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Supplementary appendix 2

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Pham QD, Stuart RM, Nguyen TV, et al. Estimating and mitigating the risk of COVID-19 epidemic rebound associated with reopening of international borders in Vietnam: a modelling study. *Lancet Glob Health* 2021; published online April 12. http://dx.doi.org/10.1016/S2214-109X(21)00103-0.

Supplementary materials to "Lessons learned from Vietnam's COVID-19 response: the role of adaptive behavior change and testing in epidemic control"

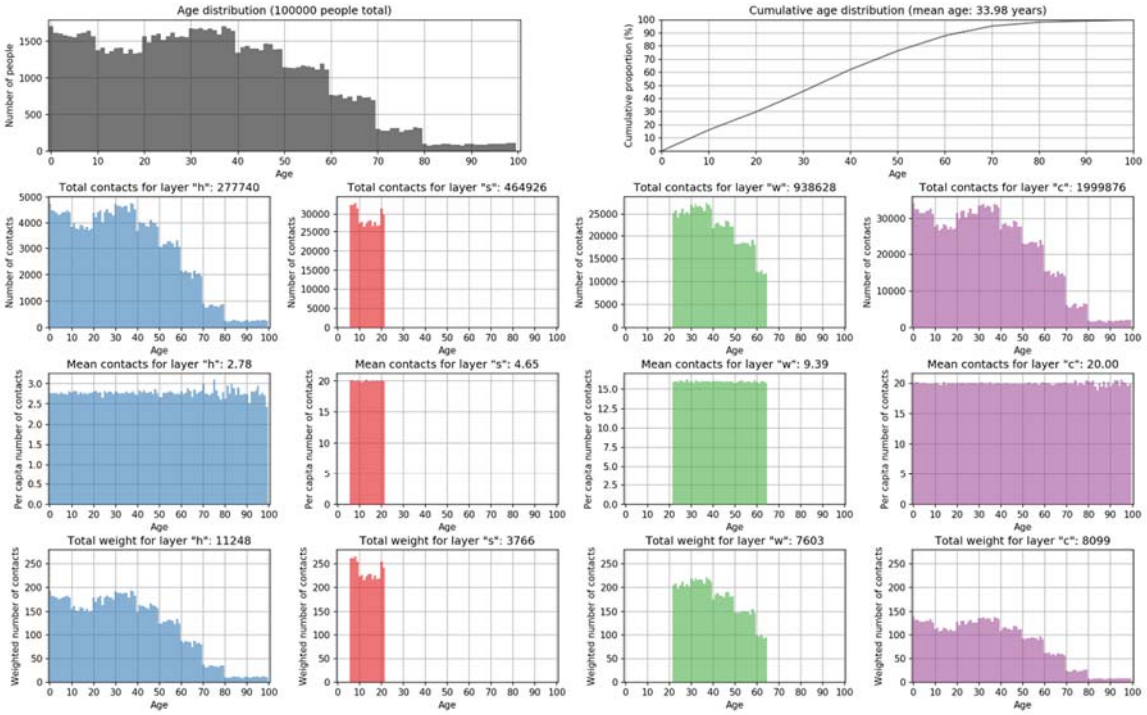

Figure S1. Characteristics of the population structure modeled for Vietnam. Data on the age distribution and distribution of household sizes comes from the UN Population Division 2019 (population.un.org). Within schools, workplaces, and community settings, the number of daily contacts for each individual is drawn from a Poisson distribution with mean 20. Whilst average classroom sizes or workplace sizes may be larger than this, not all students or workers in a given classroom or workplace will meet the definition of a close contact, so we use an approximation.

Parameter	***Value/distribution and sources/notes***
Transmission: Overall scale factor for the per-contact transmission probability in the absence of interventions	0.0135 (identified via numerical optimization). Different values are then applied depending on the specific setting in which contacts take place, as documented in Kerr et al.[1]
Testing	Testing is modeled in two different ways. Firstly, in the model of Central Vietnam over June 15 – October 15, 2020, we use available data on the number of tests that were conducted. We assume that people with symptoms, and people who have a known history of contact with a confirmed case, are most likely to receive

	a test, but we allow for the possibility of those without symptoms or a contact history receiving a test. Secondly, to project the epidemic into the future, we model testing by setting a probability for testing for those with symptoms, and those without symptoms but with a known history of contact. In our core scenarios, over the course of their symptomatic period, 10% of people with COVID-19-like symptoms are assumed to seek testing (this is varied in subsequent scenarios). Furthermore, in line with Vietnam's policies, 100% of those who are identified as a contact of a confirmed case are tested.
Initial epidemic state: Number of active cases in Central Vietnam on June 15, 2020	1
Importations: Number of daily imported cases into the Da Nang region over June 15 – July 25, 2020	Drawn from a negative binomial distribution with mean of 1 and dispersion of 0.25.
Impact of school closures: relative number of daily contacts between school-aged children	Schools were closed in Central Vietnam from July 28, 2020, to September 14, 2020. Over this period, we assume that the number of contacts between school-aged children was 90% lower than its pre-lockdown value.
Impact of workplace closures: relative number of daily contacts between working adults	Workplaces were closed in Central Vietnam from July 28, 2020, to September 5, 2020. Over this period, we assume that the number of contacts between working adults was 90% lower than its pre-lockdown value.
Mask uptake	35% pre-July 26; 90% post-July 26. On July 26, the proportion of people who reported sometimes/frequently using a face mask in the past 2 weeks were 29%/35% (n=94771). These values shifted to 5%/90% (n=143277) in the survey conducted on August 2, 2020, after the identification of the new cluster of cases. To translate this to an effect size in the model, we first calculate the average relative transmission risk with 35% mask usage, assuming an aOR of 0.23 for those wearing masks, as: 65%+35%*23% = 73%. We then calculate the

	average relative transmission risk with 90% mask usage, again assuming an aOR of 0.23, as: 10%+90%*23% = 31%. This leads to a median estimated reduction in transmission risk of: 1-31%/73% = 58%. However, since there is considerable uncertainty around the size of the reduction in transmission risk associated with mask wearing, we implement this by sampling the reduction in transmission risk from a triangular distribution over the interval 26-73%, where the endpoints of this interval are calculated by substituting the endpoints of the confidence interval from[2] into the calculations above. This gives an interval broadly in line with other estimates of face mask efficacy once other behavioral changes are incorporated[3].
Tracing: probability of tracing contacts and time taken to trace	Household contacts: 100% traceable on the same day as test results are notified; School contacts: 95% notified within 1 day; Workplace contacts: 90% notified within 1 day; Community contacts: 5% notified within a week of a case notification
Isolation and quarantine: reduction in transmission probability for confirmed cases and contacts compared to undiagnosed cases	We assume that confirmed cases will isolate with near-perfect effectiveness, meaning that the probability of them transmitting to school or workplace contacts is zero, and the probability of them transmitting to their household contacts is reduced by 80%. Similarly, we assume high levels of adherence to isolation policies imposed on those who have been notified that they were in contact with a confirmed case, with a 90% reduction in their probability of transmitting to school or workplace contacts.

Table S1: list of parameters used in the calibrated Covasim model for Central Vietnam. For other model parameters, we use the default Covasim values[1].

Foreign nationals	Foreign nationals arriving to Vietnam must: 1. test negative 3-5 days before departing; 2. disclose travel 14 days before departing; 3. complete a nasopharyngeal swab sample antigen test on arrival; 4. quarantine in a hotel for 7 days, after which they are tested for SARS-CoV-2 by RT-PCR or RT-LAMP; 5. quarantine at their residence for a further 7 days if both test results are negative;

	6. continue to have their health monitored daily by a commune health worker over the remainder of their quarantine, with another nasopharyngeal swab sample collected at day 14 after arrival.
Vietnamese citizens	Vietnamese citizens who repatriated from foreign countries are quarantined for 14 days at government facilities and tested twice during the 14-day quarantine, following the testing schedule for foreign nationals.

Table S2: Quarantine protocols for international arrivals to Vietnam.

Supplementary references

1 Kerr CC, Stuart RM, Mistry D, *et al.* Covasim: an agent-based model of COVID-19 dynamics and interventions. 2020. DOI:10.1101/2020.05.10.20097469.

2 Doung-ngern P, Suphanchaimat R, Panjangampatthana A, *et al.* Case-Control Study of Use of Personal Protective Measures and Risk for SARS-CoV 2 Infection, Thailand - Volume 26, Number 11—November 2020 - Emerging Infectious Diseases journal - CDC. DOI:10.3201/eid2611.203003.

3 Mitze T, Kosfeld R, Rode J, Wälde K. Face masks considerably reduce COVID-19 cases in Germany. *PNAS* 2020; published online Dec 3. DOI:10.1073/pnas.2015954117.