Lies, damned lies, and statistics

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The way we understand the causes and patterns of COVID has been stirred by a chaos of statistics. As an epidemiologist, here are three takeaways that I believe we must communicate, at least for vaccine-preventable diseases.

Firstly, what is vaccine effectiveness? For the sake of the argument, let's say our aim is to prevent COVID-19 hospitalisations. Next, let's look at Vaccine A.

Vaccine A has an effectiveness of 93%, which means that the incidence (new cases per population per time) of hospitalisations would be 93% lower if our population is vaccinated. However, it does not mean that 7% of the people will be hospitalised.

Let's assume three things. a) a population of 1,000,000, b) an incidence of 600 cases per 100k per week, and c) 10% of cases are hospitalised.

If people are not vaccinated, we would expect 60 people hospitalised per week per every 100k (10% of cases). But, in our vaccinated population, a 93% vaccine effectiveness would mean that instead of 60 people hospitalised per week, we would observe 4 (60*93%), or 0.004% (4/100,000*100).

Only four people would be hospitalised instead of 60.

Secondly, should people receive a "booster" vaccination? Waning immunity over time is a recurrent hot topic.

Let's get back to Vaccine A, and let's assume that the 93% effectiveness would be 83% in 6 months — a fictitious number for the sake of this argument. Decreasing 10 percentage points means the vaccine is less effective. Correct. But what does this mean when we look at the number of hospitalisations?

With an 83% vaccine effectiveness, we would observe 10 hospitalisations instead of 60 without vaccination, which is still remarkably better than no vaccination. However, if we administer a booster, we are using more doses of the vaccine, all while a large majority of other countries have vaccinated less than 20% of their populations. So in this case, we need to ask ourselves: should we issue boosters, or work to vaccinate other countries?

A ten-point effectiveness reduction sounds alarming, but the statistics show us that these vaccines could be better used by another country. Preventing high infection rates in other countries reduces the possibility of new variants.

Thirdly, can we expect many vaccinated people to get COVID-19? Does this number increase as more people get vaccinated? It has been publicly announced, for example, that 90% of COVID cases were among unvaccinated individuals, and this statistic will undoubtedly give people hope. But what of increased cases among vaccinated people?

Let's assume 600 COVID cases per 100,000 people. Of these 100k, 80% (80,000 people) are vaccinated. From the 600 COVID cases, 30% are vaccinated (180 of the 600 cases) — alarming, right? However, the weekly incidence per 100k vaccinated is 225 [(180/80,000)*100,000], whereas the weekly incidence per 100k unvaccinated is 2,100 [(420/20,000)*100,000].

The incidence is ten times higher for the unvaccinated population. Vaccination protects.

Applying simple statistical concepts to public health communication might help explain science and help us to better understand the COVID-19 pandemic. Mark Twain was right; statistics are tricky, 'but it is undoubtedly easier to lie without them.'