Para: Gerência Geral de Rádio e TV/ Gerências Operacionais/ Diretoria de Comunicação/ Direção-Geral da Assembleia/ Gerência-Geral de Saúde Ocupacional

Por: Servidores Efetivos da Gerência-Geral de Rádio e Televisão - Assembleia

Assunto: Manutenção do trabalho remoto em virtude de confirmação de caso de COVID no setor e outros suspeitos

Data: 19/11/2020

Considerando

a suspeita de surto de infecção pelo coronavírus entre trabalhadores da TV Assembleia com 2 (dois) casos, sendo um de servidor efetivo e outro de terceirizado, já confirmados (até a data presente) e ao menos outros 5 (cinco) aguardando resultado de exames;

a existência de estudos científicos que apontam o risco de transmissão em ambientes fechados a mais de dois metros da pessoa infectada e também a possibilidade de transmissão pelos olhos;

que o ambiente de trabalho da nossa Gerência-Geral não possui janelas e é atendido por sistema de ar condicionado que conecta todos os espaços de trabalho;

que todos os trabalhadores terceirizados da TV e da Rádio Assembleia foram convocados ao trabalho presencial, o que faz com que tenhamos no setor a presença maior que 30% de trabalhadores;

que a colega testada positivo esteve em contato com toda a equipe de trabalho da TV Assembleia, transitando por todos os setores, em virtude da Cobertura da Eleições 2020;

que profissionais da tv, especialmente repórteres e vários terceirizados, são vetores potenciais de risco de propagação de vírus para todos os demais setores da Assembleia, inclusive, para parlamentares;

que locutores e operadores da Rádio Assembleia trabalham em cabines e um estúdio fechados, em que a mudança de turno implica um profissional assumir o lugar em que o outro permaneceu horas, falando ao microfone e manuseando equipamentos, ou seja, um expondo o outro,

e que a morte de servidor ou terceirizado submetido ao risco de infecção pelo coronavírus pode gerar responsabilidade civil do Estado, com a posterior condenação à indenização pelos danos causados, conforme art. 37, § 6º da Constituição Federal,

nós, servidores lotados nas Gerência-Geral de Rádio e Televisão apresentamos, por meio deste ofício, pedido de urgente interdição do setor para sanitização adequada e adoção de medidas protocolares, recomendadas por autoridades sanitárias, em ambientes semelhantes ao nosso: fechado e com maior possibilidade de contágio e propagação do vírus.

Expomos abaixo razões do pedido e da solicitação ainda de esclarecimento em relação ao protocolo de retomada gradual do trabalho presencial - Assembleia Segura, que teve início no dia 16 de novembro.

O possível surto coincide com a convocação de quase a totalidade de servidores e trabalhadores terceirizados para atuação na cobertura jornalística do primeiro turno das eleições no dia 15 de novembro. O provável paciente zero já apresentava sintomas gripais desde a sexta-feira (13 de novembro) e compareceu ao trabalho presencial no domingo de eleição e somente foi afastado no dia 18 de novembro. Nesses cinco dias de contato com vários integrantes da equipe, ressaltamos um cenário de transmissão mais perigoso com a presença da colega infectada, no dia 15 de novembro, na sala de lanche, instalada no andar semienterrado (SE) do Palácio da Inconfidência para alimentação de todos os colaboradores convocados para o trabalho naquele dia. A cobertura das eleições foi realizada sem algumas medidas preventivas, como a aferição de temperatura.

Detalhando agora a questão da convocação de 100% dos trabalhadores terceirizados para trabalhar presencialmente, ultrapassou-se, em muito, nos espaços da TV e da Rádio Assembleia, a presença de 30% de trabalhadores, conforme Deliberação 2.754/2020 destinada aos efetivos. Ora, para certos setores, sem número de terceirizados como temos, a realidade nos parece bem diferente. O nosso cenário é de prejuízo claro do distanciamento social necessário para evitar a propagação da infecção. No caso dos terceirizados, foi-nos informado que pertencentes a grupos de risco acabaram convocados ao trabalho presencial, o que fere sobremaneira a dignidade da pessoa humana, o direito à saúde, o princípio da razoabilidade na Administração Pública e a isonomia em relação ao tratamento adotado para o quadro efetivo da Assembleia de Minas.

Quanto aos estudos científicos que apontam a possibilidade de infecção, em ambientes fechados, a distância maiores do que dois metros em relação à pessoa infectada, isso ocorre porque o novo coronavírus penetra as mucosas humanas, sendo que olhos, desprotegidos pelas máscaras, também representam porta de contaminação. Outra ação que gera risco é a retirada da máscara para ingestão de líquidos ou refeições, feitas na Copa da GTV. Além disso, não nos foram apresentados estudos técnicos que demonstrem que o equipamento de refrigeração do ambiente promova renovação do ar, de modo a garantir segurança mínima do ambiente.

Deve-se salientar que mesmo com a adoção do trabalho remoto e escala presencial mínima, a TV Assembleia transmitiu ao vivo todos os trabalhos de Plenário e Comissões e produziu cerca de mil conteúdos inéditos para a programação e para as redes sociais do Legislativo Mineiro. Já a Rádio Assembleia manteve cobertura remota de todos os eventos da Casa e também lançou programas inéditos, sem deixar de repassar boletins para toda a sua rede de emissoras parceiras no interior. Ou seja, servidores efetivos e terceirizados, desde março, realizaram as entregas esperadas do setor sem se submeter, intensamente, a um ambiente de trabalho sem ventilação natural e espaço físico seguro para este período de pandemia.

Registramos, por fim, que temos presenciado condutas individuais contrárias às orientações sanitárias divulgadas pela própria Assembleia. Portanto, diante da ciência do direito à defesa de nossa própria saúde, solicitamos que servidores da Gerência-Geral de Rádio e TV sejam mantidos em trabalho remoto até que sejam atendidas as demandas elencadas abaixo:

> protocolo de saúde que garanta, de modo efetivo, o afastamento preventivo imediato de trabalhadores de quaisquer vínculos com a Casa, que apresentem sintomas, quadro suspeito ou condições de contato que coloquem em risco a vida dos colegas;
>
> afastamento imediato de trabalhadores que tiveram contato mínimo com pessoas infectadas ou com casos suspeitos;

que todo o quadro funcional seja considerado para o percentual de 30% de pessoal presencial, estabelecido pela Casa e não apenas servidores. Reiteramos que é possível comprovar o trabalho remoto feito pela maioria dos terceirizados;

apresentação de estudo técnico independente em relação ao ambiente de trabalho, ao sistema de ar condicionado do setor e à sanitização dos mesmos;

estudo para transferência provisória de maquinário, estações de trabalho, controles de vídeo de Plenário e Comissões para ambientes ventilados, como salas do Edifício Tiradentes, Edifício Carlos Drummond de Andrade ou divisórias instaladas no Edjao.

Anexos, encaminhamos estudos científicos que comprovam a transmissão pelo ar a mais de dois metros em ambientes fechados; o aumento do risco de contaminação em ambientes fechados; a possibilidade de transmissão pelos olhos; e a recomendação sanitária para isolamento do paciente zero, bem como dos contatos, conforme mapeamento da rota de contágio, além de testagem em massa do setor.

COVID-19 transmission—up in the air

As we approach the end of 2020, and a year since the outbreak of COVID-19 began, cases are increasing again. We have learnt a lot about SARS-CoV-2 and our ability to test for and manage COVID-19 has improved, but ongoing debate remains about how SARS-CoV-2 is transmitted.

Respiratory viruses are transmitted in three main ways. First, contact transmission, where someone comes into direct contact with an infected person or touches a surface that has been contaminated. Second, through droplet transmission of both large and small respiratory droplets that contain the virus, which would occur when near an infected person. Third, through airborne transmission of smaller droplets and particles that are suspended in the air over longer distances and time than droplet transmission.

During the initial stages of the pandemic there was concern about surface transmission. However, latest research suggests that this is unlikely to be a major route of transmission as although SARS-CoV-2 can persist for days on inanimate surfaces, attempts to culture the virus from these surfaces were unsuccessful.

Infection control guidelines have stated that most respiratory virus transmission occurs from large infected droplets produced by coughing, sneezing, and breathing in close proximity to another person. This understanding has led to social distancing being the cornerstone of public health advice, but confusion exists as to the safe distance required between people to reduce transmission with the WHO suggesting 1 m and the CDC and NHS saying 2 m. For social distancing to be effective, infective respiratory particles would need to fall to the ground or be in low enough concentrations at 2 m from the source to not cause transmission. Studies and guidelines have historically used a threshold of 5 μm to differentiate between large and small particles, but researchers are now suggesting that a size threshold of 100 μm better differentiates aerodynamic behaviour of particles, and particles that would fall to the ground within 2 m are likely to be 60–100 μm in size. Investigators have also measured particle sizes of infectious aerosols and have shown that pathogens are most commonly found in small particle aerosols (<5 μm), which are airborne and breathable.

Initially it was thought that airborne transmission of SARS-CoV-2 was unlikely, but growing evidence has highlighted that infective microdroplets are small enough to remain suspended in the air and expose individuals at distances beyond 2 m from an infected person. This knowledge is also corroborated by investigation of spread of cases between people who were not in direct or indirect contact, suggesting that airborne transmission was the most likely route. In July, over 200 scientists published a statement calling for international bodies to recognise the potential for airborne spread of COVID-19 as they were concerned that people would not be fully protected by adhering to the current recommendations.

On Oct 5, 2020, the CDC updated their COVID-19 webpage to say that there is growing evidence that COVID-19 infection can occur from airborne exposure to the virus under certain circumstances. Cases of transmission from people more than 2 m apart have occurred but in enclosed spaces with poor ventilation, and typically with extended exposure to an infected person of more than 30 min. The CDC have been clear to point out that most infections are spread through close contact and that airborne transmission is not the primary route of transmission.

Whether droplet or airborne transmission is the main route, the risk of infection is known to be much lower outside where ventilation is better. As winter approaches in the northern hemisphere, the opportunity to socialise and exercise outdoors becomes more challenging and concerns are growing over the increased risk of transmission of COVID-19. Public health guidance now needs to advise people how to navigate risk in indoor settings and wearing facemasks is becoming mandatory in many countries for travelling on public transport, indoor shopping, and gatherings. Facemasks and shields offer protection from larger droplets but their effectiveness against airborne transmission is less certain. Advice on spending time indoors should also focus on improved ventilation and avoiding crowded spaces.

As 2021 draws near, people are getting tired of the disruption the pandemic has brought to their lives and their willingness to adhere to strict rules and lockdowns might wane. As cases of COVID-19 increase globally, we need to more fully understand the transmission routes. It is crucial that we embrace new research and do not rely on recommendations based on old data so that clearer and more effective infection control guidance can be provided in the face of pandemic fatigue.

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For more on **SARS-CoV-2 transmission by fomites** see **Correspondence** in *Lancet Infect Dis* 2020; published online Sept 20. https://doi.org/10.1016/S1473-3099(20)30678-2

For more on **airborne transmission and aerodynamic behavior** see https://science.sciencemag.org/content/370/6514/303.2

For more on **particle sizes of infectious aerosols** see **Viewpoint** in *Lancet Respir Med* 2020; **8:** 914–24

For more on the **WHO advice for the public** see https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

For the **statement on airborne transmission of COVID-19** see https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciaa939/5867798

For more on the **CDC brief on potential airborne transmission** see https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html

For more on **CDC guidance of face masks on public transport** see https://www.cdc.gov/quarantine/masks/mask-travel-guidance.html

Clinical Infectious Diseases

INVITED COMMENTARY

It Is Time to Address Airborne Transmission of Coronavirus Disease 2019 (COVID-19)

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Keywords. airborne transmission; airborne infection spread; coronavirus; COVID-19; SARS-CoV-2 virus.

We appeal to the medical community and to the relevant national and international bodies to recognize the potential for airborne spread of coronavirus disease 2019 (COVID-19). There is significant potential for inhalation exposure to viruses in microscopic respiratory droplets (microdroplets) at short to medium distances (up to several meters, or room scale), and we are advocating for the use of preventive measures to mitigate this route of airborne transmission.

Studies by the signatories and other scientists have demonstrated beyond any reasonable doubt that viruses are released during exhalation, talking, and coughing in microdroplets small enough to remain aloft in air and pose a risk of exposure at distances beyond 1–2 m from an infected individual ([1–4]). For example, at typical indoor air velocities [5], a 5-µm droplet will travel tens of meters, much greater than the scale of a typical room, while settling from a height of 1.5 m to the floor. Several retrospective studies conducted after the severe acute respiratory syndrome coronavirus 1 (SARS-CoV-1) epidemic demonstrated that airborne transmission was the most likely mechanism explaining the spatial pattern of infections [6]. Retrospective analysis has shown the same for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [7–10]. In particular, a study in their review of records from a Chinese restaurant observed no evidence of direct or indirect contact between the 3 parties [10]. In their review of video records from the restaurant, they observed no evidence of direct or indirect contact between the 3 parties. Many studies conducted on the spread of other viruses, including respiratory syncytial virus (RSV) [11], Middle East Respiratory Syndrome Coronavirus (MERS-CoV) [8], and influenza [2, 4], show that viable airborne viruses can be exhaled [2] and/or detected in the indoor environment of infected patients [11, 12]. This poses the risk that people sharing such environments can potentially inhale these viruses, resulting in infection and disease. There is every reason to expect that SARS-CoV-2 behaves similarly, and that transmission via airborne microdroplets [10, 13] is an important pathway. Viral RNA associated with droplets <5 µm has been detected in air [14], and the virus has been shown to maintain infectivity in droplets of this size [9]. Other viruses have been shown to survive equally well, if not better, in aerosols compared to droplets on a surface [15].

The current guidance from numerous international and national bodies focuses on hand washing, maintaining social distancing, and droplet precautions. Most public health organizations, including the World Health Organization (WHO) [16], do not recognize airborne transmission except for aerosol-generating procedures performed in healthcare settings. Hand washing and social distancing are appropriate but, in our view, insufficient to provide protection from virus-carrying respiratory microdroplets released into the air by infected people. This problem is especially acute in indoor or enclosed environments, particularly those that are crowded and have inadequate ventilation [17] relative to the number of occupants and extended exposure periods (as graphically depicted in Figure 1). For example, airborne transmission appears to be the only plausible explanation for several superspreading events investigated that occurred under such conditions [10], and others where recommended precautions related to direct droplet transmissions were followed.

The evidence is admittedly incomplete for all the steps in COVID-19 microdroplet transmission, but it is similarly incomplete for the large droplet and fomite modes of transmission. The airborne transmission mechanism operates in parallel with the large droplet and fomite routes [16] that are now the basis of guidance. Following the precautionary principle, we must address every potentially important pathway to slow the spread of COVID-19. The measures

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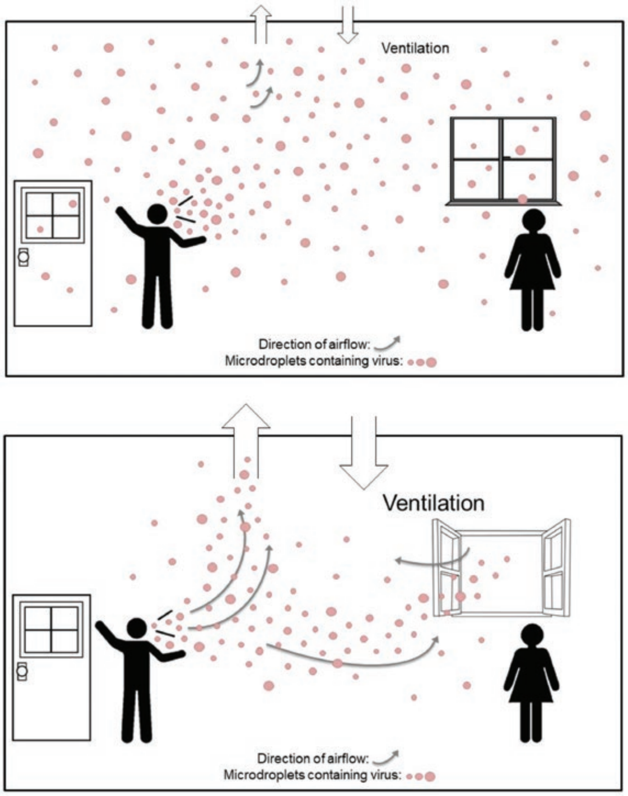

Figure 1. Distribution of respiratory microdroplets in an indoor environment with (*A*) inadequate ventilation and (*B*) adequate ventilation.

that should be taken to mitigate airborne transmission risk include:

- Provide sufficient and effective ventilation (supply clean outdoor air, minimize recirculating air) particularly in public buildings, workplace environments, schools, hospitals, and aged care homes.
- Supplement general ventilation with airborne infection controls such as local exhaust, high efficiency air filtration, and germicidal ultraviolet lights.
- Avoid overcrowding, particularly in public transport and public buildings.

Such measures are practical and often can be easily implemented; many are not costly. For example, simple steps such as opening both doors and windows can dramatically increase air flow rates in many buildings. For mechanical systems, organizations such as ASHRAE (the American Society of Heating, Ventilating, and Air-Conditioning Engineers) and REHVA (the Federation of European Heating, Ventilation and Air Conditioning Associations) have already provided guidelines based on the existing evidence of airborne transmission. The measures that we propose offer more benefits than potential downsides, even if they can only be partially implemented.

It is understood that there is not as yet universal acceptance of airborne transmission of SARS-CoV2; but in our collective assessment there is more than enough supporting evidence so that the precautionary principle should apply. In order to control the pandemic, pending the availability of a vaccine, all routes of transmission must be interrupted.

We are concerned that the lack of recognition of the risk of airborne transmission of COVID-19 and the lack of clear recommendations on the control measures against the airborne virus will have significant consequences: people may think that they are fully protected by adhering to the current recommendations, but in fact, additional airborne interventions are needed for further reduction of infection risk.

This matter is of heightened significance now, when countries are reopening following lockdowns: bringing people back to workplaces and students back to schools, colleges, and universities. We hope that our statement will raise awareness that airborne transmission of COVID-19 is a real risk and that control measures, as outlined above, must be added to the other precautions taken, to reduce the severity of the pandemic and save lives.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Notes

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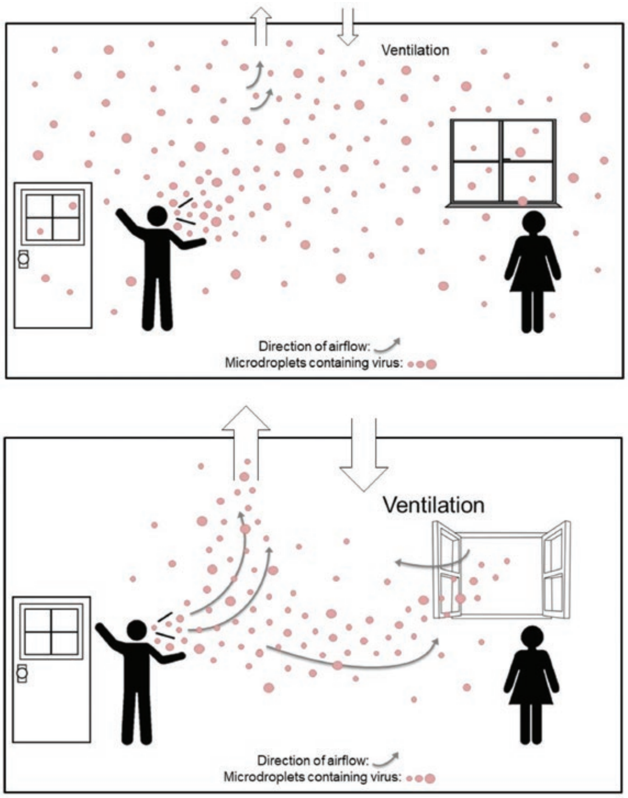
Ventilation
Direction of airflow:
Microdroplets containing virus:
Ventilation
Direction of airflow:
Microdroplets containing virus:

Figure 1

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Transmission of SARS-CoV-2 by inhalation of respiratory aerosol in the Skagit Valley Chorale superspreading event

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Abstract

During the 2020 COVID-19 pandemic, an outbreak occurred following attendance of a symptomatic index case at a regular weekly rehearsal on 10 March of the Skagit Valley Chorale (SVC). After that rehearsal, 53 members of the SVC among 61 in attendance were confirmed or strongly suspected to have contracted COVID-19 and two died. Transmission by the airborne route is likely. It is vital to identify features of cases such as this so as to better understand the factors that promote superspreading events. Based on a conditional assumption that transmission during this outbreak was by inhalation of respiratory aerosol, we use the available evidence to infer the emission rate of airborne infectious quanta from the primary source. We also explore how the risk of infection would vary with several influential factors: the rates of removal of respiratory aerosol by ventilation; deposition onto surfaces; and viral decay. The results indicate an emission rate of the order of a thousand quanta per hour (mean [interquartile range] for this event = 970 [680-1190] quanta per hour) and demonstrate that the risk of infection is modulated by ventilation conditions, occupant density, and duration of shared presence with an infectious individual.

Keywords: aerosol transmission, infectious disease, ventilation, virus, pandemic, risk

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Practical Implications

- During respiratory disease pandemics, group singing indoors should be discouraged or at a minimum carefully managed as singing can generate large amounts of airborne virus (quanta) if any of the singers is infected.
- Ventilation requirements for spaces that are used for singing (e.g., buildings for religious services and rehearsal/performance) should be reconsidered in light of the potential for airborne transmission of infectious diseases.
- Meetings of choirs and other kinds of singing groups during pandemics should only be in spaces that are equipped with a warning system of insufficient ventilation which may be detected with CO_2 “traffic light” monitors.
- Systems that combine the functions heating and ventilation (or cooling and ventilation) should be provided with a disclaimer saying “do not shut this system off when people are using the room; turning off the system will also shut down fresh air supply, which can lead to the spread of airborne infections.”

Introduction

SARS-CoV-2 was first reported in China at the end of 2019 and rapidly spread to the rest of the world over the subsequent months. Evidence from laboratory studies has shown that the SARS-CoV-2 virus can remain infectious while airborne for extended periods.[1,2] The virus has been detected by PCR in the air in several healthcare environments.[3-9] Researchers have reported values for the SARS-CoV-2 viral load in the mouth that span an extraordinarily broad range: 10^2 and 10^{11} copies per mL of respiratory fluid.[10-12] Viral loads vary over the course of the disease, tending to peak at the onset of symptoms.

Airborne transmission is now strongly suspected to play a significant role in superspreading events (SSEs) under certain conditions.[13] SSEs occur when a large number of secondary transmissions are produced early in an outbreak and transmission is sustained in later stages.[14] Some people release respiratory aerosol at an order of magnitude greater rate than their peers and might contribute to superspreading events.[15] The very broad range of viral loads in respiratory fluids may also be an important factor influencing SSE. An infectious respiratory aerosol is a collection of pathogen-laden particles in air emitted during respiring activities of an infected individual. [16]

In this paper, we first estimate the infectious quanta emission rate during a choir rehearsal that has been identified as a superspreading event. Quanta are used to represent infectious respiratory aerosol when the actual viral dose in the aerosol and the human dose-response required to cause infection are unknown.[17,18] We then explore the sensitivity of the secondary attack rate of infection to the loss rate of airborne virus, whether by ventilation, deposition onto surface, or biological decay.

Case Study

An SSE occurred in Skagit Valley, Washington, USA.[19] When the Skagit Valley Chorale (SVC) met on the evening of March 10, 2020, one person attending the rehearsal had cold-like symptoms that had developed three days earlier; that individual subsequently tested positive for COVID-19. This person is considered the “index case.” At the time of the rehearsal the Skagit County Health Department was not recommending widespread closure of public venues or public events. They were recommending that those 60 y of age and older should avoid large public gatherings. Choral members were told by the director in an email to not attend on March 10 if they were sick with *any kind of symptoms* or if they had concerns.

At the time of the rehearsal, there were no known COVID-19 cases in Skagit Valley County, nor were any closures in effect. The day after the rehearsal on March 11, the governor of Washington recommended physical distancing and no large group meetings in three other nearby counties. Before detecting the cluster on March 17, Skagit county had developed seven COVID-19 cases.

The SVC has 122 members, but only 61 attended rehearsal on March 10, amid concerns about COVID-19 transmission. Precautions were taken during rehearsal, including the use of hand sanitizer, no hugging or handshakes.[20]

Some members began experiencing illness from March 11 to March 15. The timing of these potential secondary infections is consistent with what is known about the temporal dynamics of virus shedding and the serial interval for COVID-19.[21] Among the 61 attendees at the rehearsal, 53 cases in total were subsequently identified including the index case, with 33 confirmed through positive COVID-19 tests and 20 unconfirmed but probable secondary cases based on symptoms and timing. Accounting for the one presumed index case, the secondary infection attack rate is thus in the range 32/60 to 52/60, or 53-87%.

The chorale met in the Fellowship Hall of a church in Mount Vernon, Skagit County. A seating chart obtained through personal communication showed the layout of participants among 120 chairs plus the position of the choir director and piano accompanist. Although the chart cannot be reproduced because of privacy concerns,[19] a centrally important point for interpreting the cause of transmission is that the cases were broadly distributed throughout the room with no clear spatial pattern.

The rehearsal started at 6:30 pm. The SVC rehearsed in a single group in the Fellowship Hall for 45 minutes, then split into two approximately equal-sized groups for 45 minutes. One group, mostly male singers, went to practice around a piano in a different room of the church, while a second group stayed in the Fellowship Hall. After practicing separately, and following a 10-minute break, the members reconvened in the Fellowship Hall for another 50 minutes, until 9 pm. During the split session, those who remained in the Fellowship Hall occupied about half of the space.

Limited information is available about the heating and ventilating system; what was learned from personal communications is summarized here. The Fellowship Hall is heated by a relatively new commercial forced-air furnace. Three supply air registers are situated 2.4 m above the floor on one wall with a single return on an adjacent wall, just above the floor (~0.15 m). Someone in the front office reportedly turned on the heating system prior to the rehearsal to warm the space, and the thermostat was set to 20 °C (68 °F). It was about 7 °C (45 °F) outside, so the heating was on at the start of the rehearsal, but with so many people in the room, it did not need to stay on to maintain a comfortable temperature. During the entire rehearsal no exterior doors were open. It is not known whether the forced-air furnace fan operated (only) under thermostatic control or whether it ran continuously. The furnace is installed with both outside make-up and combustion air, but it is not known how much outside make-up air was supplied that evening. The furnace is also outfitted with a MERV 11 filter, which has a single-pass efficiency of ≥ 30-65% for airborne particles of diameter 1 μm or larger.[22,23]

Modeling Airborne Infection Risk

Inhalation of respiratory aerosol most likely dominated infection transmission during this event, as other modes of transmission are unlikely to account for the high secondary attack rate. For example, it seems infeasible that all attendees touched the same surface(s) as the index case. Furthermore, rehearsal attendees expressed that they had taken great care to minimize contact transmission (personal communication). There is no evidence to suggest that more than one person was infected at the time of the rehearsal. The index case would have spent extended time within a few meters of only a small proportion of the rehearsal attendees. Other close contact events that extend to a high proportion of the attendees would have been brief and incidental. Consequently, we believe it likely that shared air in the Fellowship Hall, combined with high emissions of respiratory aerosol from singing, were important contributing factors.

On the basis of the available information about this event, a modeling effort was undertaken with two goals. The first goal was to estimate an average quanta emission rate that is consistent with the evidence. The calculation proceeds in two steps: determining the average airborne quanta concentration from the reported secondary infection attack rate, and then evaluating the emission rate that would have produced the inferred average concentration. The second modeling goal was to explore how a change in the loss rates, for example owing to improved ventilation and filtration, would have altered the infection risk. In pursuing both goals, the modeling effort uses an idealization of the more complex real situation, in part because some key data are lacking. A similar approach has been used in other studies to explore airborne infection risk in indoor environments.[17,24]

The model of infection risk due to airborne transmission is based on the Wells-Riley formulation,[25,26] as amended by Gammaitoni and Nucci.[27] In applying this approach, these assumptions are made: i) there is one infectious individual who emits SARS-CoV-2 quanta at a constant rate throughout the event, ii) there is no prior source of quanta in the space, iii) the latent period of the disease is longer than the time scale of the model, iv) the infectious respiratory aerosol quickly becomes evenly distributed throughout the room air, and v) infectious quanta are removed by first-order processes reflecting the sum of ventilation, filtration, deposition, and inactivation. The assumption that the indoor environment can be modeled as well-mixed is substantiated in this case by the broad spatial distribution of secondary infections among the rehearsal participants. In epidemic modelling, where the aim is to assess the spread of the disease in the community, it is impossible to specify geometries, ventilation efficiency, and the locations of the infectious sources in each microenvironment. Therefore, adopting the well-mixed assumption is generally more reasonable than hypothesizing about specific patterns of emissions, airflow and removal processes.[28] This distinctive superspreading event, occurring in an enclosed community facility, with indoor space shared for a specified period of time, offers a unique opportunity to examine a range of physical parameters that influence the eventual outcome.

The modeled probability of infection (p) is related to the number of quanta inhaled (n) according to equation (1):[26]

$$p = 1 - e^{-n} \qquad (1)$$

Equation (1) is used to estimate the average quanta concentration during the practice. The airborne quanta concentration increases with time from an initial value of zero following a "one minus exponential" form, which is the standard dynamic response of a well-mixed indoor volume to a constant input source. The time-average quanta concentration (C_{avg}, q m^{-3}) is the quanta inhaled divided by the volume of air breathed. The volume of air breathed (m^3) is equal to the duration of the event (D, h) multiplied by the volumetric breathing rate of rehearsal participants (Q_b, m^3 h^{-1}).

A well-mixed material balance model for the room (equation (2)) is applied next to relate the quanta concentration, C (quanta per m^3), to the emission rate, E (quanta per h):

$$\frac{dC}{dt} = \frac{E}{V} - \lambda C \qquad (2)$$

Here V = volume of the rehearsal hall (m^3) and λ = first-order loss rate coefficient for quanta (h^{-1}) due to the summed effects of ventilation (λ_v), deposition onto surfaces (λ_{dep}), and virus decay (k).[29] Assuming the quanta concentration is 0 at the beginning of the rehearsal, equation (2) is solved and the average concentration determined as follows:

$$C(t) = \frac{E}{\lambda V}\left(1 - e^{-\lambda t}\right) \qquad (3)$$

$$C_{avg} = \frac{1}{D}\int_0^D C(t)\,dt = \frac{E}{\lambda V}\left[1 - \frac{1}{\lambda D}\left(1 - e^{-\lambda D}\right)\right] \qquad (4)$$

Here, t = time (h). Equation (4) is rearranged to solve for the emission rate, E:

$$E = \lambda V C_{avg}\left[1 - \frac{1}{\lambda D}\left(1 - e^{-\lambda D}\right)\right]^{-1} \quad (5)$$

A Monte Carlo simulation was run (N = 1000) to estimate E for the superspreading event given a range of input values. The unknown parameters (p, Q_b, λ_v, λ_{dep}, k) were specified as probabilistic using uniform distributions bounded by specified upper and lower limits. These parameters were assumed to be uncorrelated.

The ranges of the uncertain model parameter values explored in the Monte Carlo simulation are summarized in Table 1. Constant values were used for the volume of the Fellowship Hall and the rehearsal duration.

Table 1. Parametric Values used in the Monte Carlo Simulation for Estimating E

Parameter	Value(s)	Distribution	Reference(s)
Probability of Infection, p (%)	53-87	Uniform	19
Volumetric Breathing Rate, Q_b (m^3 h^{-1})	0.65-1.38	Uniform	30, 31
Loss Rate due to Ventilation, λ_v (h^{-1})	0.3-1.0	Uniform	Appendix
Loss Rate due to Deposition onto Surfaces, λ_{dep} (h^{-1})	0.3-1.5	Uniform	32, 33
Loss Rate due to Virus Inactivation, k (h^{-1})	0-0.63	Uniform	1, 2
Volume of Rehearsal Hall, V (m^3)	810	Constant	Personal Communication
Duration of Rehearsal, D (h)	2.5	Constant	19

Volumetric inhalation rates of singers have been reported by Binazzi et al.[31] to be in the range 0.22-1.0 m^3 h^{-1} and by Adams et al.[30] to be 1.38 m^3 h^{-1}. SARS-CoV-2 was found in air samples in two size ranges: 0.5-1 μm and > 2.5 μm.[7] The surface deposition loss rate range was based on data from Thatcher et al.[33] and Diapouli et al.[32] The range of values for virus decay is based on two sources: Fears et al.[1] showed no decay in virus-containing aerosol for 16 hours at 53% RH, whereas van Doremalen et al.[2] estimated the half-life of airborne SARS-CoV-2 is 1.1 h, which equates to a decay rate of 0.63 h^{-1}. The loss rate due to ventilation is likely to have been in the range from 0.3 to 1 h^{-1} (see Appendix).

Results

The mean (± standard deviation) inferred emission rate was E = 970 (± 390) quanta per h. Additional statistics for the distribution of E from the Monte Carlo simulation are as follows: geometric mean = 900 q h^{-1}; geometric standard deviation = 1.5; 10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th} percentiles: 550, 680, 910, 1180, 1510 q h^{-1}.

The emission rate was derived based on an assumption of one index case. It is plausible that more than one person attending the rehearsal was infectious, given that the disease was diagnosed in some of the singers soon after the March 10 rehearsal. If this was the case then our emission rate would be the sum of emission rates from each infectious individual. However, the average incubation time for this case was ~3-4 days, which is comparable to literature reports, making the presence of additional index cases less likely.

Quanta emission rates for influenza have been reported to be in the range 15-128 quanta h^{-1};[17,34] for measles: 5,580 q h^{-1};[35] and for tuberculosis: 1.25 to 30,840 q h^{-1} (the high value attributed to intubation).[36] The quanta for SARS transmission in a hospital and in an elementary school was estimated to be 28 q h^{-1}.[37] A forward model was used to estimate a large range of estimated quanta emission rates for SARS-COV-2, depending on activity level and respiratory activity: 10.5-1030 quanta h^{-1}.[24]

To explore the influence of changing the loss rate on the probability of infection, we performed sensitivity simulations in which we varied the loss rate. In these simulations, we used the mean emission rate of E = 970 q h^{-1} and a constant volumetric breathing rate of Q_b = 1.0 m^3 h^{-1}. If λ is systematically increased by some combination of increased ventilation, deposition, filtration, and inactivation loss rates, how would the probability of infection decrease? We also explored what would happen if the emission rate was set at the 10^{th} and 90^{th} percentile values from the Monte Carlo simulation. Using the model equations above with λ ranging from 0.6 to 12 h^{-1}, the percentage of the rehearsal participants infected is determined. The results are plotted in Figure 1.

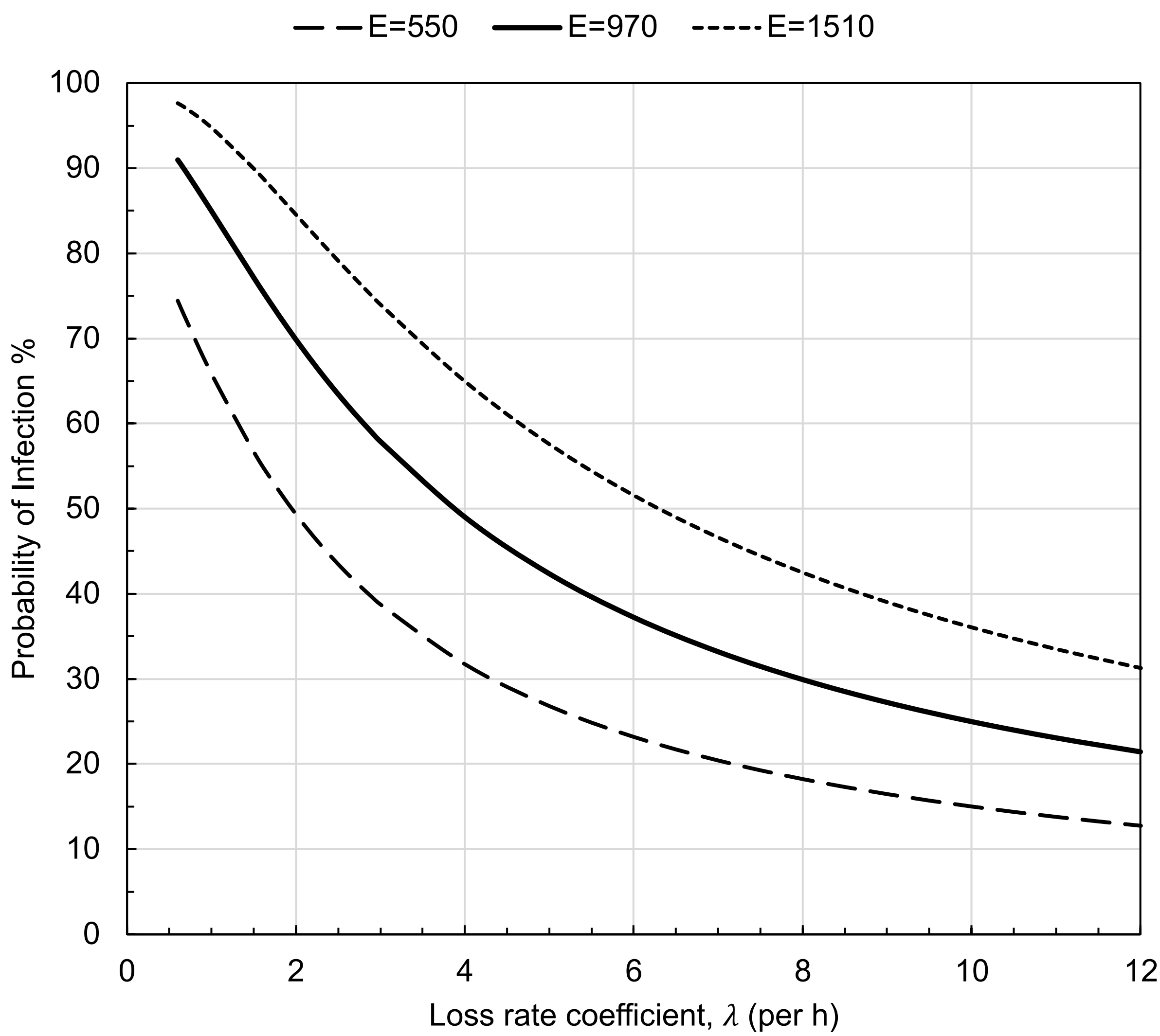

Figure 1. *Probability of infection for each rehearsal participant as a function of loss rates for varying airborne quanta emission rates (E, q h^{-1}). Infection probability is plotted for the predicted mean emission rate (970 q h^{-1}) and the 10^{th} and 90^{th} percentile emission rates (550 and 1510 q h^{-1}, respectively.) A rehearsal duration of 2.5 hours, an indoor volume of 810 m^3 and a volumetric breathing rate of 1.0 m^3 h^{-1} were assumed.*

A key point displayed in Figure 1 is that, for the mean value E = 970 q h^{-1}, increasing the loss rate coefficient from a nominal baseline value of 0.6 h^{-1} to 5 h^{-1} would reduce the probability of infection by a factor greater than two, from 91% to 42%. For the full range of loss rates plotted in Figure 1, the infection risks spans a factor of four: from 91% to 21%.

We also explored how changing the duration of the event would impact the probability of infection as a function of loss rate. Again, we use the mean emission rate of 970 q h^{-1} and a volumetric breathing rate of 1.0 m^3 h^{-1}. For durations ranging from 0.5 to 2.5 hours, and λ ranging from 0.6 to 12 h^{-1}, the predicted percentage infected ranged broadly, from 4% to 91%. The results are plotted in Figure 2.

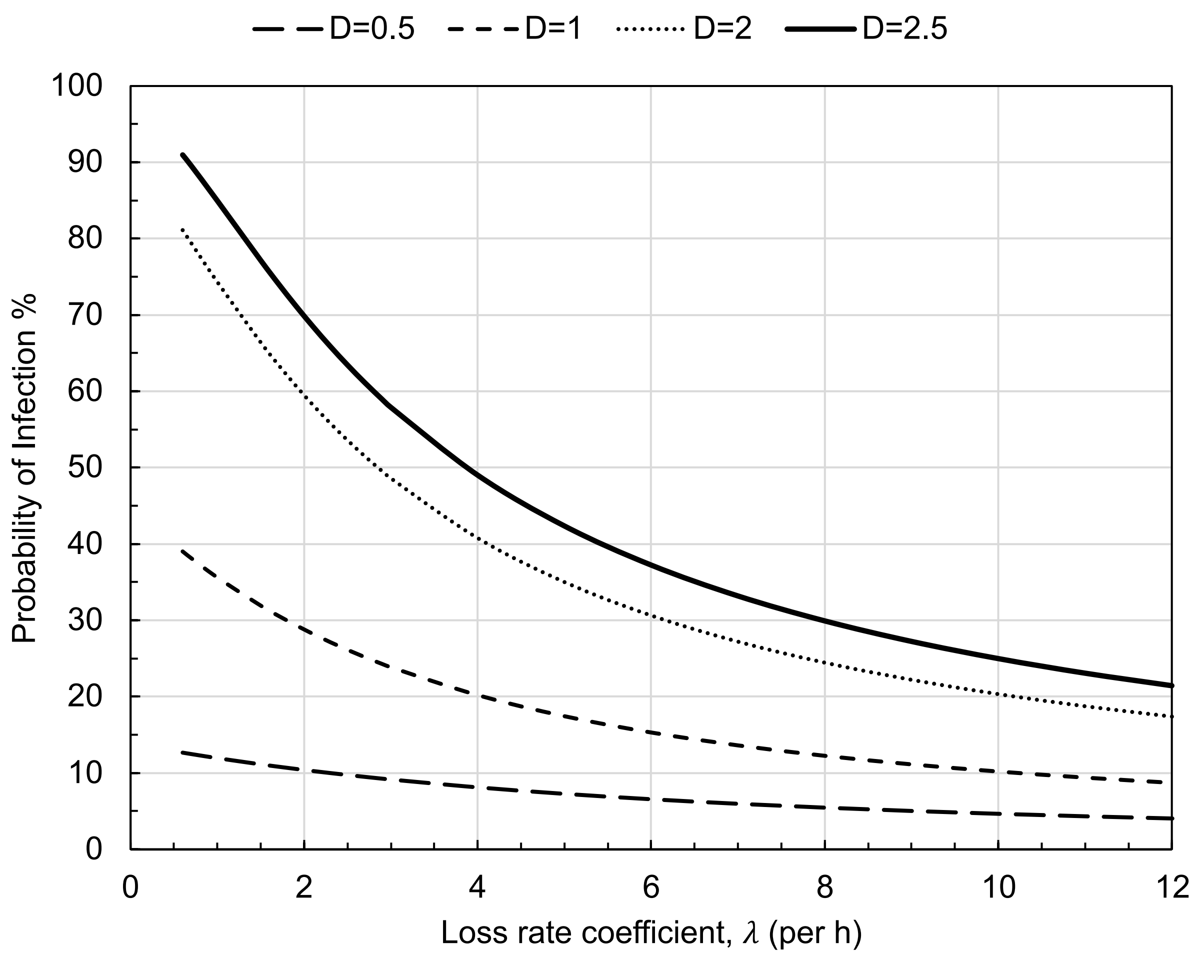

Figure 2. *Probability of infection as a function of loss rates for varying event duration (D, h). A mean emission rate (970 q h^{-1}) and constant volumetric breathing rates of 1.0 m^3 h^{-1} were assumed.*

Discussion

Growing evidence supports a view that inhaling respiratory aerosol is an important route for transmission of SARS-CoV-2 under certain conditions. At the time of the chorale rehearsal on 10 March 2020, because of emerging concern about SARS-CoV-2, person-to-person contact and touching of surfaces was consciously limited. The risk of widespread transmission owing to close contact would seem to be low in this event, considering that there is believed to have been only one index case who would have been seated in proximity to only a small proportion of the other chorale members. If transmission by close contact and/or fomites were indeed the dominant modes of transmission, then the secondary attack rate should have been much smaller than the observed range of 53-87%. We would also expect to see the secondary cases predominantly among those in closer proximity to the index case rather than distributed broadly throughout the room. Given the circumstances of the rehearsal, such a high secondary attack rate by the close-contact route would have necessitated effective transmission based largely on brief proximate encounters. That interpretation of the high attack rate in this event seems much less probable than the alternative explanation, i.e. that inhalation of infectious respiratory aerosol from "shared air" was the leading mode of transmission.

Literature evidence suggests that singing could have been a contributing factor to the high secondary attack rate compared to other common indoor activities. The rate of aerosol emission during vocal activities increases with the loudness of the sound.[15] A study of respiratory emissions also found higher emission rates of respiratory droplets to be associated with more extensive vocalization.[38] Outbreaks of tuberculosis, a disease known to be transmitted via inhalation, have been linked to singing.[39-41] At the time this article is being written, there have been additional media reports of COVID-19 outbreaks associated with choirs. Cases with high secondary attack rates have been reported in the Netherlands, Austria, Canada, Germany, England, South Korea, and Spain.[42,43]

Loudon and Roberts[44] characterized respiratory aerosol emitted during talking, singing and coughing. They reported that "fewer droplets were expelled during singing than during talking, but a higher proportion of them were in the smaller size range. The percentage of droplets still airborne as droplet nuclei after a 30-minute settling period were 35.7, 6.4, and 48.9 for singing, talking, and coughing, respectively."

The inferred emission rate of 970 quanta h^{-1} is plausible given observations of airborne concentrations of SARS-CoV-2 in hospitals. The highest concentrations reported averaged 3000 ± 2700 viral RNA copies m^{-3} across 18 measurements in Nebraska[9] and 2600 ± 1000 viral RNA copies m^{-3} and across two measurements in Singapore.[3] In the Singapore study, the highest values were measured on day 5 of illness where a symptomatic patient had a high viral load in their nasopharyngeal swab (Ct value 18.45). If the dominant removal mechanism is ventilation at an average rate of 13 h^{-1} in Nebraska and 12 h^{-1} in Singapore, then these concentrations correspond to emission rates of the order of 10^6 viral RNA copies h^{-1} from a patient. Typically, only 0.1-1% of viral RNA copies represent an infectious virion for influenza,[45] so if that value is applicable to SARS-CoV-2, the emission rate would correspond to 1000-10,000 infectious virions emitted per hour; viral load emitted also varied between coughing and breathing/speaking.[45] Lindsley et al. have shown this effect, too, for infectious influenza virus.[46]

The plausibility of the inferred quanta emission rate can also be demonstrated by combining evidence on respiratory aerosol emissions with viral loads for SARS-CoV-2 in saliva. Concentrations of respiratory aerosol in exhaled breath that are smaller than 10 μm diameter are in the approximate range 1-10 nL m^{-3} for vocalization activities.[38] For this concentration range, a volumetric breathing rate of 1 m^3 h^{-1} would produce an emission rate of 1-10 nL h^{-1} of respiratory aerosol. In limited sampling of SARS-CoV-2 in saliva and other respiratory fluids, viral loads as high as 10^{11} viral RNA copies mL^{-1} have been reported.[10,11,12,50] At 10 nL h^{-1}, a viral load in respiratory fluids of 10^{11} RNA copies mL^{-1} (= 10^5 copies nL^{-1}) would lead to the emission of 10^6 viral RNA copies per h, which would be of order 1000 quanta h^{-1} assuming an equivalence of 1 quanta to 1000 viral RNA copies.

This modeling analysis has explored the very probable situation in which transmission by inhaling respiratory aerosol that were released during singing caused a large COVID-19 outbreak. Accumulating evidence points to these factors being important for increasing the risk of airborne transmission indoors: high occupancy, long duration, loud vocalization, and poor ventilation.

In the domain of indoor environmental quality control, the first and best measure is generally to minimize indoor emissions.[47] Because we are not yet able to identify individuals who are highly infectious and therefore are potential superspreaders, effective source control can not be so well practiced, short of suspending high-risk indoor events. The simulation results presented here show that the risk of secondary infections can be substantially reduced although not practically eliminated through a combination of increasing removal rates and by limiting the duration of indoor activities. The high ventilation rate in the hospital settings combined with other controls such as use of isolation rooms and effective PPE is likely to mitigate transmission from a high viral shedder in the healthcare environment.[3,9] In the many community indoor spaces not dedicated to infection control, controlling airborne diseases transmission remains a great challenge during this pandemic. Ventilation rates corresponding to current standards would allow occupancy duration of only about 0.5 h for an infection risk level below 10% for a such high emission activity as investigated here. Indoor environmental quality control measures available to improve conditions include enhanced ventilation, mechanical filtration, and germicidal ultraviolet disinfection.[48,49] Widespread application of effective indoor environment controls could help limit the extent of superspreading events and therefore contribute to slowing the pandemic spread.

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Appendix

Ventilation Rate Estimates

The ventilation rate was estimated assuming that the HVAC fan was not operating during the rehearsal and that the metabolic energy generated by the SVC rehearsal attendees was sufficient to maintain a comfortable temperature without supplemental heating. For conditions of metabolic activity at 1.2 met, clothing insulation of 1.0 clo, at 22 °C (71 °F), the metabolic heat generation per occupant is 78 W. [51] Assuming that half of the metabolic energy goes to continuously heat the room air (with the other half lost through the building envelope by conduction and to heat storage), then each occupant would contribute 39 W to the ventilation air. Given the reported difference between indoor and outdoor temperature (23 °F = 13 K) and the heat capacity of air (1 J g^{-1} K^{-1}), one can derive the ventilation rate to be 39 W $person^{-1}$ ÷ 13 J g^{-1} = 3 g/s per person. At a density of 1.2 g/L, the resulting ventilation flow rate would be 2.5 L/s per person. For a room volume of 810 m^3 with 61 occupants, the corresponding air-change rate would be 0.7 per h^{-1}. We bracket this estimate by applying an uncertainty of ± 50% so that the modeled range in the Monte Carlo simulation is 0.3-1 per h.

By way of comparison, we have estimated the outdoor air ventilation rate based on the relevant ASHRAE standard combined with information from the mechanical drawings for the rehearsal hall under the assumption that the HVAC fan was on for the event duration. The outdoor make-up air flow specified by ASHRAE Standard 62.1 for places of worship (Table 6.2.2.1) is 2.5 L s^{-1} $person^{-1}$ + 0.3 L s^{-1} per m^2 of floor area. [52] The default occupant density is 120 persons per 100 m^2 of floor area. The corresponding outdoor air rate per m^2 of floor area would then be (120/100) × 2.5 + 0.3 = 3.3 L s^{-1} m^{-2}. The reported averaging ceiling height for the Fellowship Hall is 4.5 m and the estimated floor area is 180 m^2. The total ventilation flow rate would therefore be 180 × 3.3 = 594 L s^{-1} = 2100 m^3 h^{-1}, corresponding to an air-change rate of 2.6 h^{-1}. Additionally, mechanical drawings of the rehearsal hall show specifications of 3 × 1560 cfm supply registers (indicated to be 8 ft above the floor along one wall). This information indicates that the ventilation system is designed to supply 4700 cfm = 8000 m^3 h^{-1}, which would be a mixture of outdoor air and recirculated indoor air (filtered through a MERV 11 filter). That supply flow rate corresponds to 10 room volumes per hour. Applying the outdoor air flow rate from ASHRAE 62.1, at this overall flow rate, the mix would be about 25% outside air and 75% recirculated air. These 2.5-10 effective air changes per hour are unlikely to have been provided during the rehearsal, based on personal communication received during our investigation.

Running title: Aerosol transmission of SARS-CoV-2

Evidence for probable aerosol transmission of SARS-CoV-2 in a poorly ventilated restaurant

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Abstract (249 words)

Main text (3456 words)

Abstract

Background: The role of aerosols in the transmission of SARS-CoV-2 remains debated. We analysed an outbreak involving three non-associated families in Restaurant X in Guangzhou, China, and assessed the possibility of aerosol transmission of SARS-CoV-2 and characterize the associated environmental conditions.

Methods: We collected epidemiological data, obtained a video record and a patron seating-arrangement from the restaurant, and measured the dispersion of a warm tracer gas as a surrogate for exhaled droplets from the suspected index patient. Computer simulations were performed to simulate the spread of fine exhaled droplets. We compared the in-room location of subsequently infected cases and spread of the simulated virus-laden aerosol tracer. The ventilation rate was measured using the tracer decay method.

Results: Three families (A, B, C), 10 members of which were subsequently found to have been infected with SARS-CoV-2 at this time, or previously, ate lunch at Restaurant X on Chinese New Year's Eve (January 24, 2020) at three neighboring tables. Subsequently, three members of family B and two members of family C became infected with SARS-CoV-2, whereas none of the waiters or 68 patrons at the remaining 15 tables became infected. During this occasion, the ventilation rate was 0.75–1.04 L/s per person. No close contact or fomite contact was observed, aside from back-to-back sitting by some patrons. Our results show that the infection distribution is consistent with a spread pattern representative of exhaled virus-laden aerosols.

Conclusions: Aerosol transmission of SARS-CoV-2 due to poor ventilation may explain the community spread of COVID-19.

Keywords: COVID-19, SARS-CoV-2, airborne transmission, aerosol transmission, building ventilation

Introduction

Debate continues on the role of aerosol transmission of SARS-CoV-2, the virus that causes COVID-19, in the rapidly growing COVID-19 pandemic. The COVID-19 outbreak in Guangzhou, China was identified in early 2020 and linked to three seemingly non-associated clusters of unrelated families (A, B, C) (Lu et al., 2020). Families B (n = 4) and C (n = 7) comprised local Guangzhou residents with no history of travel to or encounters with inhabitants from Hubei, but nevertheless three members of family B and two members of family C were confirmed infected with the virus on February 4 or 6, at which time only ~10 cases of infection had been confirmed in the city.

Local health officials learned that families B and C had eaten lunch at the same restaurant on Chinese New Year's Eve (January 24, 2020), as had family A (n = 10) from Wuchang, Wuhan (the epicenter of the Chinese epidemic), who had arrived in Guangdong by train on January 23. One person from family A reported experiencing the onset of COVID-19 symptoms on January 24, and video records from the restaurant show that families A, B, and C were seated at tables along the exterior window, with family A's table in the center. None of the restaurant waiters or remaining 68 patrons distributed at 15 other tables became infected with SARS-CoV-2. Families A, B, and C had not met previously and did not have close contact during the lunch, aside from some patrons sitting back-to-back.

To investigate the possibility of aerosol transmission of SARS-CoV-2, we analyzed the spatial distribution data from this outbreak using computer models and experiments based on airflow dynamics. We use our results to assess the ventilation conditions of aerosol transmission.

Methods

Epidemiologic analysis

We obtained the seating arrangement of the three family members and remaining patrons in Restaurant X as well as the dates of COVID-19 symptom onset (Figure 2A), where the symptom onset date is defined as the day when symptoms (e.g., fever or cough) were first noticed by the patient. SARS-CoV-2 infection was confirmed by real-time polymerase chain reaction with reverse transcription (RT-PCR) analysis of throat swabs. Demographic data, travel history, exposure history, and symptoms of the infected individuals were collected (Lu et al., 2020), and we also obtained the floor plan and design of the air conditioning and ventilation system of the restaurant, and the hourly weather data for January 24 from a weather station near the site. A closed-circuit television camera record in the restaurant and elevator was reviewed to determine the elevator use by patrons, the fire-door use by both patrons and waiters, the table and seating arrangement during the lunch, and any close contact behavior between Family A and others.

Restaurant X has five floors. The outbreak occurred on the third floor, which has a volume of 431 m^3 (height of 3.14 m, length of 17 m, and average width of 8.1 m) (Figure 1). Large and small tables have a diameter of 1.8 m and 1.2 m, respectively, and rectangular tables measure 0.9 m × 0.9 m and 1.2 m × 0.9 m. Five fan coil air-conditioning units are installed on the third floor, and there is no outdoor air supply: ventilation is thus achieved using only infiltration and natural ventilation through an occasionally open door driven by an exhaust fan installed inside the restroom. Four exhaust fans are installed on the south glass window but were not used during this lunch. At noon on January 24, the third floor of the restaurant had 18 tables and 89 patrons. We label Tables A, B, and C as TA, TB, and TC, respectively, and the remaining tables are labeled as T4–T18 (Figure 1). According to video analyses, the fire door was used approximately every 2 minutes.

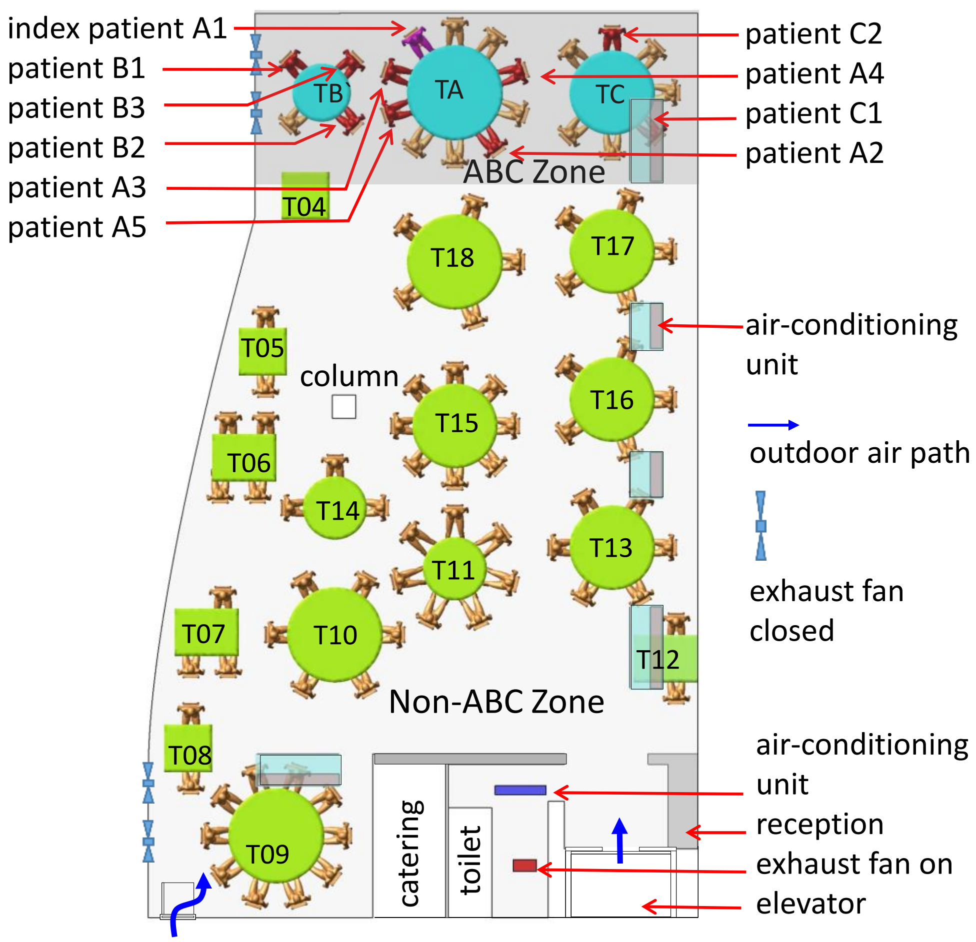

Figure 1. Distribution of SARS-CoV-2 infection cases at tables in Restaurant X. The probable air-flow zones are in dark grey and light grey. Each table is numbered as T#. Eighty-nine patrons are shown at the 18 tables, with one table being empty (T04). Tables TA, TB, and TC are where families A, B and C sat, some of whose members became infected. Patient A1 at TA is the suspected index patient. Patients A2–A5, B1–B3, and C1–C2 are the individuals who became infected. Other tables are numbered as T4–T18. Each of the five air-conditioning units condition a particular zone. Patrons and waiters entered the restaurant floor via the elevator and stairwell, which are connected by the fire door.

We studied the infection data with regards to seating location and used a chi-square test to explore the relationship between a patron's location (i.e., table) and his/her probability of becoming infected. Table A was excluded in this analysis. The other tables were categorized according to two criteria: distance from TA (e.g., immediate vs. remote neighbors) and air-conditioning zone (i.e., the ABC zone was that immediately around TA, TB and TC and serviced by one air conditioning unit, and the non-ABC zone was everywhere else, serviced by the four other air conditioning units).

Experimental tracer gas measurements and computational fluid-dynamics simulations

Tracer gas measurements and computational fluid dynamics (CFD) simulations were used to predict the spread of fine droplets exhaled by the index patient and the detailed airflow pattern in the restaurant. The CFD simulation models were the same as those used in previous studies of two 2003 SARS-CoV outbreaks in Hong Kong (Yu et al., 2004, Wong et al., 2004, Li et al., 2005).

The tracer measurement was carried out on March 19–20 when the intensity of the direct solar radiation was similar to that on January 24, i.e., weak sunshine, with clouds and rain. We first measured the supply/return/exhaust air flow and temperature at each air-conditioning unit and at the exhaust fan in the restroom. We arranged the tables and chairs to match the arrangement used at the January 24 lunch, as determined by analyses of the video of this occasion. The air conditioning units were turned on and the exhaust fans in the vertical glass window were left off to simulate the air-flow conditions at the time of SARS-CoV-2 infection during the lunch on January 24. Volunteers were not recruited because the experiment was performed during the strict intervention (i.e., lockdown) phase of the epidemic in Guangzhou. However, nine experimental staff sat on Tables A, B, and C and simple thermal mannequins were placed at the others. The mannequins were warm and hollow, containing a 60-W electrical bulb enclosed by a stainless steel cylinder, which produced warm plumes similar to the above human subjects.

The same simple heat source with a 60-W electrical bulb was also used to simulate warm food on each table.

The tracer gas measurement consisted of two stages. In the first stage, we released ethane gas through an 8-mm inner diameter pipe at a speed of 1.5 m/s at 32–34 °C, with the pipe outlet placed immediately above the index patient's nose. This mode of release mimicked the index patient (assumed to be A1) talking and moving their head around. Tracer gas is known to be an effective surrogate for modelling the spread of fine droplets or droplet nuclei (Bivolarova et al., 2017). In the first of two experiments, we monitored the gas concentrations at 14 points, namely all of the chairs where the infected persons of families B and C had sat (Figure S3). In the second experiment, gas concentrations were only monitored at seven points, owing to the time required for rotational sampling at each point.

In the second stage, the air change rate was measured using the tracer decay method, which involved the release of a tracer gas into the restaurant that subsequently mixed the flow from with 10 desk fans. We measured the tracer concentration at three points in the room. The elevator and fire door were used every two minutes to mimic the traffic that was observed in the recording of the January 24 lunch, with the fire door closing automatically after a period of 3 s. We identified an exhaust flow through the doorway of the restroom and that bidirectional air exchange occurred through the opening and closing of the fire door. The non-operating exhaust fans were sealed relatively well, with nearly negligible air flow. After the measurements, we assigned the health status (ill vs. healthy) of each person at non-A tables as the dependent variable and applied a binary logistic regression model to investigate the association between the measured concentrations of trace gas and infection probability.

We adopted the widely used CFD software package Fluent (Ansys Fluent, USA), which is a three-dimensional, general-purpose CFD software package for modeling fluid flows. We used the basic renormalization-group (RNG) k-ε turbulence model to simulate the effects of turbulence on airflow and dispersion of pollutants. We assumed that the virus-laden water droplets generated from the index patient at TA rapidly evaporated (i.e., after a few s in air). We approximated the exhaled droplet nuclei as a passive scalar and the deposition effect was therefore neglected. The prediction was compared to measurement (Figure S4). After CFD modeling, we used the health status (ill vs. healthy) of each person at non-A tables as the dependent variable and applied a binary logistic regression model to investigate the association between the predicted concentrations and infection probability. In both the experiments and simulations, we assumed that the tracer gas was released from the index patient's mouth.

Results

The outbreak

Detailed epidemiological, clinical, laboratory, and genomic findings for this outbreak and all of the associated patients have been described in detail by Lu et al. (2020). The first confirmed case (A1) from family A who was confirmed on January 24 is assumed to be the index patient. The last patient was confirmed on February 6 (Figure 2B). The three families occupied the restaurants at different times (family A 12:01–13:23; family B 11:37–12:54; and family C 12:03–13:18). According to the video analysis, there was no significant close contact between the three families in the elevator or restroom (Supplementary information A). Contact tracing identified 193 patrons in the restaurant, 68 of whom were on the third floor at the same time as families A, B, and C, including 57 restaurant workers and 11 workers in the hotel where Family A had stayed. None of these people were infected with the virus. Thus, only the 10 patrons in the restaurant were infected, comprising the index patient and nine others, and at least five of them who we suspect became infected at this lunch due to exposure to exhaled droplets from the index patient that contained virus particles.

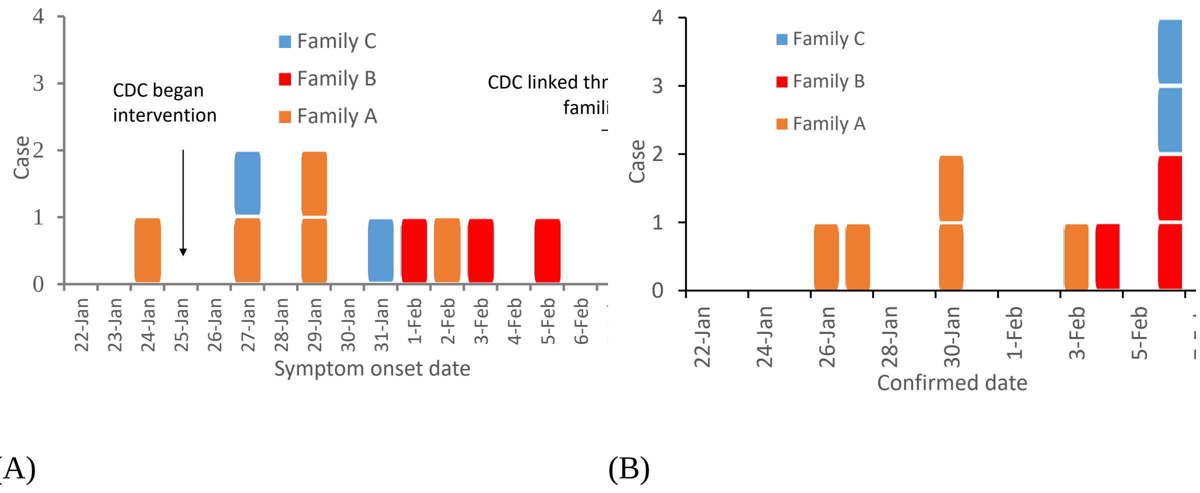

Figure 2. Dates of (A) symptom onset and (B) confirmation of the 10 patients from the three families.

Spatial distribution analysis of infection cases

The tables and patrons were first categorized by distance from TA, as immediate neighbors (TB, TC, and T18) or remote neighbors (Tables T4–17). The 10 patients who were shortly thereafter be confirmed as having COVID-19 sat at one of the three tables by the window. Three of the four members of family B were infected, and two of the seven members of family C were infected. Five members of family A were also infected, including the index patient. The two patrons at TC who sat the closest to TA were not infected, nor were any patrons at the remote neighboring tables, but the patrons at neighboring tables had a higher infection probability than patrons at remote tables (X^2=16.08, P<0.001, chi-squared test with continuity correction, Table 1). The infection risk was also higher for patrons at zone ABC tables than those at non-ABC zone tables (X^2=25.78, P<0.001, chi-squared test with continuity correction, Table 1). None of the patrons seated in the non-ABC zone were infected.

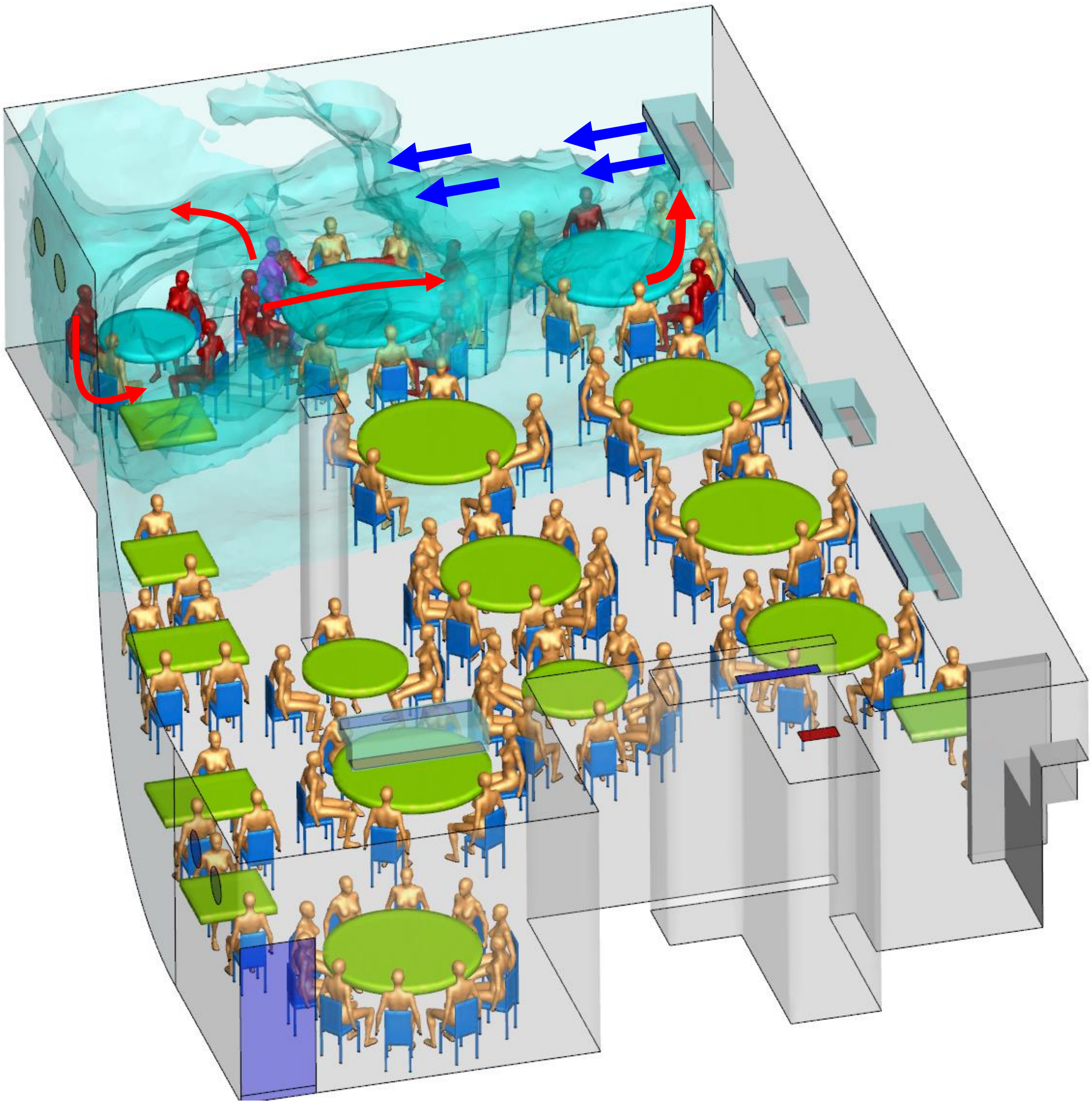

Figure 3. Simulated dispersion of fine droplets exhaled from index Patient A1 (magenta-blue), which are initially confined within the cloud envelope due to the zoned air-conditioning arrangement. The fine droplets eventually disperse into the other zones via air exchange and are eventually removed via the restroom exhaust fan. The ABC zone clearly has a higher concentration of fine droplets than the non-ABC zone. Other infected patients are shown in red and other non-infected in gold color. Only a single human body is used to represent all patrons.

Ventilation and dispersion of exhaled droplet nuclei

The results of two tracer gas decay experiments show that the air exchange rate was only 0.77 air changes per hour (ACH) at 16:00–17:00 and 0.56 ACH at 18:00–19:30 (Figure S4). For a volume of 431 m^3 and 89 patrons, this is equivalent to an outdoor air supply of 1.04 and 0.75 L/s per patron, respectively.

The predicted contaminated cloud envelope in the ABC zone is shown in Figure 3. In the zone with families A, B, and C, the exhaled air stream from the index patient first falls and then rises, following the interaction of thermal plumes and the air jet of the air conditioning (Figure S2). The high-momentum air-conditioning jet carries the contaminated air at ceiling height. Upon reaching the opposite glass window, the jet bends downward and returns at a lower height. At each table, the rising thermal plumes from warm food and people carry the contaminated air upwards, and the remaining air returns to the air-conditioning unit and forms a recirculation zone or cloud envelope, referred to as the ABC zone. Similarly, other air-conditioning units also produce cloud envelopes, although these are not as distinct as that in the ABC zone, due to mixing by the air-conditioning jet of the air-conditioning unit above T09. Air exchange occurs between all of the zones because there are no physical barriers between them.

The formation of a relatively isolated contamination cloud in the ABC zone is supported by the measured ethane concentration data. The average measured ethane concentrations over a period of 66.67 min (Table S1) at TA, TB, and TC are the highest, being 1.00, 0.92, and 0.96 (normalized by concentration at TA), respectively, while the concentrations are 0.86 ppm and 0.73 ppm at T17 and T18, respectively, and are 0.55–0.70 at the other remote tables. As expected, some mixing clearly occurred between the different air-conditioning zones (Figure S1), although a stable higher concentration was maintained in the ABC zone.

The predicted average concentrations over a period of 66.67 min are listed in Table S1. According to the results of the logistic regression model, a higher measured concentration is associated with a higher risk of acquiring COVID-19 (odds ratio associated with a 1% increase in concentration: 1.115; 95% CI: 1.008–1.233; *P* = 0.035) (Table S1). Similarly, a higher predicted concentration is associated with a higher risk of acquiring COVID-19 (odds ratio associated with a 1% increase in concentration: 1.268; 95% CI: 1.029–1.563; *P* =0.026).

Discussion

Lu et al. (2020) suggested that droplet transmission is the most likely primary cause of this outbreak, but pointed out that the outbreak cannot be explained by droplet transmission alone, because the distances between the index patient (A1) and patrons at the other tables are all greater than 1 m. We estimate that such distances may have been as far as 4.6 m (Figure S1). Lu et al. (2020) also suggested that "strong airflow from the air conditioner could have propagated droplets from table C to table A, then to table B, and then back to table C", but stopped short of pinpointing the role of aerosol transmission due to the lack of environmental data. The role of aerosol transmission was postulated by the Chinese National Health Council (NHC) (Li and Gao, 2020) during the early phase of the COVID-19 epidemic in China, however, no specific evidence is provided in the NHC's recommendation.

We attempted to identify the role of fomite and close contact by examining individual trajectories during the patrons' stay in the restaurant from the available video record. However, no evidence was identified to support exposure to SARS-Co-V2 occurring via these routes in this instance.

Our prediction shows that a contaminated recirculation envelope was created in the ABC zone (Figure 3), which thus sustained a higher concentration of exhaled droplet nuclei from the index patient. The overlap period for families A and B in the restaurant was 53 min (between 12:01 and 12:54) and 75 min for families A and C (between 12:03 and 13:18), which would have allowed sufficient exposure time to the exhaled droplets. Patient C1 arrived late, at 12:32, and had a 46-min overlap with family A. That none of the waiters were infected can be attributed to their relatively short exposure time to exhaled droplets from the index patient. A relatively high concentration of trace gas was also measured at Table T17, however the patrons at this table (*n* = 5) arrived later (13:00, 18 min of exposure with Table A) and none were infected.

The formation of individual circulation zones was due to the spatial configuration and installation of five air-conditioning units (Figure S2).

However, the formation of a contaminated recirculation envelope in the ABC zone cannot alone explain the outbreak. Further evidence comes from the low ventilation rates: the observed high concentrations of the simulated contamination result from the lack of outdoor air supply. The exhaust fans in the walls were found to be turned off and sealed during the January 24 lunch, meaning that there was no outdoor air supply aside from infiltration and infrequent and brief opening of the fire door due to the negative pressure generated by the exhaust fan in the restroom. This outdoor air was mainly distributed to the non-ABC zone, thus exacerbating the ventilation deficit of the ABC zone.

The measured average air flows of 1.04 L/s and 0.75 L/s per patron in the non-ABC and ABC zones, respectively, are considerably lower than the 8–10 L/s per person required by most authorities or professional societies (American Society of Heating, Refrigerating and Air-Conditioning Engineers Standard 62.1, 2004). The restaurant was also crowded, as to accommodate the increased number of customers on Chinese New Year's Eve, the restaurant had added extra tables. Consequently, the occupant density was only 1.55 m^2 per patron, including the area occupied by tables. The transmission of SARS-CoV-2, which subsequently resulted in an outbreak of COVID-19, thus occurred in a crowded and poorly ventilated space.

Lack of adequate ventilation and overcrowding is known to be associated with respiratory infection outbreaks, although some are not commonly thought to be transmitted by aerosols.

This restaurant SARS-CoV-2 outbreak resembles the Alaska plane influenza outbreak (Moser et al., 1979), in which a plane with a 56-seat passenger compartment was delayed by engine trouble and no mechanical ventilation was provided during the 4.5-h wait. The index patient was a passenger who became ill with influenza within 15 min after boarding the plane. There was approximately 3 m^3 of compartment space per seat, and the provision of outdoor air was only possible by the plane doors being open for some periods during the 4.5-h wait, and during the movement of passengers in and out of the plane. According to Rudnick and Milton (2003), this resulted in there being only 0.08–0.40 L/s of air circulation per passenger, which is slightly less than the range measured in Restaurant X, and this resulted in 72% of the 54 passengers on board this plane being infected with influenza.

A systematic review by the World Health Organization (WHO) also found evidence for the association between crowding and infection (WHO, 2018). During the 2009 H1N1 pandemic, the basic reproduction number was as high as 3.0–3.6 in outbreaks in crowded schools, compared to 1.3–1.7 in less crowded settings (Lessler et al., 2009, Writing Committee, 2010). The SARS-CoV-2 virus can survive in air for at least 3 h (van Doremalen et al., 2020) and airborne influenza virus genomes and viable influenza virus particles have been detected (Lindsley et al., 2012, 2016, Yan et al., 2018, Xie et al., 2020).

It is important to note that our results do not show that long-range aerosol transmission of SARS-CoV-2 can occur in any indoor space, but that transmission may occur in a crowded and poorly ventilated space. Gao et al. (2016) showed that the relative contribution of aerosols to respiratory infection is a function of ventilation flow rate. A sufficiently high ventilation flow-rate reduces the contribution of aerosol transmission to a very low level, whereas a low ventilation flow-rate leads to a relatively high contribution of aerosols to transmission.

Both fine and large droplets are exhaled during respiration, and the infection risk from respiration is known to be highest when two people are in close contact. Liu et al. (2017) proposed that in addition to the traditional large-droplet mechanism, a short-range aerosol mechanism may also be important. An examination of the spatial concentration profile starting from the mouth of the infected person shows a continually reduced concentration profile in the exhaled jet, which weakens at some distance and merges into and becomes indistinguishable from the background room air. The average room concentration of aerosols is thus a function of source strength and ventilation rate. When the ventilation rate of the room is sufficiently low, the room average condition can become as concentrated as within the exhaled air. Hence, in theory, even if an infectious agent is not typically (i.e., under adequate ventilation) transmitted by a long-range aerosol mechanism, the spatial extent of transmission increases if the ventilation rate is very low. We refer to such transmission as an extended short-range aerosol mechanism.

In summary, our epidemiologic analysis, onsite experimental tracer measurements, and airflow simulations support the probability of an extended short-range aerosol spread of the SARS-CoV-2 having occurred in the poorly ventilated and crowded Restaurant X on January 24, 2020.

This conclusion has important implications for intervention methods in the ongoing COVID-19 pandemic. Specifically, although close contact and fomite exposure may play a major role in the transmission of SARS-CoV-2, extended short-range aerosol transmission of the virus is possible in crowded and poorly ventilated enclosures. Our study suggests that it is crucial to prevent overcrowding and provide good ventilation in buildings and transport cabins for preventing the spread of SARS-CoV-2 and the development of COVID-19.

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Author contributions

Y. Li, H. Qian, J. Hang and M. Kang contributed equally. Y. Li, M. Kang, and H. Qian contributed to the study design, hypothesis formulation, and coordination. H. Qian led the CFD modeling. J. Hang led the field environmental experiments. M. Kang, J. Li, and X. Chen, contributed to the field investigation, data analyses, and reporting. X. Chen, P. Liang, and H. Ling contributed to the field studies and experiments. J. Wei and L. Liu contributed to experimental design. S. Xiao contributed to statistical analysis. Y. Li wrote the first draft of the paper. M. Kang, H. Qian, J. Hang, and X. Chen contributed major manuscript revisions. All of the other authors contributed revisions.

The authors declare no conflict of interest.

All of the authors approved the submitted version and have agreed to be personally accountable for their own contributions.

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Table 1. Number of cases and susceptible at non-A tables in different zones of Restaurant X. There were a total of 79 patrons on other 17 tables.

Category of zones	**Zones**	**Number of patrons**	**Number of infected cases**	**Attack rate (%)**	***RD* (95%CI)***	X^2	***P***
Table A neighbours	Immediate neighbouring tables	16	5	31.25	31.25 (8.54, 53.96)	16.08#	<0.001#
	Remote neighbouring tables	63	0	0			
Air conditioning	ABC zone	11	5	45.45	45.45 (16.03,74.88)	25.78#	<0.001#
	Non-ABC zone	68	0	0			

*RD: Rate difference

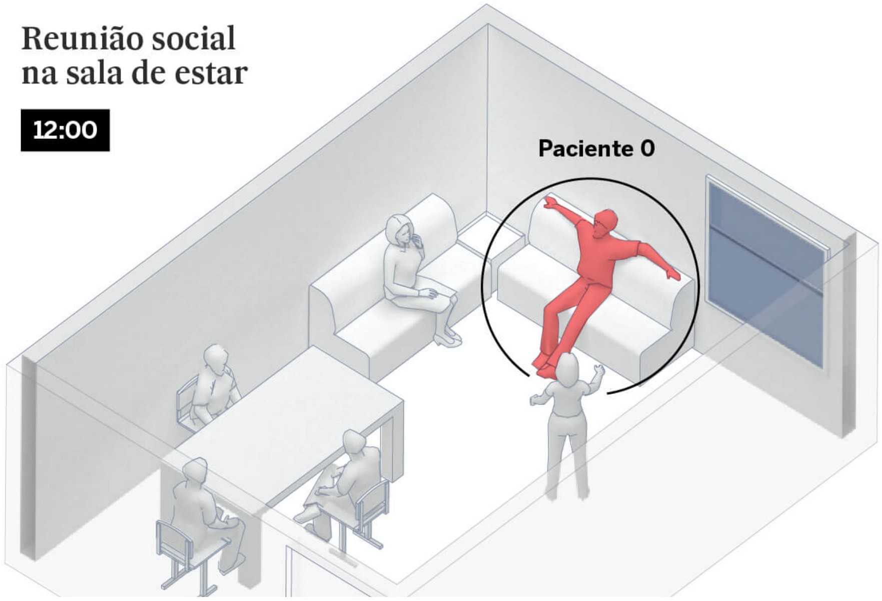
Chi-squared test with continuity correction

ASSINE FAÇA LOGIN

PANDEMIA DE CORONAVÍRUS

Uma sala de estar, um bar e uma sala de aula: assim o coronavírus é transmitido pelo ar

Os espaços fechados são os mais perigosos, mas é possível minimizar os riscos tomando todas as medidas disponíveis para combater o contágio por aerossóis. Estas são as probabilidades de infecção nestes três cenários cotidianos dependendo da ventilação, do uso de máscaras e da duração do encontro



Numa casa se reúnem seis pessoas, uma delas contagiada. **31% dos contágios conhecidos na Espanha acontecem em encontros sociais,** sobretudo entre familiares e amigos.

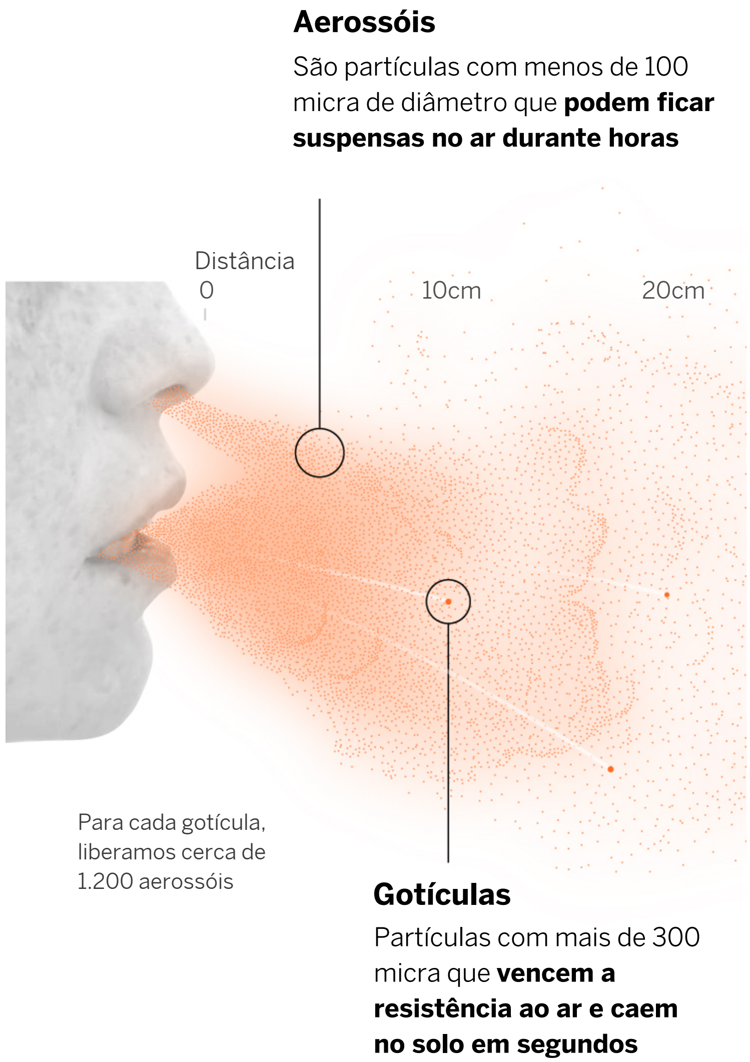
Independentemente da distância, se o grupo passasse quatro horas sem máscaras nem ventilação e falasse em voz alta, **outras cinco pessoas seriam contagiadas** (segundo o modelo científico explicado na metodologia).

Caso as máscaras fossem usadas, o risco diminuiria para quatro infecções. As máscaras por si sós não evitam os contágios se a exposição for muito prolongada.

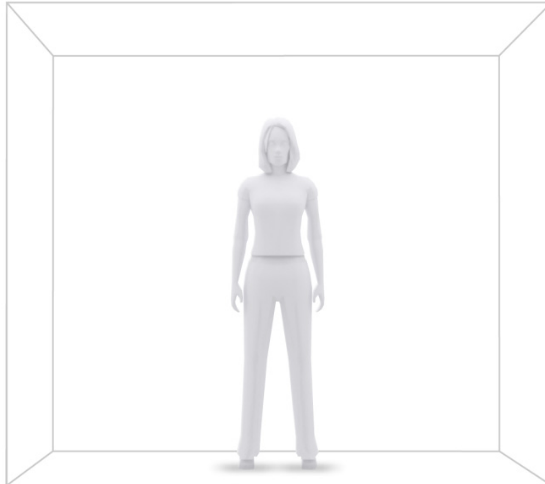
O perigo de infecção cai para menos de uma pessoa contagiada quando o grupo **usa máscaras, reduz a duração do encontro pela metade e ventila o ambiente.**

MARIANO ZAFRA |
JAVIER SALAS
28 OCT 2020 - 07:59 BRT

A **covid-19** é transmitida pelo ar, sobretudo em espaços fechados. Não é tão infecciosa quanto o sarampo, mas os cientistas já reconhecem abertamente o papel desempenhado na pandemia pelo **contágio por aerossóis** — partículas minúsculas exaladas por um doente e que ficam suspensas no ar em ambientes fechados. Como funciona esse modo de transmissão? E, acima de tudo, como podemos contê-lo?



Neste momento, as autoridades sanitárias reconhecem três modos de contágio da covid-19: as gotas que os infectados exalam ao falar ou tossir, que acabam nos olhos, boca ou nariz do infectado; as superfícies contaminadas, embora os **Centros de Prevenção e Controle de Doenças (CDC)** dos EUA indiquem que este caso é o menos provável e o Centro Europeu de Prevenção e Controle de Doenças informe que não foi descrito nem um único contágio por essa via; e, por último, a infecção por aerossóis: quando respiramos essas partículas infecciosas invisíveis exaladas por uma pessoa doente e que se comportam como uma fumaça ao sair de nossa boca. Sem ventilação, elas ficam suspensas e se condensam na sala à medida que o tempo passa.



Sem ventilação, os aerossóis ficam suspensos e se condensam na sala à medida que o tempo passa.

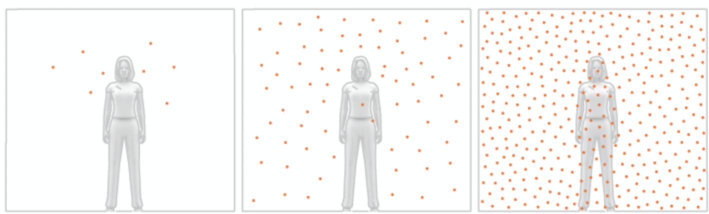
No início da **pandemia**, teve-se a impressão de que o principal veículo de contágio eram essas grandes gotas que lançamos ao tossir ou espirrar. Mas agora sabemos que gritar e cantar num espaço fechado, mal ventilado e por muito tempo também gera um alto risco de transmissão. Isso acontece porque, ao falarmos a plenos pulmões, lançamos 50 vezes mais partículas carregadas de vírus do que em silêncio. Se não forem diluídos com a ventilação, esses aerossóis se concentram com o passar do tempo, aumentando o risco de contágio. Os cientistas demonstraram que essas partículas, que também liberamos ao respirar ou com máscaras mal ajustadas, podem ser contagiosas a cinco metros de um doente e durante muitos minutos, dependendo das condições. Essas são as condições que reproduzimos nestes exemplos e que convém evitar a todo custo.

Cada **ponto alaranjado** representa uma **dose de partículas capaz de infectar** ao ser inalada

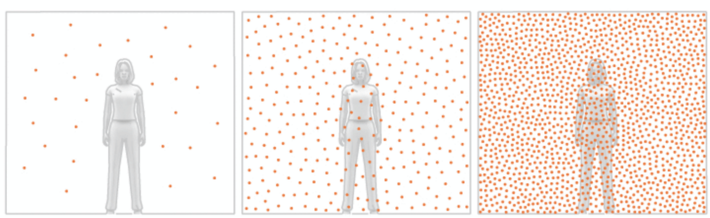
Em silêncio | **Falar** | **Gritar ou cantar**

2 minutos

15 minutos



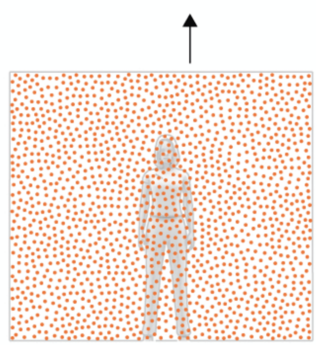
1 hora



Ao falar, emitimos cerca de **10 vezes mais** partículas respiratórias que em silêncio

Ao gritar, emitimos cerca de **50 vezes mais** partículas respiratórias que em silêncio

No pior cenário (gritar ou cantar uma hora num espaço fechado), uma pessoa com covid-19 liberaria **1.500 doses infecciosas.**

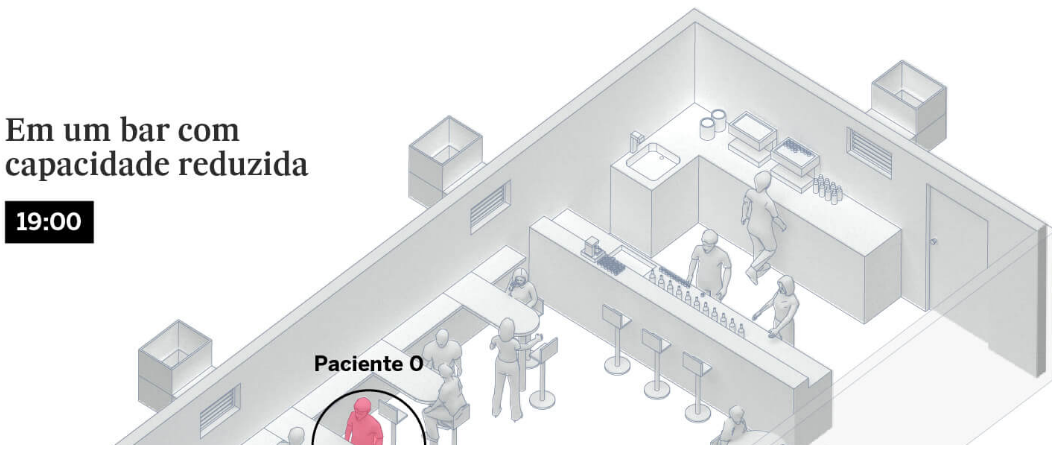


Vídeos: Luis Almodóvar

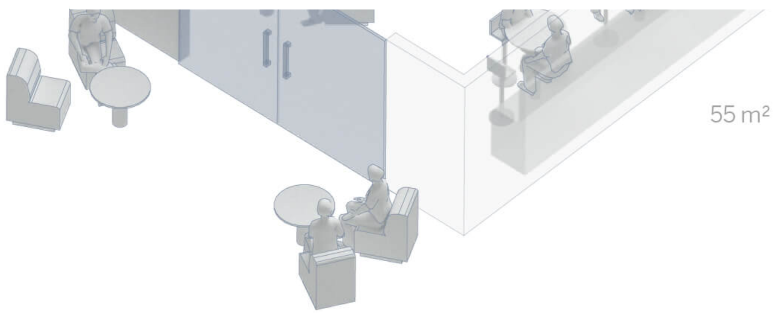
Na primavera do hemisfério norte, as autoridades sanitárias ignoraram essa via de contágio, mas recentes publicações científicas obrigaram a **Organização Mundial da Saúde (OMS)** e os CDC a reconhecer esse risco. Um artigo da revista *Science* fala de evidências "esmagadoras", e os CDC afirmam que, "sob certas condições, pessoas com covid-19 poderiam ter infectado outras que estavam a mais de dois metros de distância. Essas transmissões ocorrem dentro de espaços fechados com ventilação inadequada. Em alguns casos, a pessoa infectada respirava com intensidade, por exemplo ao cantar ou se exercitar".

Um bar ou restaurante

Os contágios em eventos, lojas e estabelecimentos como bares e restaurantes são uma parte importante das transmissões do âmbito social. E são os mais explosivos: cada surto numa discoteca envolve em média 27 pessoas infectadas, contra apenas 6 contágios em reuniões familiares como a mostrada no princípio. Exemplo do que pode ser um desses supercontágios foi o que aconteceu numa boate de **Córdoba (Espanha)**, com 73 infectados após uma noite de festa. Ou ainda o contágio de 12 clientes num bar do **Vietnã**, analisado recentemente pelos cientistas.



Neste bar, **a capacidade foi reduzida pela metade,** com 15 pessoas consumindo e três funcionários. As portas estão fechadas e não há ventilação mecânica.



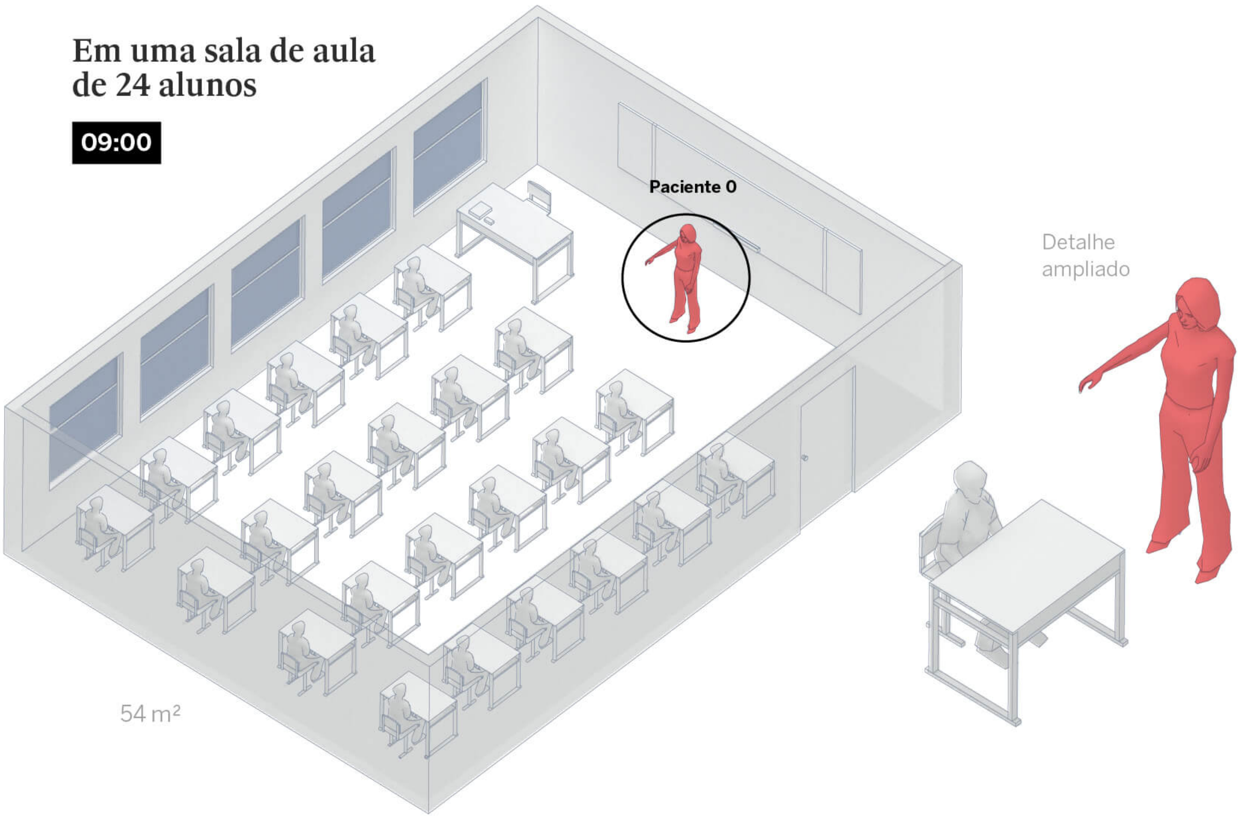
No pior dos casos, **sem tomar nenhuma medida,** após quatro horas 14 clientes são infectados.

Se eles usassem máscaras de forma permanente, essa probabilidade cairia para até 8 contágios.

Com a ventilação do bar, o que pode ser feito com bons equipamentos de ar condicionado, **e se os clientes passassem menos tempo ali,** a probabilidade de contágio cairia para até uma única pessoa.

O colégio

As **escolas** representam apenas 6% dos contágios registrados pelo Ministério da Saúde espanhol. As dinâmicas de contágio por aerossóis na sala são muito diferentes se o paciente zero for aluno ou docente. Os professores falam por muito mais tempo, elevando a voz para serem ouvidos, o que multiplica o lançamento de partículas potencialmente contagiosas. Em comparação, um possível aluno doente fala de forma muito esporádica. O Governo espanhol já recomendou, com diretrizes do CSIC (agência espanhola de pesquisa científica), que as salas de aula sejam arejadas embora isso signifique desconforto por causa do frio ou o uso de equipamentos de ventilação.



A situação mais perigosa aconteceria numa sala de aula sem ventilação onde a pessoa infectada fosse o professor (paciente 0).

Se os estudantes passassem duas horas de aula com um professor doente, **sem nenhuma medida** contra os aerossóis, a probabilidade de contágio alcançaria até 12 alunos.

Se todos usassem máscaras, apenas 5 poderiam se infectar. Em transmissões reais, observou-se que a distribuição dos contágios é aleatória, já que os aerossóis se acumulam e se distribuem por toda a sala sem ventilação.

Se além disso **a sala fosse ventilada durante a aula** (de forma natural ou mecânica) **e a atividade fosse interrompida após uma hora** para renovar completamente o ar, o risco cairia drasticamente.

Para calcular as probabilidades de contágio das pessoas presentes em situações de risco, usamos um simulador desenvolvido por um grupo de cientistas liderado pelo professor **José Luis Jiménez**, da Universidade do Colorado (EUA), criado com a intenção de mostrar a importância dos fatores que reduzem o contágio por aerossóis. O cálculo não é exaustivo nem pode incluir as inúmeras variáveis que influem num contágio, mas serve para ilustrar a progressão dos riscos em função dos fatores nos quais podemos intervir. Os participantes mantêm a distância de segurança nas simulações, eliminando o risco de contágio por gotículas, mas ainda assim podem contrair o vírus se não forem tomadas todas as medidas ao mesmo tempo: ventilar corretament[...] ar a capacidade do estabelecimento e **usar máscaras**. Em todos os contextos, o cenário ideal seria um espaço aberto, onde as partículas infecciosas se diluem rapidamente. Se não for mantida a distância em relação ao possível paciente zero, a probabilidade de contágio se multiplica porque entram em jogo as gotas expelidas e porque a ventilação não seria suficiente para diluir os aerossóis se as duas pessoas estiverem muito juntas.

Os cálculos mostrados nos três cenários se baseiam em estudos sobre como ocorrem as transmissões por aerossóis, com contágios reais que puderam ser analisados em detalhe. Um caso de grande utilidade para entender a dinâmica de contágio em espaços fechados foi vivido durante um ensaio de um coral no **Estado de Washington (EUA)** em março. Apenas 61 dos 120 membros do coral compareceram ao ensaio e tentaram manter distância e higiene. Sem saber, provocaram um cenário de máximo risco: sem máscaras, sem ventilação, cantando e dividindo espaço por muito tempo. Um único portador do vírus, o paciente zero, contagiou 53 pessoas em duas horas e meia. Alguns dos infectados estavam 14 metros atrás dele, de modo que somente os aerossóis podem explicar o contágio. Dois dos doentes morreram.

Após estudar minuciosamente esse caso, os cientistas puderam calcular até que ponto o risco seria reduzido se tivessem sido tomadas medidas contra a transmissão aérea. Nas condições reais, o contágio afetou 87% dos presentes. Com máscaras durante o ensaio, o risco cairia pela metade. Num ensaio mais curto e ventilado, apenas dois membros do coral teriam se infectado. Esses cenários de supercontágio cada vez parecem mais decisivos no desenvolvimento e na propagação da pandemia. Portanto, contar com ferramentas para evitar as infecções em massa em eventos desse tipo é vital para controlar a doença.

Metodologia: *Calculamos o risco de infecção por covid-19 a partir de uma ferramenta desenvolvida por José Luis Jiménez, especialista em química e dinâmica de partículas no ar da Universidade do Colorado (EUA). Outros colegas do mundo todo revisaram o simulador, que se baseia em dados e métodos publicados para estimar a importância de diferentes fatores mensuráveis que entram em jogo num cenário de contágio. Ainda assim, o modelo tem precisão limitada porque é baseado em números que ainda são incertos, como a quantidade de vírus emitida por uma pessoa infectada e sua capacidade de infecção. O modelo assume que as pessoas praticam o distanciamento físico de dois metros e que não há pessoas imunes. Em nosso cálculo, atribuímos às máscaras o valor por padrão para a população em geral, que inclui toda a variedade de máscaras (cirúrgicas e de tecido) e um tom de voz alto, o que aumenta a quantidade de aerossóis exalados.*

Vídeos de **Luis Almodóvar.**

ARQUIVADO EM:

Brasil América Ciência Coronavirus Coronavirus Covid-19 Doenças Respiratórias Mascarillas Mascarillas Faciales Investigação Científica Contágio Colégios Escolas Públicas Medidas Contención

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Quais problemas de saúde uma máscara suja pode causar e quais você já pode descartar

PANDEMIA DE CORONAVÍRUS

Anticorpos contr enos sete meses

PANDEMIA DE CORONAVÍRUS

O que é o fator K e por que é importante saber onde nos infectamos

Com o aumento dos casos de Covid, Estado interrompe desmobilização de leitos de UTI

Renata Galdino
rgaldino@hojeemdia.com.br
19/11/2020 - 15h07 - Atualizado 15h10

A elevação dos casos de Covid-19 em Minas Gerais levou o governo do Estado a interromper a desmobilização de leitos de UTI para atender a esses pacientes.

"Nós orientamos a desmobilização. Só que agora, como estamos tendo uma flutuação nítida (de notificações confirmadas da doença), não é o momento para continuar", explicou o secretário de Estado de Saúde, Carlos Eduardo Amaral, durante entrevista coletiva nesta quinta-feira (19).

Segundo o titular da pasta, os leitos só devem se tornar inoperantes com a chegada do verão, quando se espera uma queda no número de casos. Mesmo assim, as regionais de Saúde estão orientadas a monitorar a situação, para identificar uma possível necessidade de abertura de vagas na terapia intensiva ou a adoção de alguma outra medida específica.

Carlos Eduardo Amaral afirmou que o Estado não vive uma segunda onda da pandemia de Covid-19. "De forma geral, hoje, não temos nenhuma sinalização de explosão de casos. O que precisamos é tomar cuidado", frisou.

O secretário reconhece ter havido mudança no comportamento de muitas pessoas, que acabaram relaxando nas medidas de prevenção. Conforme o Hoje em Dia mostrou na edição desta quinta-feira, parte dos moradores e comerciantes de Belo Horizonte está deixando de usar máscaras nas ruas e no atendimento os clientes.

A falta de cuidado, destacou Carlos Eduardo Amaral, pode resultar em mudança no perfil comportamental da pandemia. "A região Central ainda está na onda verde (dentro do programa Minas Consciente), mas é fundamental que todos se cuidem, usem máscaras e álcool gel, mantenham o distanciamento", alertou.

Link: http://hoje.vc/30o80