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outbreak. Significant work is being done, especially in the areas of early detection, laboratory testing, isolation, contact tracing and referral of patients." Hutin referred to the existing pattern of transmission as local rather than community and agreed with local authorities on additional measures to further slowdown COVID-19 spread.⁵ The report listed the various steps that have been made by the Egyptian Government—namely, allocating additional dedicated human and financial resources needed to contain the outbreak, expanding the number of peripheral laboratories that are able to test for SARS-CoV-2, and with support from WHO and other partners, increasing testing capacity (Egypt now has the capacity to do up to 200 000 tests).⁵ The report also commended Egypt's strong disease surveillance system and contact-tracing efforts as the main reasons behind the successful management of sporadic and clusters of cases before they spread.⁵

Another potential explanation for the low number of COVID-19 cases in Egypt is the mandatory—and free of charge—vaccination against tuberculosis with the BCG vaccine. The immune response-boosting effect of this vaccine has been postulated to potentially protect against SARS-CoV-2 infection, given that it has been shown to be effective against similar viruses. In March, a multicentre, phase 3, randomised clinical trial in Australia endorsed by WHO was fast tracked to investigate whether the BCG vaccine can protect against SARS-CoV-2.⁶ This trial aims to enrol 4000 health-care workers from hospitals in Australia in the next few weeks and should allow assessment of whether BCG vaccine can lessen the severity of COVID-19 symptoms.⁶

Finally, evolving data continue to support the slow spread of COVID-19 in Egypt. As of April 21, 2020, WHO estimates are of 3333 diagnosed cases in Egypt.⁷ These estimates continue to be carefully monitored, together with efforts taken to continue to slow down the spread of the disease.

I declare no competing interests.

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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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We read with interest the Correspondence by Ashleigh Tuite and colleagues.¹ We thank them for their interest in estimating the coronavirus disease 2019 (COVID-19) burden in Egypt. However, their model-based calculations used the number of patients known on March 6, and the numbers of patients and deaths are continuously changing. Attempting to reach a more up-to-date estimate

of the expected number of patients in Egypt, we used other assumptions according to real-life data.

The rapid spread of COVID-19, which started in China, led to its characterisation as a pandemic by WHO on March 11.² On Feb 14, Egypt announced its first COVID-19 case.³ Thereafter, Egypt scaled up preventive measures, with a partial lockdown starting on March 25. RT-PCR was done in nasopharyngeal swabs from symptomatic patients and contacts of confirmed cases traced in the preceding 2 weeks. In patients with a high rate of suspicion, the test was repeated after 48 h. Screening at airports included body temperature and clinical assessment and the use of a rapid diagnostic test for anti-severe acute respiratory syndrome coronavirus 2 IgM and IgG. Deaths from influenza-like illness were also reviewed.

As of March 31, Egypt announced 710 COVID-19 cases and 46 related deaths (fatality rate 6.48%, 95% CI 4.78–8.55).⁴ We acknowledge that, in the absence of open screening, this could be an underestimation of the total number of patients and an overestimation of the fatality rate. To estimate the expected disease burden in Egypt, we used fatality rates in the USA and Germany, because they applied open screening, and in regional countries with conditions similar to those of Egypt (Algeria, Bahrain, Iran, Israel, Jordan, Saudi Arabia, Lebanon, Morocco, Palestine, Qatar, Tunisia, Turkey, and United Arab Emirates). On



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	Number of patients with confirmed COVID-19*	Number of deaths related to COVID-19*	Fatality rate, % (95% CI)	Expected number of patients with COVID-19 in Egypt (95% CI)
Egypt	710	46	6.48% (4.78–8.55)	..
Germany	71 690	774	1.08% (1.01–1.16)	4261 (3377–5241)
USA	185 159	3773	2.04% (1.97–2.10)	2257 (1720–2886)
USA and Germany	256 849	4547	1.77% (1.72–1.82)	2598 (1974–3331)
Region†	68 936	3281	4.76% (4.60–4.92)	966 (738–1233)
Global	854 013	42 006	4.92% (4.87–4.96)	935 (697–1222)

COVID-19=coronavirus disease 2019. *As of March 31, 2020. †Includes Algeria, Bahrain, Iran, Israel, Jordan, Saudi Arabia, Lebanon, Morocco, Palestine, Qatar, Tunisia, Turkey, and the United Arab Emirates.

Table: Estimated number of patients with COVID-19 in Egypt

the basis of WHO's report on March 31,⁴ the fatality rate of all reported countries ranged from 0.7% to 11.8%. We deduced a factor by dividing our fatality rate by the global rate and those of the listed countries. This factor was then multiplied by our number of identified cases to estimate the expected total number (table).

In conclusion, the expected total number of patients with COVID-19 in Egypt, as of March 31, could be in the range of 710–5241 patients. Notably, the exclusion of patients who have not acquired the infection from the reporting country could have decreased these numbers. Additionally, the listed countries do not share the same curves of spread or deaths, stages of the epidemic, or steps of interventions.

We declare no competing interests. HZ is the Minister of Health and Population of Egypt. MH and WA-R contributed equally.

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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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The foundation of any estimation process is the use of independent unbiased samples. However, when

attempting to estimate Egypt's burden of coronavirus disease 2019 (COVID-19) by studying exported cases, Ashleigh Tuite and colleagues¹ established neither independence nor absence of bias for the cases used in their study. This approach is especially problematic in the light of widespread news of a tourist cruise ship in Egypt exporting COVID-19 across the world through hundreds of tourists who were onboard during the timeframe used by Tuite and colleagues in their Correspondence.

Regarding sample independence, the authors used two scenarios to estimate the number of COVID-19 cases in Egypt: one with 14 cases and another assuming dependence between some of these cases and hence reducing the number of cases used to five. For the more conservative scenario, Tuite and colleagues estimated Egypt to have 19 310 cases (95% CI 6270–45 070) at the time. However, they acknowledged the cruise ship situation and revised their estimate to “near 6000 cases”. However, no analytical basis for this revision was given. For example, if all five cases considered were related to the cruise ship, this would amount to one single case and lead to a different model with a different estimate and different error margins.

Regarding sample bias, if all cases in Tuite and colleagues' analysis were indeed related to the cruise ship, then the sample used would be very biased and thus invalid. Egypt has US\$2549 of GDP per capita. Therefore, most Egyptians do not have the disposable income to spend on an upscale Nile cruise. Finally, Tuite and colleagues' most conservative estimate is close to 6000 cases by the end of their analysis (March 6, 2020). From March 6 to the date of publication (March 26), 20 days passed. COVID-19's case-count growth rate has been roughly doubling every 3 days in many countries that have lower population density and are more developed than Egypt.² Assuming that the number of cases grows at the same rate of doubling

every 3 days, Egypt would have had about 640 000 cases by March 26, a time when the whole world had just 593 300 cases reported.³ That is an extraordinary claim. Extraordinary claims require extraordinary proofs, which I could not find in the analysis by Tuite and colleagues.

I declare no competing interests. The opinions expressed in this Correspondence are my own and not necessarily those of my employer.

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Authors' reply

We thank Mohamed Hassany and colleagues, Ahmed Negida, Tarek Sahmoud, and Khaled Elmeleegy for raising their concerns about our modelling study. We would like to reiterate that the number of confirmed cases of coronavirus disease 2019 (COVID-19) in every country worldwide (Egypt included) is an underestimate of the true burden of illness, regardless of the screening programmes in place. Although we are aware that all modelling studies have limitations, we believe that it is important to rely on multiple sources of information to have a more accurate reflection of the so-called ground truth. For example, as of April 12, 2020, Egypt has reported 146 COVID-19-related deaths,¹ and as with reported cases, reported deaths are also an underestimate of the true value. By use of mortality data (both retrospectively and in real-time), other models² have corroborated our findings and still predict a much larger outbreak than that currently reported



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