8-2020

Severe Acute Respiratory Syndrome Coronavirus 2 Transmission Potential, Iran, 2020

Kamalich Muniz-Rodriguez
Isaac Fung
Shayesteh R. Ferdosi
Sylvia Ofori
Yiseul Lee

See next page for additional authors

Follow this and additional works at: https://digitalcommons.georgiasouthern.edu/bee-facpubs

Part of the Biostatistics Commons

This article is brought to you for free and open access by the Biostatistics, Epidemiology, and Environmental Health Sciences, Department of at Digital Commons@Georgia Southern. It has been accepted for inclusion in Biostatistics, Epidemiology, and Environmental Health Sciences Faculty Publications by an authorized administrator of Digital Commons@Georgia Southern. For more information, please contact digitalcommons@georgiasouthern.edu.
Authors
Kamalich Muniz-Rodriguez, Isaac Fung, Shayesteh R. Ferdosi, Sylvia Ofori, Yiseul Lee, Amna Tariq, and Gerardo Chowell
To determine the transmission potential of severe acute respiratory syndrome coronavirus 2 in Iran in 2020, we estimated the reproduction number as 4.4 (95% CI 3.9–4.9) by using a generalized growth model and 3.5 (95% CI 1.3–8.1) by using epidemic doubling time. The reproduction number decreased to 1.55 after social distancing interventions were implemented.

For method 1, we used a generalized growth model (2) with the growth rate and its scaling factor to characterize the daily reported incidence. Next, we simulated the calibrated generalized growth model by using a discretized probability distribution of the serial interval and assuming a Poisson error structure (Appendix).

We based method 2 on calculation of the epidemic’s doubling times, which correspond to the times when the cumulative incidence doubles and are estimated by using the curve of cumulative daily reported cases. To quantify parameter uncertainty, we used parametric bootstrapping with a Poisson error structure around the number of new reported cases to derive 95% CIs (3–5). Assuming exponential growth, the epidemic growth rate is equal to \( \ln(2)/\text{doubling time} \). Assuming that the preinfectious and infectious periods follow an exponential distribution, \( R_0 \approx (1 + \text{growth rate} \times \text{serial interval}) \) (Appendix) (6).

For both methods, the serial interval was assumed to follow a gamma distribution; mean (± SD) = 4.41 (± 3.17) days (7; C. You et al., unpub. data, https://www.medrxiv.org/content/10.1101/2020.02.08.20021253v2). We used MATLAB version R2019b (https://www.mathworks.com) and R version 3.6.2 (https://www.r-project.org) for data analyses and creating figures. We determined that a priori \( \alpha = 0.05 \).

Using Wikipedia as a starting point, we double-checked the daily reported new cases during February 19–March 19, 2020 (the day before the Iranian New Year) against official Iran press releases and other credible news sources and corrected the data according to official data (Appendix Tables 2, 3, Figure 1). Incident cases for the 5 regions were missing for 2 days (March 2–3), which we excluded from our analysis. Because the reported national number of new cases did not match the sum of new cases reported in Iran’s 5 regions on March 5, we treated each time series as independent and used the data as reported. Using method 1, we estimated \( R_0 \) data for February 19–March 1, 2020. Using method 2, we estimated \( R_0 \) from the early transmission phase (February 19–March 1, 2020) and \( R_e \) based on the growth rate estimated during March 6–19, 2020, when the epidemic slowed, probably reflecting the effect of social distancing.

Using method 1, we estimated an \( R_0 \) of 4.4 (95% CI 3.9–4.9) for COVID-19 in Iran. We estimated a growth rate of 0.65 (95% CI 0.56–0.75) and a scaling parameter of 0.96 (95% CI 0.93–1.00) (Appendix Table 4). The scaling parameter indicated near-exponential epidemic growth (Figure). Using method 2, we found...
that during February 19–March 1, the cumulative incidence of confirmed cases in Iran had doubled 8 times. The estimated epidemic doubling time was 1.20 (95% CI 1.05–1.45) days, and the corresponding $R_0$ estimate was 3.50 (95% CI 1.28–8.14). During March 6–19, the cumulative incidence of confirmed cases doubled 1 time; doubling time was 5.46 (95% CI 5.29–5.65) days. The corresponding $R_0$ estimate was 1.55 (95% CI 1.06–2.57) (Appendix Table 5, Figures 7, 8). Our results are robust and consistent with Iran’s COVID-19 $R_0$ estimates of 4.7 (A. Ahmadi et al., unpub. data, https://www.medrxiv.org/content/10.1101/2020.03.17.20037671v3) and 4.86 (E. Sahafizadeh, unpub. data, https://www.medrxiv.org/content/10.1101/2020.03.20.20038422v2) but higher than the $R_0$ of 2.72 estimated by N. Ghaffarzadegan and H. Rahmandad (unpub. data, https://www.medrxiv.org/content/10.1101/2020.03.22.20040956v1).

Our study has limitations. Our analysis is based on the number of daily reported cases, whereas it would be ideal to analyze case counts by dates of symptoms onset, which were not available. Case counts could be underreported because of underdiagnosis, given subclinical or asymptomatic cases or limited testing capacity to test persons with mild illness. The rapid increase in case counts might represent a belated realization of epidemic severity and rapid catching up and testing many persons with suspected cases. If the reporting ratio remains constant over the study period, and given the near-exponential growth of the epidemic’s trajectory, our estimates would remain reliable. Although data are not stratified according to imported and local cases, we assumed that persons were infected locally because transmission has probably been ongoing in Iran for some time (8).

Although the COVID-19 epidemic in Iran has slowed substantially, the situation remains dire. Tighter social distancing interventions are needed to bring this epidemic under control.

G.C. received support from NSF grant 1414374 as part of the joint NSF-NIH-USDA Ecology and Evolution of Infectious Diseases program. I.C.-H.F. received salary support from the Centers for Disease Control and Prevention (CDC) (19IPA1908208). This article is not part of I.C.-H.F’s CDC-sponsored projects.
Cluster of Coronavirus Disease Associated with Fitness Dance Classes, South Korea

Sukbin Jang, Si Hyun Han, Ji-Young Rhee

Author affiliation: Dankook University Hospital, Dankook University College of Medicine, Cheonan, South Korea

DOI: https://doi.org/10.3201/eid2608.200633

By April 30, 2020, South Korea had reported 10,765 cases of coronavirus disease (COVID-19) (1); ≈76.2% of cases were from Daegu and North Gyeongsang provinces. On February 25, a COVID-19 case was detected in Cheonan, a city ≈200 km from Daegu. In response, public health and government officials from Cheonan and South Chungcheong Province activated the emergency response system. We began active surveillance and focused on identifying possible COVID-19 cases and contacts. We interviewed consecutive confirmed cases and found all had participated in a fitness dance class. We traced contacts back to a nationwide fitness dance instructor workshop that was held on February 15 in Cheonan.

Fitness dance classes set to Latin rhythms have gained popularity in South Korea because of the high aerobic intensity (2). At the February 15 workshop, instructors trained intensely for 4 hours. Among 27 instructors who participated in the workshop, 8 had positive real-time reverse transcription PCR (RT-PCR) results for severe acute respiratory syndrome coronavirus 2, which causes COVID-19 (19) burden and potential for international dissemination of infection from Iran. Ann Intern Med. 2020. https://doi.org/10.7326/M20-0696

By March 9, we identified 112 COVID-19 cases associated with fitness dance classes in 12 different sports facilities in Cheonan (Figure). All cases were confirmed by RT-PCR; 82 (73.2%) were symptomatic and 30 (26.8%) were asymptomatic at the time of laboratory confirmation. Instructors with very mild symptoms, such as coughs, taught classes for ≈1 week after attending the workshop.