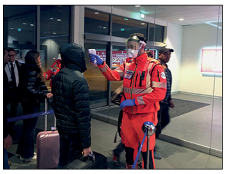
The value of early transmission dynamic studies in emerging infectious diseases



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The world is braced for a public health emergency of international concern caused by a novel emerging infectious disease, a coronavirus with similarities to severe acute respiratory syndrome coronavirus (SARS-CoV). Person-to-person transmission of SARS-CoV-2, the causative agent of coronavirus disease 2019 (COVID-19), started in December, 2019, in Wuhan, China and has spread to become a global pandemic, with, as of Feb 26, 2020, community transmission in Italy, Iran, and South Korea.

Modelling studies have aided understanding of COVID-19 dynamics from the first announcement of the epidemic and publication of the genetic sequence of the causative virus. Initial phylogenetic analysis of closely related viruses suggested highly linked person-to-person spread of SARS-CoV-2 originating from mid-November to early December, 2019.[1,2] Following this, modellers provided simple calculations that identified a mismatch between reported cases in China and reported importations of cases from travellers. Based on travel volumes, modellers inferred[3] that cases in Wuhan were underestimated by a factor of 40—a crucially important finding. Further calculations, again based on travel volumes, suggested that some countries would be expected to have many more travel-related cases than had been notified,[4] drawing attention to the possibility of undetected cases and community transmission in several countries.

Transmission dynamic models are a necessary first step in understanding the pandemic potential of an emerging infectious disease, including estimating the reproduction number—the number of new cases arising from a typical infected case. The first published transmission dynamic study of COVID-19 was rapid and uncomplicated, estimating the basic reproduction number as time-invariant[5] without exploring some of the major underlying assumptions, such as lack of infectiousness during the incubation period. Since this early publication, many estimates for the reproduction rate have appeared, ranging from around 2 to more than 6.[6]

In *The Lancet Infectious Diseases*, the study by Adam Kucharski and colleagues[7] addresses many of the assumptions of earlier works. The report contributes a time-varying reproduction number, showing the effect of the massive public health interventions put in place by China from Jan 23, 2020. By using additional datasets of travel-related exported cases, Kucharski and colleagues do not rely entirely on notified cases in Wuhan, which are likely to bias estimates caused by changes in case detection over time. The authors show that the reproduction number fell almost to the threshold value of 1 during the unprecedented public health restrictions in China.[7]

Kucharski and colleagues[7] suggest that chains of transmission might not take off initially and might require up to four imported cases to establish transmission. This estimate assumes that SARS-CoV-2 has heterogeneity of infectiousness similar to SARS, which was characterised by a number of super-spreaders with most cases infecting no other people. If SARS-CoV-2 has a more homogenous infectiousness profile (to which emerging evidence is pointing) in which most people infect two to three others, the risk of established local transmission with a single imported case is considerably higher.

This study answers—at least in one location over a restricted time—a critical question regarding this emerging pandemic, its reproduction number.[7] This crucial number began at 2·35 and declined to 1·05 over the course of December, 2019, and January, 2020. Many questions remain unanswered and should be addressed with urgency, including the infectiousness of cases over the duration of their illness—particularly how much transmission could occur from people who are unaware that they have illness, including asymptomatic and mildly symptomatic people. Initial reports suggest that live virus can be recovered from asymptomatic or mildly symptomatic people,[3] which is of great concern as it will make disease much harder to detect and therefore control. However, what contribution such people make to the overall epidemic is unknown. Additionally, the infection severity, including the infection-fatality rate across different ages and risk groups, must be established. Early reports provide estimates of case fatality of 2·3% within China.[8] However, it is notoriously difficult to make such estimates early in an outbreak,[9] and it is clear that not all infections become cases and studies of many tiers of severity (deaths measured as a proportion of hospitalisations, notified cases and syndromic surveillance, and even potentially serosurveillance testing when available) will be needed to establish infection-fatality rates.

Ongoing modelling and surveillance should continue at the epicentre of the pandemic in mainland China to assess the effect of public health measures. However, attention must also move to the emerging foci outside of China, including Italy, Iran, and South Korea, to determine if the reproduction ratio might vary in different climates and sociological contexts. New foci of infection across different continents change the risk to global communities, as this coronavirus becomes a pandemic.

I declare no competing interests.

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Management of pregnant women infected with COVID-19

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Since December, 2019, the outbreak of coronavirus disease 2019 (COVID-19), which originated in Wuhan, China, has become a global public health threat.[1] On Feb 28, 2020, WHO upgraded their assessment of the risk of spread and the risk of impact of COVID-19 to very high at global level. By March 10, 2020, 116 166 cases have been reported globally, causing 4088 deaths. The epidemic has spread to 118 countries around the world.[2]

With immunocompromised status and physiological adaptive changes during pregnancy, pregnant women could be more susceptible to COVID-19 infection than the general population. As COVID-19 is rapidly spreading, maternal management and fetal safety become a major concern, but there is scarce information of assessment and management of pregnant women infected with COVID-19, and the potential risk of vertical transmission is unclear. In *The Lancet Infectious Diseases*, Nan Yu and colleagues[3] report the clinical features and obstetric and neonatal outcomes of pregnancy with COVID-19 pneumonia in Wuhan, China. Seven pregnant women with COVID-19 pneumonia were assessed and the onset symptoms were similar to those reported in non-pregnant adults with COVID-19. All patients received oxygen therapy and antiviral treatment in isolation. All patients had caesarean section after consultation with a multidisciplinary team and the outcomes of the pregnant women and neonates were good. Three neonates were tested for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and one was found to be infected with COVID-19 36 h after birth. The findings of the study provide some indications for clinical assessment and management of pregnant women with COVID-19, but questions remain on how to manage pregnant women infected with COVID-19.

As Yu and colleagues[3] reported, five pregnant women were treated with steroids after caesarean section. Two were also treated with traditional Chinese medicine. However, no reliable evidence recommends any specific COVID-19 treatment for pregnant women. WHO guidance and some clinical evidence does not recommend the use of corticosteroids for COVID-19.[4,5]