Measures of frequency: calculating prevalence and incidence in the era of COVID-19

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PRACTICAL SCENARIO

Coronavirus disease 2019 (COVID-19), caused by the coronavirus designated SARS-CoV-2, has become a pandemic despite global efforts to prevent its spread. The first confirmed case of COVID-19 in Brazil was reported on February 26 of 2020. Until May 11 of 2020, a total of 168,331 Brazilians had a confirmed diagnosis of COVID-19, of whom 89,429 (53.1%) were still infected, 67,384 (40%) had been cured, and 11,519 (6.8%) had died. The number of new cases on May 11th was 5,632, and the reported incidence was 80.1/100.000 population.[1]

MEASURES OF MORBIDITY AND MORTALITY OF COVID-19

Counting mild-to-severe and asymptomatic cases of COVID-19 is essential to describe and interpret local epidemic responses. In this scenario, repeated estimates of prevalence and incidence inform trajectory trends of the disease and guide the decision-making process related to control measures and resource allocation.[2]

Prevalence is defined as the proportion of a population who has the disease at one time point (Table 1). Cross-sectional studies are commonly used in order to conduct prevalence studies because they examine the disease at one particular time point. The prevalence of confirmed COVID-19 cases on May 11th was 0.08%, estimated as the number of cases of COVID-19 on that day divided by the population at risk (the Brazilian population).[1] Because measures of prevalence include both new and existing cases, they do not provide a complete picture of the natural history of the disease. In addition, the calculation of COVID-19 prevalence in Brazil on May 11th might not be accurate, because the data reported by the Brazilian Ministry of Health did not include extensive testing for SARS-CoV-2 across the full spectrum of the disease severity; therefore, the number of reported cases were likely to represent the more severe ones (because most tests were performed in symptomatic individuals and not in the general population) and, as a consequence, underestimating the actual disease prevalence.

Incidence is a measure of the occurrence of new cases during a specified period in a population at risk for the disease. Prevalence focuses on new and existing cases of the disease, whereas incidence focuses only on new cases (Table 1). To estimate incidence, all individuals in the denominator (population at risk) must have the potential to be in the numerator (those who develop the disease). Estimates of incidence require longitudinal follow-up (e.g., hours, days, or years). The study design of choice is cohort studies involving individuals at risk but without the disease at baseline who are followed through time and are evaluated if they develop the disease. Finally, the incidence also depends on the frequency of the disease, the definition of cases, and the population at risk. In the Brazilian scenario, the incidence of confirmed cases of COVID-19 on May 11th was 2.7/100,000 population at risk (Table 1).

KEY POINTS TO INTERPRET PREVALENCE AND INCIDENCE ESTIMATES

1. Accurate definitions of cases and noncases are critical to defining prevalence and incidence.
2. Both prevalence and incidence estimates can be misleading if the number of cases is underestimated due to barriers in accessing information regarding diagnosis and health care practices or if only patients with severe disease are submitted to diagnostic tests.
3. The timing of the estimates of prevalence and incidence must be taken into account when interpreting these measures. For example, the estimates might be lower in the beginning of an outbreak when compared with the epidemic later.

Table 1. Incidence and prevalence of COVID-19 on May 11 of 2020 in Brazil.[1]

Measure	Definition	How to calculate	Equation	Result
Prevalence	Existing cases of a disease at a point in time divided by the population at risk of having the disease	Cases of COVID-19 on May 11th ÷ Population at risk	168,331 ÷ 210 mi	0.08%
Incidence	New cases of a disease in a defined population over a period of time (a day, for example) divided by the population at risk	New cases of COVID-19 within a day ÷ Population at risk on May 11th[a]	5,632 ÷ 209,837,301	2.7/100,000

mi: million (Brazilian population). [a]Brazilian population minus the total number of confirmed cases on May 11th.

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