Day care study – Airborne infections

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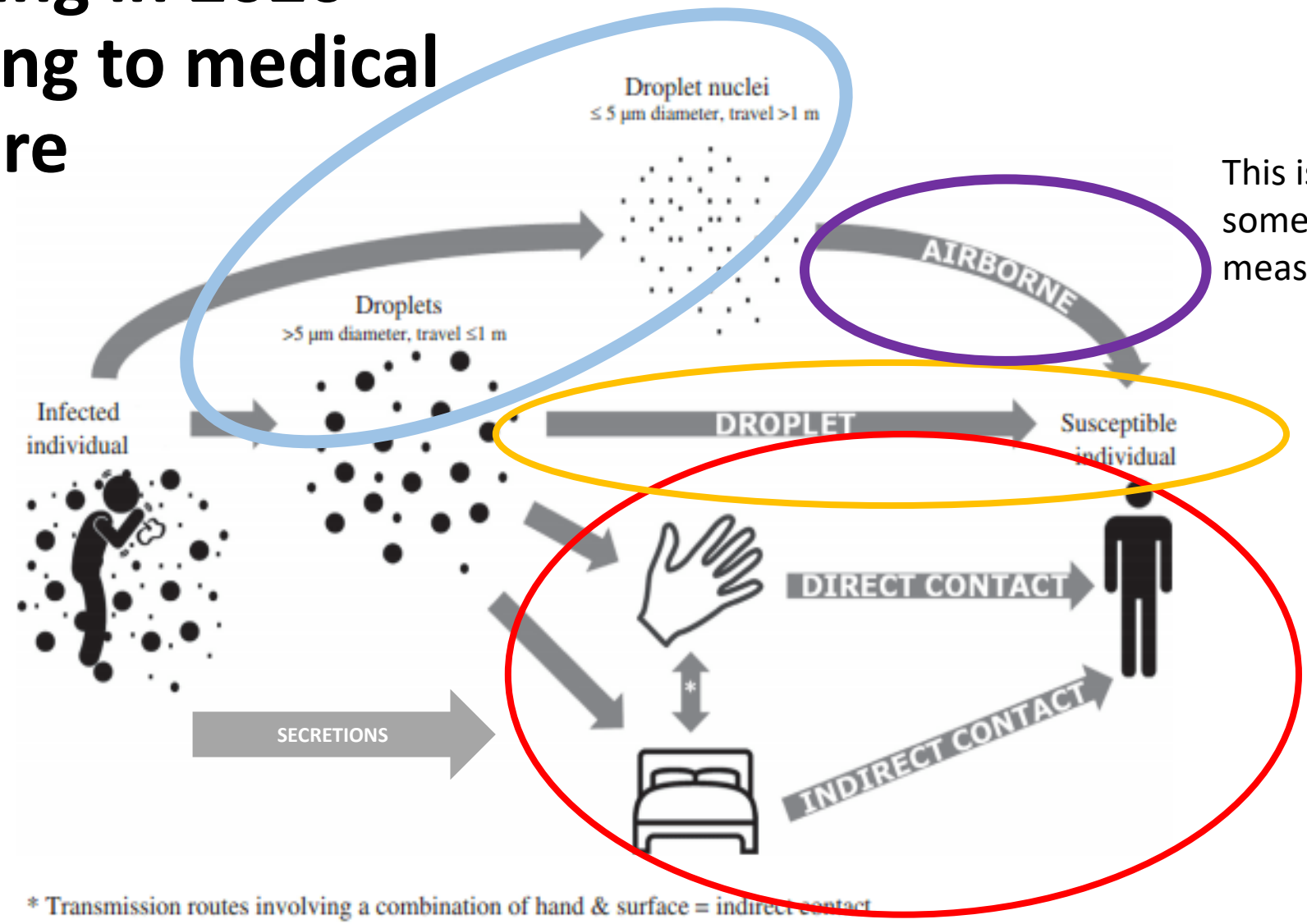
Conflicts of Interest

- Research funding
    - Business Finland
    - Finnish Medical Foundation
    - Tampere Tuberculosis Foundation
- Corporate
    - Consultancy and lecture fees from Orion pharma

Spreading in 2020 according to medical literature

This is not true



* Transmission routes involving a combination of hand & surface = indirect contact

This is remembered if someone mentions TB or measels

If someone vomits

This has been the main focus of infection prevention

https:/considering-the-role-of-environmental-contamination-in-the-spread-of-covid-19/reflectionsipc.com/2020/03/12//

Short history of arguments

Opinions on the importance of airborne infection have swung over the centuries from extremes of belief to extremes of disbelief. Galen [1], in the second century, is credited with the magnificent aphorism: "When many sicken and die at once, we must look to a single common cause, the air we breathe," and Chapin [2], after an extensive survey of available evidence in 1910, concluded: "Without denying the possibility of such (airborne) infection, it may be fairly affirmed that there is no evidence that it is an appreciable factor in the maintenance of most of our common contagious diseases." Chapin made a grudging exception in the case of tuberculosis: "It is assumed that tuberculosis, as it occurs in human beings, is usually an air-borne disease, and . . . there is more reason for such an assumption concerning this than concerning most diseases." Tuberculosis remains the most characteristic and well documented infection which is airborne from man to man, but epidemiologic studies point strongly toward airborne transmission of many other infections, particularly those caused by viruses in the respiratory tract.

RICHARD L. RILEY, M.D.
Baltimore, Maryland

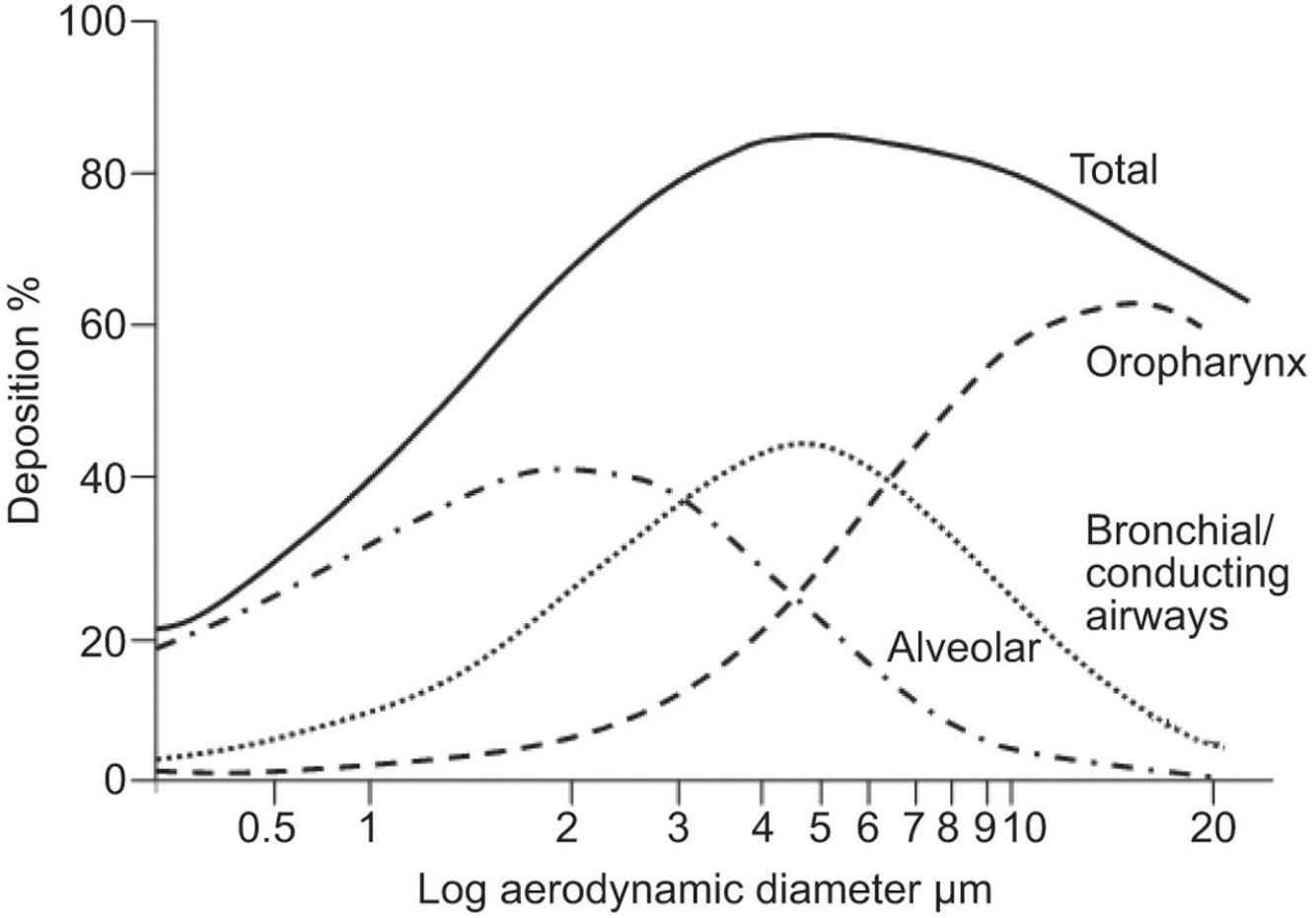
September 1974 The American Journal of Medicine Volume 57

single building [20].

The most convincing way to demonstrate the mechanism by which transmission of infection occurs under normal conditions is to block transmission by that mechanism and observe the effect on the spread of infection. This requires an epidemiologic approach, with suitable test and control groups. A precondition is the demonstration that the method used to block transmission is both effective and selective. Ultraviolet air disinfection, applied appropriately, is highly selective for airborne droplet nuclei and its effectiveness against many organisms has been demonstrated [3].

Tuberculosis targets the alveolar macrophages
→ It needs to get very deep into lungs to infect

Inhaled medication and pulmonary deposition



B.L. Laube, H.M. Janssens, F.H.C. de Jongh, S.G. Devadason, R. Dhand, P. Diot, M.L. Everard, I. Horvath, P. Navalesi, T. Voshaar, H. Chrystyn
European Respiratory Journal 2011 37: 1308-1417; **DOI:** 10.1183/09031936.00166410

What is an aerosol?

nature communications

SARS-CoV-2 disease severity and transmission efficiency is increased for airborne compared to fomite exposure in Syrian hamsters

Transmission of SARS-CoV-2 is driven by contact, fomite, and airborne transmission. The relative contribution of different transmission routes remains subject to debate. Here, we show Syrian hamsters are susceptible to SARS-CoV-2 infection through intranasal, aerosol and fomite exposure. Different routes of exposure present with distinct disease manifestations. Intranasal and aerosol inoculation causes severe respiratory pathology, higher virus loads and increased weight loss. In contrast, fomite exposure leads to milder disease manifestation characterized by an anti-inflammatory immune state and delayed shedding pattern. Whereas the overall magnitude of respiratory virus shedding is not linked to disease severity, the onset of shedd
severity. Airborne transmission is mor
on the direction of the airflow. Careful

Human Influenza Resulting from Aerosol Inhalation

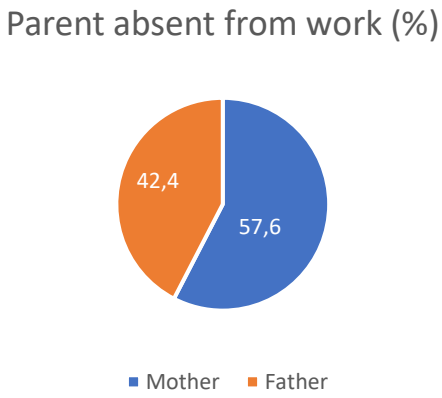
Robert H. Alford, Julius A. Kasel, Peter J. Gerone, more...

First Published July 1, 1966 | Research Article

Volunteers were given A2 influenza virus in a small-particle aerosol. Infection and typical influenza resulted from low doses of virus administered in this manner. Low levels of serum neutralizing antibody were not completely effective in preventing infection and illness. The human infectious dose of this influenza strain when administered by aerosol to subjects free of serum neutralizing antibody was approximately 3 $TCID_{50}$.

Reference study

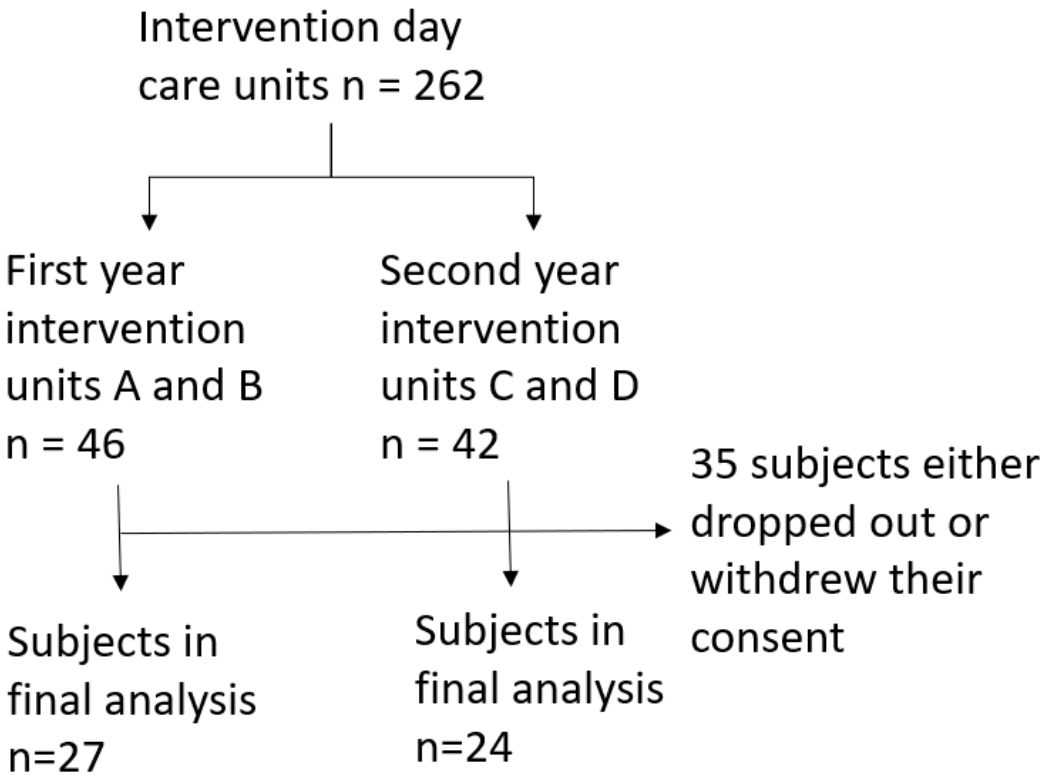
- 394 children participated
- 0.85 days/child/month
- 55.4% of the sickness episodes didn’t cause adult’s absence from work (grandparents and remote working might affect to some extent)
- 15% of the times when the child was sick, they were taken to the doctor
- 7.5% of the times when the child was sick, antibiotics were prescribed.
- 49.6% of the times the child was taken to the doctor, they got antibiotics.



- The significance of the difference was tested with Wilcoxon signed rank test
- $p<0.001$ compared to 50-50

Methods - Design

- Four daycare centers were included in the **two-year crossover study**.
- Data was collected by electronic journals between **November and April** during winters 2022-2023 and 2023-2024
- All children attending the daycare were invited to participate (n = 262), consent was obtained from 88 guardians. 35 withdrew their consent or were lost to follow up resulting in **51 subjects** for the final analysis.



Methods - Intervention

- Clean air flow rate was increased by **2.1-2.9 times** compared to baseline mechanical ventilation of the premises.
- Intervention was implemented in two of the four day care centers each year
- Placement was guided by risk model

Day care center	Number of persons	Clean air flow rate (l/s/person)		Multiplication factor in clean air flow rate
		Control sequence (Mechanical ventilation only)	Intervention sequence (Mechanical ventilation + PAC)	
A	123	12·8	27·5	2·2
B	110	11·9	29·1	2·4
C	105	19·0	40·6	2·1
D	105	14·5	42·3	2·9
Average		**14·5**	**34·9**	**2·4**

VA Vartiainen, J Hela, A Luoto, P Nikuri, E Sanmark, A Taipale, I Ehder-Gahm, N Lastovets, P Sormunen, I Kulmala, A Säämänen
The effect of room air cleaners on infection control in day care centres
Indoor Environments 2024 Mar; 1(1)

Results

- The effect of intervention was compared using negative binomial regression.
- Age, sex, period, and sequence were included as cofactors

Primary outcome:

- The intervention reduced incident infections from **0.95 to 0.78 infections per child per month** among the children (primary outcome) in daycare.
- The reduction attributed to intervention in the statistical model was **18.0 %** (95% CI 2.1-31.3 %, **p = 0.028**)

Secondary outcome:

- Non-significant decrease of 15.8 % in work absences of the parents was observed
- Decrease did not reach statistical significance (95% CI -0.29 – 0.64, p = 0.46).

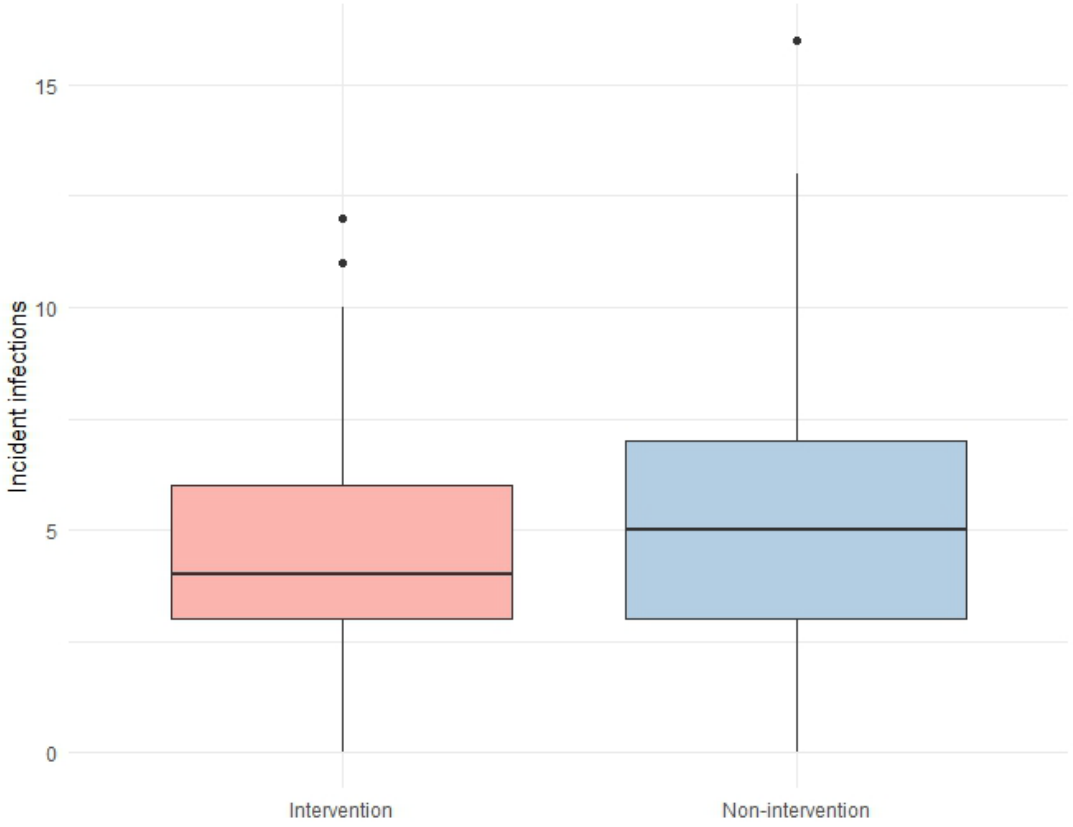


Figure 2: Cumulative infections during the intervention periods of the two-year study

Conclusions

- We observed a significant decrease in incident infections without implementing any other infection mitigation strategies but air cleaning.
- Our results challenge the current paradigm which still emphasizes fomite and contact transmission and infection control measures that target these pathways.
- As ventilation and air cleaning can only affect particles able to float in the air stream, **our results support the significance of airborne transmission** among common respiratory pathogens as well as air cleaning as a control measure.

Thank you!

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