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## Estimation of the COVID-19 burden in Egypt through exported case detection

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In December, coronavirus disease 2019 (COVID-19) emerged in Wuhan, China, causing a pandemic that continues to spread globally.<sup>1</sup> 86 countries have reported cases.<sup>2</sup> As of March 6, 2020, Egypt has reported three cases of COVID-19; however, at least 14 cases have been exported from Egypt to four countries.<sup>3</sup> The burden of infection in Egypt, therefore, might be substantially larger than reported. We estimated the potential burden of COVID-19 in Egypt using the approach of Fraser and colleagues.<sup>4</sup>



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We investigated two scenarios: (1) all exported cases, considered to be independent ( $n=14$ ); and (2) all exported cases minus travellers who had visited multiple countries and possibly linked cases ( $n=5$ ). In the second scenario, linked cases included six cases exported to France, all of whom appeared to be from the same tour group and so were counted as a single case. Similarly, the two exported cases to the USA, a husband and wife, were counted as a single case, and five cases exported to Canada were counted as three cases because two cases were linked to a third case. One exported case to Taiwan also travelled to the United Arab Emirates, where COVID-19 has been reported, and so was not counted in the second scenario.

We used travel data from the International Air Transport Association, which accounts for over 90% of the world's travel flights and traveller volumes. In February, 2019, 829 370 international air travellers departed from Egypt. The four countries reporting exported cases were ranked eighth (USA), 13th (France), 31st (Canada), and 40th (Taiwan) for travel volumes and together accounted for 5.1% of outbound air travellers from Egypt. We

used data from the UN World Tourism Organization on the average length of stay in Egypt by tourists (11.6 days) and proportion of air travellers who are tourists rather than residents of Egypt (61%) and assumed that COVID-19 had been transmitting in Egypt from Feb 6 to March 6, 2020. Residents were assumed to have a 1-month exposure period. Under the conservative estimate of the COVID-19 burden, in which linked and ambiguous cases were eliminated (ie, scenario 2), we estimated an outbreak size of 19 310 cases (95% CI 6270–45 070) in Egypt. Using all cases, regardless of possible non-independence, we obtained a higher estimate of 51 520 cases (28 170–86 440), but given reports that several Nile tour operators have COVID-19 infections, these values might overestimate the burden in Egypt if tourists are preferentially affected and exporting cases. Given this observation, we estimate that the true value is probably closer to the lower end of the CI in the conservative estimate, and probably near 6000 cases.

Egypt probably has a large burden of COVID-19 cases that are unreported, and increased clinical capacity for public health might help identify and manage cases. Using the lower bound of our more conservative estimate, this estimate would still represent a substantially greater number of cases than has been officially reported in the country. Additionally, Egypt might be a source of COVID-19 exportation that is not yet accounted for by many public health initiatives.

KK is the founder and CEO of BlueDot, a social benefit company that tracks emerging infectious diseases. IIB has consulted to BlueDot. All other authors declare no competing interests.

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- 4 Fraser C, Donnelly CA, Cauchemez S, et al. Pandemic potential of a strain of influenza A (H1N1): early findings. *Science* 2009; **324**: 1557–61.

## Estimation of COVID-19 burden in Egypt

To estimate the burden of coronavirus disease 2019 (COVID-19) in Egypt, Ashleigh R Tuite and colleagues<sup>1</sup> used the same model of exported case detection used by Fraser and colleagues for the H1N1 outbreak in Mexico.<sup>2</sup> However, Tuite and colleagues neither clarified nor verified the assumptions of this exported case-detection model. First, the authors used data from the UN World Tourism Organization (UNWTO) on the average length of stay in Egypt by tourists (11.6 days), which is not accurate for the following reasons: we contacted UNWTO to verify the most recent estimates, and the average length of stay by tourists in Egypt was 11.6 days in 2018, 7.78 days in 2017, 6.1 days in 2016, 9 days in 2015, and 10 days in 2014, with no estimates available for February, 2020; the UNWTO estimates combine the length of stays of domestic and international tourists, including visitors from several countries other than the USA, Canada, France, and Taiwan; and for Egypt, a country with rapid changes in the political,

	Date	Travel history	Total number of confirmed COVID-19 cases until Feb 6, 2020
USA	Jan 20, 2020	Returned from Wuhan, China	12
Canada	Jan 27, 2020	Returned from Wuhan, China	5
France	Jan 24, 2020	Returned from China	6
Taiwan	Jan 21, 2020	Returned from China	13
Total	..	..	36

COVID-19=coronavirus disease 2019.

**Table:** Date and travel history of the first confirmed COVID-19 case in the USA, Canada, France, and Taiwan

economic, and tourism fields, it would be inaccurate to confidently consider these incomplete statistical data for the present model of February, 2020. Second, Tuite and colleagues' model assumes that the population mixing in Egypt is equally likely between Egyptian residents and tourists and that tourists and Egyptian residents are at equal risk of infection, which is not correct for the following reasons: Egyptian population demographics are different from those of the USA, Canada, France, and Taiwan, particularly regarding life expectancy and population age groups, a well known risk factor for symptomatic COVID-19 infections; and Egypt is an agricultural country, with tourism destinations in Egypt, as reported on the official website of the ministry of tourism, being related to either Ancient Egypt or the coastal areas.<sup>3</sup> Most tourism destinations are in special locations far away from residential places and have low population densities. Therefore, we cannot assume that population mixing in Egypt is equally likely between Egyptian residents and tourists because several high-density residential cities do not have tourists.

Third, Tuite and colleagues' model focused on 1 month, from Feb 6 to March 6, 2020. By Feb 6, the four countries (USA, Canada, France, and Taiwan) had officially reported a total of 36 confirmed COVID-19 cases (table). Therefore, we cannot rule out the opposite possibility that some of

these COVID-19 cases were infected before arriving in Egypt. What makes this scenario possible is that Egyptian authorities applied COVID-19 airport screening for travellers from China alone but not from other countries, owing to insufficient resources (as reported by the WHO office in Egypt). Another observation is that most of the early confirmed Egyptian cases were reported in Luxor and Aswan, two major tourism destinations in Egypt.

On the basis of these points, I argue that Tuite and colleagues' model is not accurate and might not be suitable to estimate the burden of COVID-19 in Egypt. Besides, we cannot rule out the possibility that COVID-19 cases in Egypt were imported from other countries.

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- 1 Tuite AR, Ng V, Rees E, et al. Estimation of the COVID-19 burden in Egypt through exported case detection. *Lancet Infect Dis* 2020; published online March 26. [https://doi.org/10.1016/S1473-3099\(20\)30233-4](https://doi.org/10.1016/S1473-3099(20)30233-4).
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- 3 Egyptian Tourism Authority. This is Egypt. 2020. <http://www.egypt.travel> (accessed March 27, 2020).

I read with interest the Correspondence by Ashleigh Tuite and colleagues,<sup>1</sup> and I respectfully disagree with the methods used by the authors and their conclusion.

Tuite and colleagues stated that they estimated the potential burden of coronavirus disease 2019 (COVID-19) in Egypt using the approach of Fraser and colleagues.<sup>2</sup> This approach was applicable to a scenario where abundant data were obtained from an epicentre of the H1N1 epidemic in Mexico in 2009, an approach that was disease and context specific. Although both viruses cause respiratory diseases and spread by contact and nose droplets, influenza has a shorter median incubation period than does severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Also, by contrast with influenza transmission, initial data for COVID-19 indicate that children are less affected than adults and that clinical attack rates in the 0–19 years age group are low. Fraser and colleagues used detailed H1N1 incidence data; by May 4, 2009, 11 356 suspected and 822 laboratory-confirmed cases had been reported in Mexico.<sup>2–4</sup> By contrast, Tuite and colleagues based their conclusion on three reported cases in Egypt by March 6.<sup>1</sup> The scarcity of data available to the authors, as stated in their Correspondence, does not allow for the use of an appropriate modelling technique to estimate the burden of an epidemic.

Alternatively, Tuite and colleagues should have considered potential reasons for the low number of COVID-19 cases in Egypt, such as the considerable effort the Egyptian government has made to effectively control the outbreak. On March 25, a team of experts from WHO concluded a COVID-19 technical mission in Egypt. Yvan Hutin, director for communicable diseases in WHO's regional office and mission team lead, stated that "after several days of intensive meetings and field visits both inside and outside Cairo, we see that Egypt is making substantial efforts to control COVID-19



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