

LARGE FAMILIES ARE AT EXTRAORDINARY RISK DURING THE COVID-19 PANDEMIC

The need for additional non pharmaceutical interventions

(10)(2e), (10)(2e), (10)(2e),

Dept. of public health, University of Copenhagen Denmark

Correspondence: (10)(2e)@sund.ku.dk

In New Jersey, the COVID-19 pandemic has severely hit a family (1). The mother of 11 and grandmother of 27 is dead, so are two of her 11 children. Four of her other children have contacted coronavirus also and are hospitalized, three of them in critical condition. This could be an extraordinary outcome of the distribution curve, or instead point to an familial, inherited susceptibility (2). Here, we reason that large families living in the same households are at an extraordinarily risk just because they are big.

Comprehensive contact tracing of index cases with SARS-CoV-2 infection in Taiwan has shown an overall secondary clinical attack rate of 2.4%, but it was 8.5% among non-household family contacts and 13.6% among household contacts (3). Similar observations are reported in the United States. The first 10 patients with travel-related confirmed COVID-19 elicited a symptomatic secondary attack rate of 0.45% among all close contacts and 10.5% among household members (4).

The manifold higher attack rates within households indicate that members of large families will add disproportionately many COVID-19 cases to the epidemic. This is even more so when multiple generations of the same family are living under the same roof. Older and frail members enhance transmission as they are at the highest risk of disease and complications, thus higher viral load and longer virus-shedding period (5).

Larger families in Africa are shown to be at risk of increased mortality due to infection. Survival of offspring decreases 2.8% for each increase in the number of offspring (6). Studies of measles epidemics have shown that secondary cases within big households suffer a 3-4 fold increased mortality risk due to repeated, more intense exposure to the virus (7).

Experimental models support the thesis that a high-infection-load predisposes for a fulminant clinical course. Repeated low-dose of virus influenza A in mice causes more severe pulmonary disease with higher viral loads, increased tissue inflammation, and mortality (8). High levels of IL1-B upon repeated exposure with influenza A in animal models reflect the cytokine storm in critically ill patients with COVID-19 (9).


A 'grand' family is exactly what this corona virus appears to love and current COVID-19 guidelines need to be adapted accordingly (10). We suggest three additional non pharmaceutical interventions:

- Apply social distancing within the non-household family; a protective corridor of 1-2 meters air need to be adhered to irrespective of the blood band;
- Quarantine patients in their own house when having symptoms; when sick, you should either move out of the house or live separately in your own room, own bed and eat on your own;
- Except for high-risk families, curfews should not be introduced as they will increase indoor transmission of the virus.

Not introducing specific non pharmaceutical interventions for large families may considerably reduce the expected effects of general non-pharmaceutical interventions to contain the epidemic and to safeguard access to overloaded healthcare systems.

SUBMITTED – NOT FOR FURTHER DISTRIBUTION

References

1. <https://www.nytimes.com/2020/03/18/nyregion/new-jersey-family-coronavirus.html?action=click&module=Spotlight&pgtype=Homepage>
2. Sørensen TI, Nielsen GG, Andersen PK, Teasdale TW. Genetic and environmental influences on premature death in adult adoptees. *N Engl J Med.* 1988 ;318:727-32.
3. Cheng H-Y, Jian S-W, Liu D-P, Ng T-C, Huang W-T, Taiwan COVID-19 outbreak investigation team, et al. High transmissibility of COVID-19 near symptom onset. <https://www.medrxiv.org/content/10.1101/2020.03.18.20034561v1>
4.  Yan L-M, Wan L, Xiang T-X, Le A, Liu J-M, et al. Viral dynamics in mild and severe cases of COVID-19. *Lancet Infect Dis* Published Online March 19, 2020 [https://doi.org/10.1016/S1473-3099\(20\)30232-2](https://doi.org/10.1016/S1473-3099(20)30232-2).
5. Burke RM, Claire M, Midgley CM, Dratch A, Fenstersheib M, Haupt T, et al. Active Monitoring of Persons Exposed to Patients with Confirmed COVID-19 — United States, January–February 2020. *MMWR* 2020 / 69(9);245–246.
6. Meij JJ, van Bodegom D, Ziem JB, Amankwa J, Polderman AM, Kirkwood TB, et al. Quality-quantity trade-off of human offspring under adverse environmental conditions. *J Evol Biol.* 2009; 22:1014-23.
7. Aaby P, Bukh J, Lisse IM, Smits AJ. Overcrowding and intensive exposure as determinants of measles mortality. *Am J Epidemiol.* 1984;120:49-63.
8. Song Y1, Wang X2, Zhang H1, Tang X1, Li M3, Yao J4, et al. Repeated Low-Dose Influenza Virus Infection Causes Severe Disease in Mice: a Model for Vaccine Evaluation. *J Virol.* 2015;8:7841-51.
9. Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ, ET AL. COVID-19: consider cytokine storm syndromes and immunosuppression *Lancet* Published Online March 13, 2020 [https://doi.org/10.1016/S0140-6736\(20\)30628-0](https://doi.org/10.1016/S0140-6736(20)30628-0)
10. Imperial College COVID-19 Response Team. Impact of non-pharmaceutical interventions (NPIs) to reduce COVID- 19 mortality and healthcare demand. <https://doi.org/10.25561/77482>