

PASS THE TURKEY, HOLD THE VIRUSES: MORE ON HOUSEHOLD TRANSMISSION OF SARS- COV-2

TOM BECKER

NORTHWEST PORTLAND AREA INDIAN HEALTH BOARD

GAME PLAN FOR TODAY

- Review a recent article on household transmission from a large study in Singapore (a place where Covid-19 has been successfully held in check)
- Touch on newsworthy findings in other scientific reports (MMWR and others)

OBJECTIVES

- Summarize the key behavioral/environmental features important to household transmission from one study with very thorough case and contact investigations

TAKE HOME MESSAGES

- Several well-investigated case-clusters of household transmission from multiple settings now reported with widely disparate findings
- Behavioral/environmental factors most strongly associated with household transmission in Singapore were sharing a bedroom, engaging >30 minutes of conversation with index case/s
- Overall attack proportion was low (6%) among household contacts monitored very closely, possibly related to quick removal of index case from home environment to a Singapore hospital
- CDC has more fully embraced aerosol spread as a cause of transmission in special circumstances—not just in medical procedures—tho not the major infection route
- Reports show evidence of virions (infectious particles) in the air for long periods of time, in lab setting—as well as identification of SARS-Cov-2 RNA in air samples from other environmental studies

BACKGROUND

- Thanksgiving on the horizon, with many US households still planning large events...according to recent survey by Ohio State University (40% of sample are planning on attendance at dinners with 10 or more people; one-third of respondents will NOT ask guests to wear masks)
- Portland International Airport and regional projections for highway travel suggest a big travel holiday, though not as big as past years (same story nationwide).
- Brigg reviewed household transmission potential modelling article in a recent session: very high success for transmission with closed room (no ventilation), no masks, speaking >30 minutes...even with appropriate distancing (he also covered recent MMWR article on household transmission)
- Eileen has just reviewed Hopi household transmission study, showing a high proportion of household contacts who tested positive (or got sick) after contact with two index cases

BACKGROUND, CNTD

- Small gatherings are considered to be very important in current Covid-19 spike nationwide
- CDC has discussion of aerosol transmission on their website (low but possible risk in some crowded, non-ventilated settings)
- Political leaders (like Oregon Governor among others) strongly advise against gatherings of >6 people in updated mandates
- Most studies on household transmission have been small...the Singapore report is much more robust and worth our time/energy to digest key findings

STUDY DESIGN, NG ET AL, LANCET 2020

- Retrospective cohort (according to authors, but is more like a survey), with all confirmed cases from Jan 23 to Apr 3 in Singapore (pop 5.8 million)
- Approx. 100% of household contacts were identified and quarantined for 14 days
- All cases quickly removed from homes and hospitalized until 3 negative tests (even for mild illness)
- All household contacts monitored and reported symptoms 3 times per day
- Contacts underwent PCR testing and/or serologic testing
- Lengthy WHO-derived questionnaire
- Univariate and multivariate analyses for risk factors for infections among household contacts

RESULTS

- 1114 index cases identified by PCR tests
- 1779 household contacts (high proportion were spouses of index cases)
- 6% of household contacts were positive (up to 15% if data are viewed with different parameters in the analysis)
- Main risk factors associated with infection/illness in contacts were sharing bedroom with index case, >30 minute conversation with index case

NEXT DATA TABLES SHOW...

- (Authors approach for this part of the study: presenting the findings as a survey instead of a retrospective cohort, infected household members on far left column)
- The univariate analysis results on the left, multivariable analysis results on right side, with p values displayed after OR's and 95% confidence intervals.
- Note that the OR's can change substantially with control for multiple confounders, using regression techniques

Sharing of meals

Did not share a meal with any COVID-19 case	17 (19.1%)	228 (46.1%)	Ref	..	Ref	..
Shared a meal without involving any of the following: eating from the same plate, drinking from the same cup, or eating with the same utensils	26 (29.2%)	141 (28.5%)	2.47 (1.30– 4.72)	0.0060	1.03 (0.48– 2.21)	0.93
Shared a meal involving one or more of the following: eating from the same plate, drinking from the same cup, or eating with the same utensils	46 (51.7%)	126 (25.5%)	4.90 (2.69– 8.90)	<0.0001	1.29 (0.60– 2.80)	0.52

Longest duration that a COVID-19 case spoke to individual

Individual was not spoken to by a COVID-19 case	21 (23.6%)	331 (66.9%)	Ref	..	Ref	..
COVID-19 case spoke for <30 min	32 (36.0%)	124 (25.1%)	4.07 (2.26– 7.32)	<0.0001	3.91 (2.09– 7.34)	<0.0001
COVID-19 case spoke for ≥30 min	36 (40.5%)	40 (8.1%)	14.19 (7.55– 26.64)	<0.0001	7.86 (3.86– 16.02)	<0.0001

Sharing of bedroom and toilet

Did not share a bedroom with any COVID-19 case and did not use the same toilet as any COVID-19 case	19 (21.4%)	296 (59.8%)	Ref	..	Ref	..
Used the same toilet as a COVID-19 case but did not share a bedroom	12 (13.5%)	105 (21.2%)	1.78 (0.84– 3.79)	0.14	1.11 (0.49– 2.54)	0.80
Shared a bedroom with a COVID-19 case but did not use the same toilet	13 (14.6%)	28 (5.7%)	7.23 (3.23– 16.18)	<0.0001	5.38 (1.82– 15.84)	0.0023
Shared a bedroom and used the same toilet as a COVID-19 case	45 (50.6%)	66 (13.3%)	10.62 (5.84– 19.33)	<0.0001	5.05 (1.85– 13.79)	0.0016

UNUSUAL FEATURES OF SINGAPORE STUDY

- Mandated government compliance with public health measures (but not with study participation)
- Mandatory admission of all sick Covid-19 cases, even with mild illness—no discharge until three negative tests
- Mandatory quarantine of all home contacts with 3 times a day symptom monitoring
- Apparently lots of money to do this kind of large and thorough study!

POTENTIAL LIMITATIONS OF STUDY

- Retrospective cohort? Not really. Key data were presented mostly as a survey
- limited days of home exposure to index case (both a strength and a limitation)
- No information of co-morbid conditions of contacts at home
- limited information on mask wearing at home, or for distancing
- ? Was the >30 minute conversation cumulative, and over a consistent time period for all contacts? unclear

Household Transmission of Severe Acute Respiratory Syndrome Coronavirus 2 from Adults to Children

Chee Fu Yung, MBChB^{1,2,3}, Kai-qian Kam, MBBS^{1,2,4}, Chia Yin Chong, MBBS^{1,2,3,4}, Karen Donceras Nadua, MD^{1,2,4}, Jiahui Li, MBBS^{1,2,4}, Natalie Woon Hui Tan, MBBS^{1,2,3,4}, Sashikumar Ganapathy, MBBS^{1,2,3,4,5}, Khai Pin Lee, MBBS^{1,2,3,4,5}, Kee Chong Ng, MBBS⁶, Yoke Hwee Chan, MBBS⁶, and Koh Cheng Thoon, MBBS^{1,2,3,4}

Knowledge of transmission dynamics of severe acute respiratory syndrome coronavirus 2 from adults to children in household settings is limited. We found an attack rate among 213 children in 137 households to be 6.1% in households with confirmed adult 2019 novel coronavirus disease index case(s). Transmission from adult to child occurred in only 5.2% of households. Young children <5 years old were at lowest risk of infection (1.3%). Children were most likely to be infected if the household index case was the mother. (*J Pediatr* 2020;225:249-51).

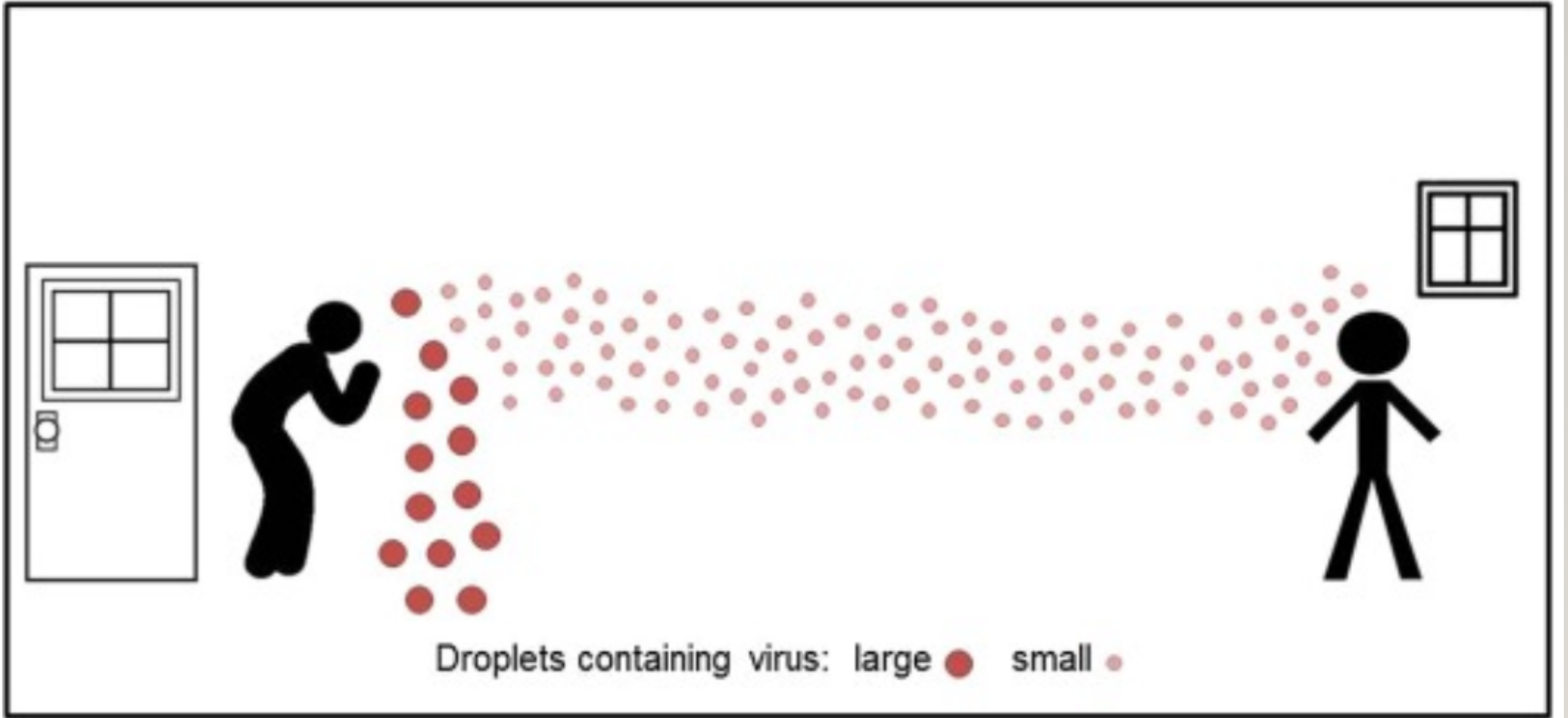
THE NEXT SLIDE IS THE 'TAKE HOME MESSAGE' IN MMWR FROM THE NASHVILLE AND MARSHFIELD HOUSEHOLD TRANSMISSION STUDY, NOV 6, 2020; REVIEWED BY BRIGG EARLIER IN OUR SERIES

Among all household members, 102 had nasal swabs or saliva specimens in which SARS-CoV-2 was detected by RT-PCR during the first 7 days of follow-up, for a secondary infection rate of 53% (95% CI = 46%–60%) ([Table 2](#)). Secondary infection rates based only on nasal swab specimens yielded similar results (47%, 95% CI = 40%–54%). Excluding 54 household members who had SARS-CoV-2 detected in specimens taken at enrollment, the secondary infection rate was 35% (95% CI = 28%–43%).

Forty percent (41 of 102) of infected household members reported symptoms at the time SARS-CoV-2 was first detected by RT-PCR. During 7 days of follow-up, 67% (68 of 102) of infected household members reported symptoms, which began a median of 4 days (IQR = 3–5) after the index patient's illness onset. The rates of symptomatic and asymptomatic laboratory-confirmed SARS-CoV-2 infection among household members was 36% (95% CI = 29%–43%) and 18% (95% CI = 13%–24%), respectively.

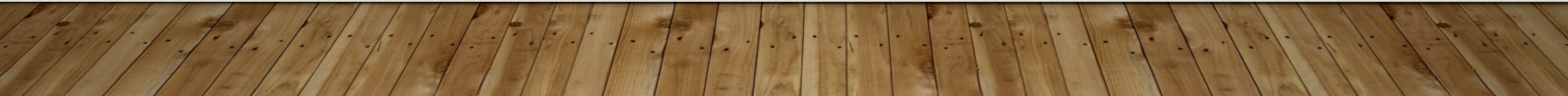
A SERIES OF REMINDERS FOR YOUR PATIENTS AND FOR YOU, RE:TRANSMISSION AT GATHERINGS

- You have seen the next slides in earlier talks on SARS-CoV-2
- CDC website and some supportive observations/studies suggest aerosol transmission may occur in special circumstances, but far less important than droplet spread



MOROWSKA REF: THE WORLD SHOULD FACE THE REALITY OF AEROSOL SPREAD...

- SARS-CoV-2 spread in air, evidence 'well supported'
- On cruise ships, many infections occurred after lockdown/confinement to rooms, implicating ventilation systems
- Growing body of lab evidence suggests importance of aerosol spread
- Current limitations on actually measuring virus in the air in 'typical rooms', given flow dynamics, dilution, etc



FEARS REF: PERSISTENCE OF SARS-COV-2

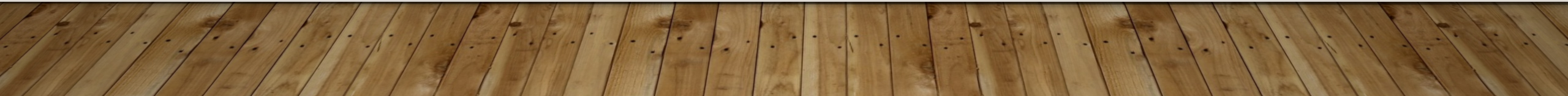
- Lab based study under controlled conditions
- Viruses were shot via nebulizer into a closed chamber
- Viruses recovered at different time periods, up to 16 hours, with retained morphology (and presumed infectiousness as with the original samples) as seen on EM
- virus has 'aerosol fitness'

SCIENTISTS' LETTER TO WHO, THE 'FIXES' RELATED TO ENVIRONMENTAL CONTROL OF AEROSOLS:

- Increased ventilation
- Exhaust control so air in buildings does not pose a risk when exhaust is in use
- Avoid overcrowding
- Brigg and others have made these points earlier

THINKING OUT OF THE BOX...RELATED TO REDUCTION OF TRANSMISSION RISK AT THANKSGIVING DINNER

- <https://www.who.int/news-room/q-a-detail/q-a-how-is-covid-19-transmitted> includes, “There have been reported outbreaks of COVID-19 in some closed settings... where people may be shouting, **talking**, or singing.” WHO
- One possible response to dampen this transmission method, particularly around the dinner table...just avoid talking, instead use...







SOCIAL GATHERING ADVICE

- Don't do it (not realistic, apparently, according to Ohio State survey)
- Pay strict attention to currently recommended containment strategies that address main transmission modes for SARS-CoV-2...including ventilation
- Don't over-react to aerosol transmission possibilities...but recognize potential still there in certain settings
- Talking produces droplets! (Not just coughing or sneezing)

REFERENCES

- [MMWR article link November 6](#)
- [arhttps://www.cdc.gov/mmwr/volumes/69/wr/mm6944e1.htm?s_cid=mm6944e1_w&utm_source=Global+Health+NOW+Main+List&utm_campaign=295490ff45-EMAIL_CAMPAIGN_2020_10_30_04_25&utm_medium=email&utm_term=0_8d0d062dbd-295490ff45-3033369](https://www.cdc.gov/mmwr/volumes/69/wr/mm6944e1.htm?s_cid=mm6944e1_w&utm_source=Global+Health+NOW+Main+List&utm_campaign=295490ff45-EMAIL_CAMPAIGN_2020_10_30_04_25&utm_medium=email&utm_term=0_8d0d062dbd-295490ff45-3033369)
- “SARS-CoV-2 seroprevalence and transmission risk factors among high-risk close contacts: a retrospective cohort study,” Ng et al. *Lancet*. [https://doi.org/10.1016/S1473-3099\(20\)30833-1](https://doi.org/10.1016/S1473-3099(20)30833-1)
- Hirschman J, et al. A SARS-CoV-2 Outbreak Illustrating the Challenges in Limiting the Spread of the Virus — Hopi Tribe, May–June 2020. *MMWR Morb Mortal Wkly Rep* 2020;69:1654–1659. DOI: <http://dx.doi.org/10.15585/mmwr.mm6944a5>
- Morawska, L., & Cao, J. (2020). **Airborne transmission of SARS-CoV-2: The world should face the reality.** *Environment International*, 105730. <https://doi.org/10.1016/j.envint.2020.105730>
- [Grazie a Grazia](#)