We divided the studies into two broad categories: 1) observational ecological studies and 2) modelling studies.

1. Observational studies where the likely mode of transmission and the ecological variables influencing the mode of viral transmission were studied with special focus on cases and deaths reported as COVID related deaths. We preliminarily defined these as:

   Mode of transmission:
   1.1 Droplet borne
   1.2 Contact borne
   1.3 Pollutant borne
   1.4 Oro-fecal

In our preliminary searches we could find no evidence on vector activity so we decided to put this on hold for now.

We further defined the following variables which may influence transmission:

- Settings - defined as in the review by Leclerc et al. [2]
- Density
- Meteorological variables
- Latitude and other geographical variables including sunlight

We will not restrict inclusion by study design, but we will include only studies using descriptive and ecological methods to identify the variables and test their relationship with each other and with incidence of cases and

deaths. For background and informative reasons, we will include studies reporting on non-COVID-19 coronaviridae.

2. We will only include modelling studies where the original data relates to transmission outcomes and not to modelled outcomes. We will hand search the references of these studies.

We will exclude studies of transmission dynamics of non coronaviridae. For each study we will extract publication data and the variables listed in the extraction sheet and produce both a set of notes for internal use and a plain language summary for public consumption. We will summarize the methods, the findings and the main limitations. We will report any assumptions and simplifications made during the data extraction process.

We will base our evaluation of quality on five criteria: (1) a clearly defined setting; (2) demographic characteristics described and testing procedures; 3) follow-up length sufficient for the outcomes (4) the transmission outcomes assessment was defined, and (5) main biases that are threats to the validity. We piloted the extraction and piloting criteria before finalising them.

We will summarise data narratively by mode of transmission or by defined variables which may influence transmission and report the outcomes as stated in the paper. Where feasible we will summarise the range of outcomes. We will provide a table of research implications (from each paper we will extract the information on research priorities); and where relevant, we will report implications for policy and practice.

Continual data release

To support transparency, rapid flow of information through the scientific community, and scientific debate, we aim to publish on the CEBM website (cebm.net),[2] summary descriptions of important relevant research papers identified during this review. Where we consider there are important policy implications we will summarise these as we progress the review. This process will be ongoing during the data acquisition and write-up of the review. We will report the scoping review according to the PRISMA statement on reporting scoping reviews. [3] We will index the review findings on the Oxford Research Archive.

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References

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Annex a – Data extraction sheet

Table. Definitions used for each of our transmission setting types (after Leclerc[2])	
Bar	Indoor space such as a bar, club, pub, small live music venues etc.
Building site	Indoor or outdoor space where construction work takes place.
Conference	Indoor professional event with many people interacting and meeting, shaking hands, eating together, team activities, etc.
Elderly Care	Care homes for the elderly; includes staff and residents. Transmission can occur between staff and residents but also from visitors.
Funeral	Indoor or outdoor burial ceremony; includes close contact with others such as hugging, shaking hands, eating together, singing, praying, etc
Hospital	Any transmission that occurs within a hospital between patients and/or staff, in a COVID19 ward or not.
Hotel	Any transmission that occurs within the hotel e.g. hotel rooms, shared spaces, reception desk, etc
Household	Transmission between individuals in a shared living space
Meal	When people eat together. Meals included took place in restaurants, hotels, cafes, home, etc. Transmission occurs over a meal by speaking, sharing foods, touching the same surfaces, etc.
Public	Where transmission occurs on public property and does not fall into any of the other settings e.g. park, welfare centre, foodbank, etc
Religious	Transmission occurs at a religious event such as mass, services, prayer time, choir practice, etc.
School	Childcare or learning environments (schools, nurseries, kindergartens etc). Includes staff and children
Ship	Any ship at sea. Includes crew and/or passengers on board
Shipyard	Large indoor or outdoor space where ships are made or repaired. Includes those working on the ship as well as customers
Shopping	A shop or shopping centre. Includes customers and those working in the shop.
Sport	Participation in a sporting activity indoor or outdoor e.g. gym or running.
Work	In the workplace, typically an office.
Worker dormitories	A shared living space for workers.