The household secondary attack rate of SARS-CoV-2: A rapid review

Journal Article,Meta-Analysis

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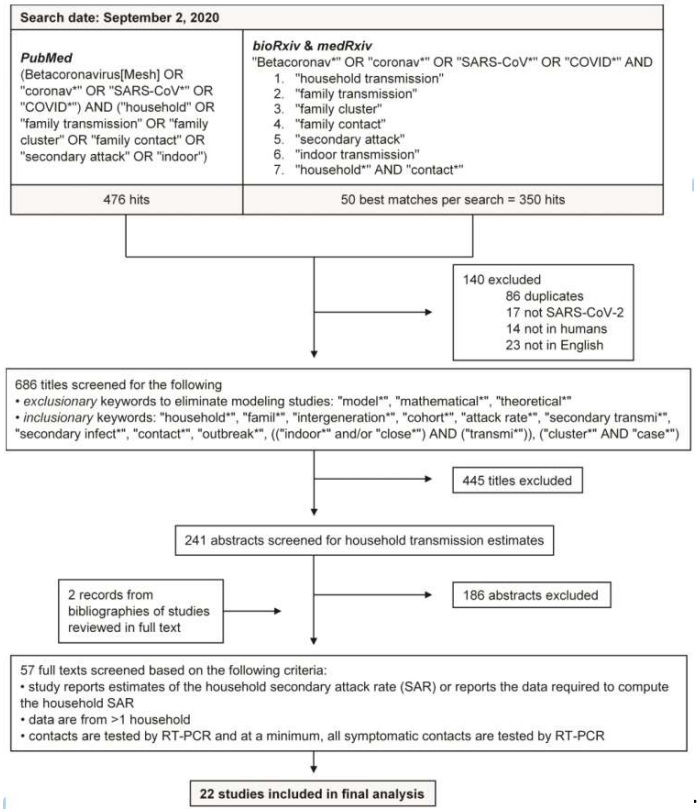
Summary

Purpose: To study the nature and determinants of household transmission ofSARS-CoV-2 infection.

Methods:

- Data from 22 published and pre-published studies from 10 countriesavailable through September collected and analysed.

Fig 1: Study selection (PRISMA)



- Estimates of the SARS-CoV-2 household secondary attack rate (SAR) were combined and variations were analysed.
- 22 (20 published, 2 unpublished) papers were included in the final sample meeting the eligibility criteria (Figure 1).
- To mitigate sources of bias, studies that did not test all symptomatic contacts were excludedas they were likely to underestimate thehousehold SAR.To minimize heterogeneity in case definition, only studies that used RT-PCR testing, rather than antibody testing were considered.
- Two reviewers independently assessed the quality of each study using a modified 9-point Newcastle-Ottawa scale for observational studies.

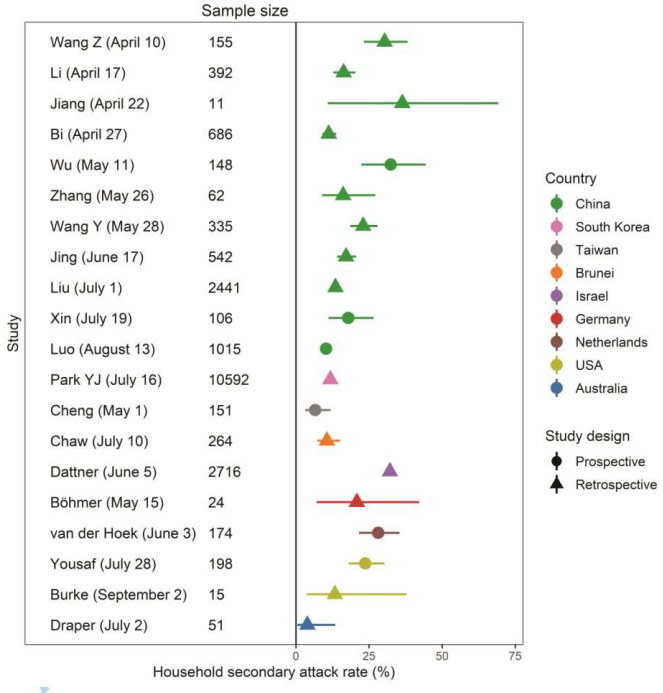
Results:

- In total, the 22 studies considered 20,291 household contacts, 3,151 (15.5%) of whom tested positive for SARS-CoV-2.
- Household SAR estimates ranged from 3.9% in the Northern Territory, Australia to 36.4% in

Shandong, China. (Figure 2)

- The overall pooled random-effects estimate of SAR was 17.1% (13.7%-21.2%), with significant heterogeneity (p<0.0001)
- The pooled SAR was higher in studiesdefining index case by symptomonsetdate,i.e the household member developing symptoms earliest (21.0% [14.9%-28.8%]) compared to ones wherethe index case was the first member confirmedto haveSARS-CoV-2 infection(15.6% [11.7%-20.3%]).
- The amount of residual heterogeneity (I^2) decreased from 96.7% to 91.2% accounting for follow-up duration and testing frequency, suggesting these as important determinants. For example: SAR of >2 follow-up tests: 21.3% (13.8%-31.35%) 2 follow-up tests:17.5% (13.9%-21.8%) and 1 follow-up test: 9.2% (6.7%-12.3%).
- The household SAR was higher among adults and older adults contacts than children, and higher among female contacts and contacts of symptomatic cases.
- SARs were high among spouses or significant others of index cases relative to non-spouse household members.
- A small subset of the studies considered influence of mask use, isolation, dining separately, ventilation, disinfection and mild index case severity suggesting lower household SAR estimates.

Fig 2: Estimates of the household secondary attack rate stratified by country and study design.



Conclusion:

- A wide heterogeneity (3.9%-36.4%) was noticed in the household SAR estimates across studies with systematic variation based on study design, testing and follow-up patterns.
- Thestudies with less intensive testing may have missed cases and underestimated the household SAR. Similarly, approaches to case selection, index and secondary case detection, the timing of testing, and the phase of the epidemic may have impacted SAR.
- Most of studies found higher SARs among adults than children. Whether it's due to differential susceptibility or exposure is not clear but higher SAR in children for other respiratory viruses suggests possible role of differential susceptibility or lower viral loads.
- While the results suggest that asymptomatic and young children (0-9 years) index cases may lead to lower household SAR, further research is needed to substantiate such effects.

- The main limitations of analysis are limited available data and representativeness across countries and regions.Household size and composition, contact patterns, and testing and isolation practices vary substantially geographically.

Appraisal

- Of the 22 studies, 11 (50%) analysed households in China of which 6 (27%) were from a single Guangdong province thereby limiting generalisability of the analysis.
- None of the included studies came from South Asia, Latin America or Africa—places that account for a substantial proportion of the global caseload.
- Index case definitions were taken from the studies as first case to be confirmed or those with earliest date of symptom onset in a household. Such definitions run the risk of misclassifying asymptomatic index cases as secondary cases.
- 4/22 (18.2%) studies were high quality and majority 14/22 (63.6%) studies were moderate quality as per Newcastle-Ottawa scale.
- Higher SAR in adults and severity of index cases must be studied further to ascertain if its due to biological or contact variations.
- Data on effect of post-exposure chemoprophylaxis among exposed household members is an important factor,and would be a value addition and could have been explored in analyses.

Implications of the study:

India's COVID-19 containment plan has largely focused on limiting transmission in public places with little consideration to transmission within households. While preventing spread of COVID-19 in congregate public settings is critical, a comprehensive strategy should be formulated for reducing transmission in domestic settings based on local customs and practices. Early detection, isolation of cases and intensive quarantine, testing and follow-up of contacts are core strategies to effectively contain household transmission. Additional factors like age (case and contacts), isolation, PPE use, behavioral modifications and severity of index cases are also critical for household quarantine policy. This becomesmore important since institutional admissions are now done only for severe cases and rest are advised home care and monitoring. Poor awareness and isolation practices and lack of evidence-based testing and follow-up policyfor household contactsis even more detrimental as household care is severely compromised assuch contacts also get infected. Design and implementation of such policy must include prioritization of cases and contacts at higher risk and should be based on local understanding of the extent, nature and determinants of household transmission.

Appraisers

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