Literature summary aerosols

Author and date	Link to article	Title	Peer reviewed yes/no	Setting	Methods	Results/conclusions	Limitations
Amoatey, 2020	https://www.sciencedirect.com/science/article/pii/S0048969720328734	Impact of building ventilation systems and habitual indoor incense burning on SARS-CoV-2 virus transmissions in Middle Eastern countries	Yes	Middle Eastern countries	Editorial	Slechte ventilatie, branden van wierook binnen en een lage binnentemperatuur kan de verspreiding van SARS-CoV-2 verhogen.	
Anderson, 2020	https://onlinelibrary.wiley.com/doi/full/10.1111/risa.13500	Consideration of the Aerosol Transmission for COVID-19 and Public Health	Yes		Commentary	Definities: *aerosol* to mean the small respirable particles <5–10 µm that can remain airborne and are capable of short- and long-range transport. Larger droplets >20 µm settle under the influence of gravity and are too large to follow inhalation airflow streamlines; the intermediate range of 10–20 µm may either settle or remain suspended (Tellier et al., 2019). Argumenten: case reports van asymptomaten die anderen besmetten in samenhang met studies die laten zien dat normaal ademen, praten etc. kleine (<1 µm) druppels produceert, beperkt aantal studies naar aerosolen SARS en SARS-CoV-2 (o.a. Van Doremalen) en literatuur over andere infectieziekten en aerosolen. Conclusie: currently available evidence strongly suggests the immediate need to address the significance of SARS-CoV-2 aerosol transmission.	
Asadi, 2020	https://www.t	The	Yes	Review	Review	Met praten worden er ook aerosolen	

	andfonline.com/doi/full/10.1080/02786826.2020.1749229	coronavirus pandemic and aerosols: Does COVID-19 transmit via expiratory particles?				geproduceerd. Hangt wel af van allerlei factoren of hier virus zit en of dit levensvatbaar is. Is nog niet aangetoond voor sars-cov-2	
Bontempi, 2020	https://www.sciencedirect.com/science/article/pii/S0013935120305326	First data analysis about possible COVID-19 virus airborne diffusion due to air particulate matter (PM): The case of Lombardy (Italy)	Yes	Lombardy, Italy	Data analysis airborne transmission air particulate matter	The results show that it is not possible to conclude that COVID-19 diffusion mechanism also occurs through the air, by using PM10 as a carrier. In particular, it is shown that Piedmont cities, presenting lower detected infections cases in comparison to Brescia and Bergamo in the investigated period, had most sever PM10 pollution events in comparison to Lombardy cities.	
Brlek, 2020	https://www.cambridge.org/core/journals/epidemiology-and-infection/article/possible-indirect-transmission-of-covid19-at-a-squash-court-slovenia-march-2020-case-report/B48D7B5B251D5174178B46FA280ED2F0	Possible indirect transmission of COVID-19 at a squash court, Slovenia, March 2020: case report	Yes	Squash, Slovenië	Epidemiologisch	Na een index nog 4 mensen positief, waarvan maar 1 direct contact had met index. We concluded that the mode of transmission between the index patient and the secondary cases in this cluster was either through contaminated common objects or virus aerosol, since all three pairs shared the same squash hall, which is a small and confined space with poor ventilation, where strenuous physical activity is performed, during which shedding and aerosolisation of the virus could be increased.	No phylogenic research, not sure if every person used the same locker room
Brurberg, 2020	https://www.fhi.no/globalas	COVID-19-EPIDEMIC:	-	Review Norwegian	Review	Our literature search has not led to the finding of studies that document	

	sets/dokumenterfiler/rapporter/2020/sars-cov-2-mers-cov-and-sars-cov-and-risk-of-airborne-transmission-report-2020.pdf	SARS-CoV-2, MERS-CoV and SARS-CoV and risk of airborne transmission – a rapid review		Institute of Health		airborne infection of SARS-CoV-2, MERS-CoV or SARS-CoV. The included studies show that infection can mainly be traced back to direct or indirect physical contact, but that caution must be exercised using aerosol generating procedures. One study has measured virus-containing particles in the air in patient rooms with hospitalised MERSCoV patients (8), while another study failed to document virus-containing particles in air samples taken more than 10 cm from the chin of a patient with ongoing SARSCoV-2 infection. (4). In both studies that have conducted air tests, there is uncertainty about the results as none of them use positive or negative controls, and because it is uncertain whether viruses detected by PCR from air samples are viable and contagious (1). Cheng: air sample o.a. vlakbij patient (10 cm). Geen virus. Roth et al. Casus Duitsland met Chinese zakenvrouw; mogelijk aerosolen? Ook asymptomatisch. Li et al. Waarschijnlijk vooral druppel/handen	
Cai, 2020	https://www.nc.cdc.gov/eid/article/26/6/20-0412_article?te=1&nl=the-morning&emc=edit_nn_20200528	Indirect Virus Transmission in Cluster of COVID-19 Cases, Wenzhou, China, 2020	Yes	Shopping mall, China	Epidemiologisch	The rapid spread of SARS-CoV-2 in our study could have resulted from spread via fomites (e.g., elevator buttons or restroom taps) or virus aerosolization in a confined public space (e.g., restrooms or elevators). All case-patients other than those on floor 7 were female, including a restroom cleaner, so common restroom use could have been the infection source.	Weinig onderbouwing voor deze suggesties.

						For case-patients who were customers in the shopping mall but did not report using the restroom, the source of infection could have been the elevators. The Guangzhou Center for Disease Control and Prevention detected the nucleic acid of SARS-CoV-2 on a doorknob at a patient's house (5), but Wenzhou Center for Disease Control and Prevention test results for an environmental sample from the surface of a mall elevator wall and button were negative.	
Cheng, 2020	https://www.cambridge.org/core/journals/infection-control-and-hospital-epidemiology/article/escalating-infection-control-response-to-the-rapidly-evolving-epidemiology-of-the-coronavirus-disease-2019-covid19-due-to-sarscov2-in-hong-kong/52513ACC56587859F9C601DC747EB6EC	Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong	Yes	Ziekenhuis, Hong Kong	Air sampling RNA	Geen RNA aangetoond in luchtsamples op afstand van 10 cm van kin patiënt	
Chia, 2020	https://www.nature.com/articles/s41467-	Detection of air and surface contamination	Yes	Ziekenhuis	Luchtmeting RNA, oppervlak	Air sampling of the AIIR environments of two COVID-19 patients (both day 5 of illness with high nasopharyngeal	Our study was limited in that it did not determine the ability of SARS-CoV-2 to be cultured from the environmental

	020-16670-2	by SARS-CoV-2 in hospital rooms of infected patients				swab viral loads) detected the presence of SARS-CoV-2 particles sized 1–4 μm and >4 μm. The absence of any detection of SARS-CoV-2 in air samples of the third patient (day 9 of illness with lower nasopharyngeal viral load concentration) suggests that the presence of SARS-CoV-2 in the air is possibly highest in the first week of illness.	swabs and the differentially sized air particles. Second, sampling in an AIIR environment may not be representative of community settings and further work is needed to generalize our current findings. Third, we sampled each room at a single timepoint during the course of illness and did not track environmental contamination over the course of illness for individual patients. Fourth, as clinical results were within 72 h of environmental testing, it is plausible that during the day of testing, viral load was actually low or negligible, hence limiting environmental contamination.
Faridi, 2020	https://www.sciencedirect.com/science/article/pii/S0048969720319148	A field indoor air measurement of SARS-CoV-2 in the patient rooms of the largest hospital in Iran	Yes	Ziekenhuis, Iran	Air sampling RNA	PCR, samples genomen binnen 2 tot 5 meter van bed patiënt met ernstige symptomen. Alle samples waren negatief.	
Fears, 2020	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7217084/	Comparative dynamic aerosol efficiencies of three emergent coronaviruses and the unusual persistence of SARS-CoV-2 in aerosol suspensions	No	Experimenteel	Aerosolen genereren, stabiliteit meten, infectieus virus via PFU	this preliminary dataset on the aerosol efficiency and persistence of SARSCoV-2 suggest that this virus is remarkably resilient in aerosol form, even when aged for over 12 hours (16 hours). Infectious virus.	
Kim, 2020	https://www.s	Infection and		Dierexperimen	Direct en	At 2 days postcontact, SARS-CoV-2 was	To evaluate the transmission mode of

	ciencedirect.com/science/article/pii/S1931312820301876	Rapid Transmission of SARS-CoV-2 in Ferrets		t, fretten	indirecte besmetting	detected in all naive direct contact ferrets. Furthermore, a few naive indirect contact ferrets were positive for viral RNA, suggesting airborne transmission. These data show that airborne transmission is likely but is considerably less robust than direct contact transmission.	the virus, naive ferrets (n = 2/group) were placed in direct contact (DC) (co-housed) or indirect contact (IC) (housed in cages with a permeable partition separating them from infected ferrets) with infected ferrets two days after the primary infection. → still next to each other, distance is not mentioned
Li, 2020	https://www.medrxiv.org/content/10.1101/2020.04.16.20067728v1	Running title: Aerosol transmission of SARS-CoV-2 Evidence for probable aerosol transmission of SARS-CoV-2 in a poorly ventilated restaurant	No	Restaurant, China	Epidemiologisch spreiding tracer gas door de ruimte	Three families (A (index), 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.	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.
Lu, 2020	https://wwwnc.cdc.gov/eid/article/26/7/20-0764_article	COVID-19 Outbreak Associated with Air	Yes	Restaurant, China	Epidemiologisch. Geen luchtmetingen gedaan. Geen	Airconditioning zou rol kunnen hebben gespeeld in de verspreiding van druppels van tafel naar tafel op >1 meter afstand. Geen infectie van	

		Conditioning in Restaurant, Guangzhou, China, 2020			swabs. Veel beperkingen	medewerkers of andere gasten →lijkt niet op aerosol overdracht. *From our examination of the potential routes of transmission, we concluded that the most likely cause of this outbreak was droplet transmission. Virus transmission in this outbreak cannot be explained by droplet transmission alone. Larger respiratory droplets (>5 μm) remain in the air for only a short time and travel only short distances, generally <1 m (2,3). The distances between patient A1 and persons at other tables, especially those at table C, were all >1 m. However, 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.* *- the lower concentrations of aerosols at greater distances might have been insufficient to cause infection in other parts of the restaurant.* *- We conclude that in this outbreak, droplet transmission was prompted by air-conditioned ventilation. The key factor for infection was the direction of the airflow.* *- To prevent spread of COVID-19 in restaurants, we recommend strengthening temperature-monitoring surveillance, increasing the distance between tables, and improving ventilation.*	
Ma, 2020	https://www.medrxiv.org/content/10.1101/2020.05.31.20115154v1	Exhaled breath is a significant source of SARS-CoV-2 emission	No	Beijing, China	Epidemiologisch Luchtmetingen, ademmetingen, oppervlaktes	Surface: 5,4% positive, N=242 Air: 3,8% positive, N=26 Exhaled breath condensate: 16,7%/5 positive, N=30 Evidences from our work show that exhaled breath emission may well be the most significant SARS-CoV-2	Beperkingen: EBC gemeten door door een rietje te ademen →met meer kracht ademen? Daardoor meer virus uitademen dan normaal? 5 van 30 patiënten met virus RNA in de adem is geen meerderheid, in hoeverre komt het dan vaak voor?

						shedding mechanism, which could have contributed largely to the observed cluster infections and the ongoing pandemic. Accordingly, measures such as enhanced ventilation and the use of face masks are essential to minimize the risk of infection by airborne SARS-CoV-2.	Geen druppelgrootte gemeten, niet duidelijk hoe groot de uitgeademde druppels zijn. RNA gemeten, niet of dit ook viable virus is.
Miller, 2020	https://www.medrxiv.org/content/10.1101/2020.06.15.20132027v2	Transmission of SARS-CoV-2 by inhalation of respiratory aerosol in the Skagit Valley Chorale superspreading event	No	Skagit Valley, USA	EpidemiologischModeling	53/61 (33 confirmed) COVID-19 cases in one choir. Avoided personal contact. Mathematical model quanta emission rate. This modeling analysis has explored the very probable situation in which transmission by inhaling respiratory aerosol that were released during singing caused a large COVID19 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 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. Widespread application of effective indoor environment controls could help limit the extent of	

						superspreading events and therefore contribute to slowing the pandemic spread. - Growing evidence supports a view that inhaling respiratory aerosol is an important route for transmission of SARS-CoV-2 under certain conditions. - 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." - This modeling analysis has explored the very probable situation in which transmission by inhaling respiratory aerosol that were released during singing caused a large COVID19 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 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. Widespread application of effective indoor environment controls could help limit the extent of superspreading events and therefore contribute to slowing the pandemic spread.	
Ong, 2020	https://jamanetwork.com/journals/jama/article-abstract/2762692	Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient	Yes	Ziekenhuis (outbreak center)	Air sampling RNA (SKC Universal pumps, Sartorius MD8 microbiological sampler)	Alle samples van lucht binnen patiëntenkamers, de sluis en buiten de kamer waren negatief. Echter swabs luchtuitlaat positief. Mogelijk virus via air flow naar ventilator / lucht uit laat.	
Richard, 2020	https://www.biorxiv.org/content/10.1101/2020.04.16.044503v1.abstract	SARS-CoV-2 is transmitted via contact and via the air between ferrets.	No	Dierexperiment, fretten	Direct en indirecte besmetting	SARS-CoV-2 transmitted to four out of four direct contact ferrets between 1 and 3 days after exposure and via the air to three out of four independent indirect recipient ferrets between 3 and 7 days after exposure.	Our experimental system does not allow to assess whether SARS-CoV-2 was transmitted via the air through respiratory droplets, aerosols or both, as donor and indirect recipient ferret cages are placed only 10 cm apart from each other
Santarpia, 2020	https://www.medrxiv.org/content/10.1101/2020.03.23.20039446v3.fu	Aerosol and Surface Transmission Potential of SARS-CoV-2	No	Ziekenhuis (quarantaine units)	Air sampling methode? PCR → RNA detectie	63,2% positief in patientkamer. (gemid 2,86 copies/L) 66,7% pos in hal. (gemid 2,59 copies/L) Echter, er kon geen virus	**Dit artikel is al maanden geleden gepubliceerd maar nog steeds niet peer reviewed!**

	ll.pdf					vermeerdering worden vastgesteld. Vervolgd onderzoek loopt nog.	
Sasidharan, 2020	https://www.medrxiv.org/content/10.1101/2020.04.13.20060798v1	A vulnerability-based approach to human-mobility reduction for countering COVID-19 transmission in London while considering local air quality	No	Londen, UK	Epidemiologisch	Our analysis shows that short-term exposure to air pollution (both NO2 and PM2.5) is significantly correlated with an increased risk of contracting and dying from COVID-19.	
Setti, 2020	https://www.mdpi.com/1660-4601/17/8/2932	Airborne Transmission Route of COVID-19: Why 2 Meters/6 Feet of Inter-Personal Distance Could Not Be Enough	Yes (?)	-	Editorial	The available information on the SARS-COV-2 spreading supports the hypothesis of airborne diffusion of infected droplets from person to person at a distance greater than two meters (6 feet). The inter-personal distance of 2 m can be reasonably considered as an effective protection only if everybody wears face masks in daily life activities.	
Siddiqui, 2020	https://www.tandfonline.com/doi/pdf/10.1080/20477724.2020.1765653	Centralized air-conditioning and transmission of novel coronavirus	No	-	Editorial	We hypothesize that SARS-CoV-2 can take refuge inside ubiquitous and environmentally hardy Acanthamoeba (the trojan horse of the microbial world) [3], allowing its persistence in the environment, and in particular, in centralized air-conditioning systems.	
Somsen, 2020	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7255254/	Small droplet aerosols in poorly ventilated spaces and SARS-CoV-2	No	Laser measurement droplets speech and coughs	Experimenteel, comment	We found two distinct types of drops, large droplets (100–1000 μm in diameter) and small droplets (1–10 μm), with the small droplets being much more prevalent. During speech, only the small droplets were found.	

		transmission				Normal breathing no droplets, sneezing only large droplets. Our findings confirm that improving ventilation of public spaces will dilute and clear out potentially infectious aerosols.	
Van Doremalen, 2020	https://www.nejm.org/doi/full/10.1056/nejmc2004973	Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1	Yes (?)	Experimenteel	Aerosolen genereren, stabiliteit meten, infectieus virus ($TCID_{50}$)	SARS-CoV-2 remained viable in aerosols throughout the duration of our experiment (3 hours), with a reduction in infectious titer from $10^{3.5}$ to $10^{2.7}$ $TCID_{50}$ per liter of air.	
Wang, 2020 Editorial	https://link.springer.com/content/pdf/10.1007/s11845-020-02218-2.pdf	COVID-19 may transmit through aerosol	Yes	Woongebouw	Epi studie.	Bewoner in flat mogelijk via aerosolen in lift of vlakbij appartement patient ziek geworden. Laboratorium medewerkers ziek zonder contact met patienten. Mogelijk via aerosolen die ontstaan uit bloed?	Maar speculatie. Onderzoek nodig om te bevestigen.
Wilson, 2020	https://onlinelibrary.wiley.com/doi/full/10.1111/anae.15093	Airborne transmission of severe acute respiratory syndrome coronavirus-2 to healthcare workers: a narrative review	Yes	Review	Review	Due to the numerous complex dynamic variables, 'droplet-airborne' spread should not be viewed as a dichotomy based on exact particle size and specific safe distances, but as a continuum over which probability of lung inoculation alters. Coughing, talking and tidal volume breathing produce respiratory tract lining fluid-derived particles which could be inhaled into a respiratory portion of the lung[10, 11]. The mechanisms of SARS-CoV-2 transmission are currently undetermined leaving a potential role for airborne infection [7]. We speculate the respiratory pathophysiology of COVID-19 could increase exhaled infectious particles.	
Xu, 2020	https://www.		No	Cruise schip	Epidemiologis	We infer that the ship central air	

	medrxiv.org/content/10.1101/2020.04.09.20059113v1	Transmission routes of Covid-19 virus in the Diamond Princess Cruise ship			ch Geen luchtmetingen	conditioning system did not play a role, i.e. the long-range airborne route was absent in the outbreak. Most transmission appears to have occurred through close contact and fomites.	
Zhang, 2020	https://www.pnas.org/content/117/26/14857.short	Identifying airborne transmission as the dominant route for the spread of COVID-19	Yes	Trend and migitation measures Wuhan, Italy, New York City	Epidemiologisch	We conclude that wearing of face masks in public corresponds to the most effective means to prevent interhuman transmission, and this inexpensive practice, in conjunction with simultaneous social distancing, quarantine, and contact tracing, represents the most likely fighting opportunity to stop the COVID-19 pandemic. *In this work, we show that airborne transmission, particularly via nascent aerosols from human atomization, is highly virulent and represents the dominant route for the transmission of this disease* *- The current mitigation measures, such as social distancing, quarantine, and isolation implemented in the United States, are insufficient by themselves in protecting the public. Our analysis reveals that the difference with and without mandated face covering represents the determinant in shaping the trends of the pandemic worldwide. We conclude that wearing of face masks in public corresponds to the most effective means to prevent interhuman transmission, and this inexpensive practice, in conjunction with extensive testing, quarantine, and contact tracking, poses the most probable fighting opportunity to stop*	Beperkingen: aanname dat SARS-CoV-2 verspreidt via aerosolen, oa gebaseerd op 3 artikelen die niet over het virus zelf gaan. Geen rekening gehouden met andere cofactoren en niet gekeken naar landen waar de maatregelen zonder masker dragen wel werken (zoals NL).

						the COVID-19 pandemic, prior to the development of a vaccine.	
Mick & Murphy, 2020	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7212733/	Aerosol-generating otolaryngology procedures and the need for enhanced PPE during the COVID-19 pandemic: a literature review	Yes	Hospital	Review	Evidence shows that otolaryngology-head and neck surgery produces aerosols and therefore otolaryngologists are at high risk of COVID-19 infection. Infected patients produce aerosols with a high viral load. Based on the evidence, it is reasonable to enhance the personal protection protocol.	Further research is needed to clarify the risk associated with performing various procedures during the COVID-19 pandemic, and the degree to which various personal protective equipment reduces the risk.
Howard, 2020)	https://journals.sagepub.com/doi/pdf/10.1177/0194599820927335	High-Risk Aerosol-Generating Procedures in COVID-19: Respiratory Protective Equipment Considerations	Yes	Hospital	Review	N95 masks are appropriate for most airborne precaution situations. But more high-risk aerosol-generating procedures (eg. long exposure period, proximity to the airway, manipulation of high-viral load tissues, use of energy devices) require higher level PPE. Better PPE can include Powered Air-Purifying Respirators (PAPRs), controlled air-purifying respirators (CAPRs) and masks with 99- to 100-level filters (both elastomeric and disposable)	
Workman et al., 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7251624/	Airborne Aerosol Generation During Endonasal Procedures in the Era of COVID-19: Risks and Recommendations	Yes? Received on same day as acceptance	Cadaver laboratory and clinical examination room	Prospective quantification of airborne aerosol generation during surgical and clinical simulation	Surgical simulation: - During Cold Instrumentation and Microdebridement: did not produce significant airborne aerosols of 1-10 µm. - During High-Speed Drilling Conditions: significant generation of aerosols 1-10µm. aerosol generation increased with increased length of procedure. The number of particles of a certain diameter decreased as the diameter increased. - During Transnasal Cautery: also produced aerosols. The particles were	

						generally smaller than during high-speed drilling conditions. Clinical simulation: - Simulated patient activities: Panting and coughing generated detectable 1- to 10-μm aerosols that were not significantly greater than background. Nasal endoscopy and speech conditions generated significant airborne aerosols. Simulated sneezing generated the most airborne particles per minute by an order of magnitude. Simulated topical spraying of lidocaine and oxymetazoline generated airborne aerosols comparable to those generated with sneezing - Detection During Simulated Sneeze Under Masked Conditions: The surgical mask alone attenuated airborne aerosol generation, however, statistically significant aerosol escape was still detected. An N95 respirator and a modified N95 VENT respirator ameliorated airborne particle generation to background levels.	
Harding et al., 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7263217/	Aerosol generating procedures and infective risk to healthcare workers: SARS-CoV-2 – the limits of the evidence	Yes	Review	Review	Reports suggest airborne transmission. Covid-19 can survive for 3 hours in an aerosol. But this does not confirm airborne transmission. However, the risk for airborne transmission is significant.	
Godri Pollitt et al., 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7214856/	COVID-19 vulnerability: the potential impact of genetic	Yes	Review	Review	While the WHO has dismissed airborne transmission, this review suggests that airborne aerosols might play a role in COVID-19 transmission. However, no definitive answer to this question is	

		susceptibility and airborne transmission				*found yet.*	
Morawska et al., 2020)	*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7250761/*	*How can airborne transmission of COVID-19 indoors be minimized?*	*yes*	*Review*	*Review*	*While evidence for the role of airborne transmission of Covid-19 is still incomplete, there is evidence that suggests that it does play a role. In the light of this potential airborne transmission, the risk of transmission would be higher indoors in poorly ventilated rooms. Therefore, they propose the following recommendations regarding ventilation:* *1. remind building and hospital managers that engineering controls are effective to reduce the risk of airborne infection.* *2. increase existing ventilation rates and to enhance ventilation effectiveness.* *3. prevent air-recirculation within the ventilation system.* *4. add portable air cleaners to existing ventilation systems when there is known air stagnation. Or isolate air with high viral load. Adequate replacement of filters is crucial.* *5. avoid over-crowding.*	
Beggs, 2020)	*https://www.medrxiv.org/content/10.1101/2020.05.22.20109991v2.full.pdf*	*Is there an airborne component to the transmission of COVID-19? : a quantitative analysis study*	*No*	*Review*	*Review*	*The analysis shows that airborne transmission of Covid-19 is likely, however, the extent remains unknown. One of the reasons for this is the ambiguity and confusion of distinction between droplets, droplet nuclei and aerosols. They do recommend further research into the airborne transmission of the virus.*	
McArthur et al., 2020)	*https://www.medrxiv.org/c*	*COVID-19; Systematic*	*No*	*Review*	*Review*	*SARS-CoV-2 has been shown to survive in aerosolised form for more than 3*	During the review period, the data on COVID-19 constantly changed with

	ontent/10.1101/2020.05.14.20102475v1	*and literature review of transmission, case definitions, clinical management and clinical trials.*				*hours under experimental conditions, but this mechanical generation of aerosols is unlikely to mimic the true clinic scenario. Certain clinical procedures involving the upper airway, such as obtaining a nose or throat swab, endotracheal intubation, manual ventilation or nebulisation are capable of generating particles <5µm, allowing for airborne transmission in healthcare settings. In particular, intensive care units (ICU) have been associated with a higher risk of infection*	increasing amounts of literature both peer-reviewed and non-peer-reviewed. COVID-19 data was dependent on country level definitions and testing rates.
Arav et al., 2020)	*https://www.medrxiv.org/content/10.1101/2020.05.12.20099085v1.full.pdf*	*Understanding the indoor pre-symptomatic transmission mechanism of COVID-19*	*No*	*Mathematical model*	*evidence based quantitative mechanistic mathematical model*	*Using the model we identified the dominant driver of pre-symptomatic transmission, which was found to be contact route, while the contribution of the airborne route is negligible. We provide evidence that a combination of rather easy to implement measures of frequent hand washing, cleaning fomites and avoiding physical contact decreases the risk of infection by an order of magnitude, similarly to wearing masks and gloves.*	
J. Borak, 2020)	*https://pubmed.ncbi.nlm.nih.gov/32476011/*	*Airborne Transmission of Covid-19*	*Yes*	*Editorial*	*Editorial*	*- There is more than enough evidence of the interpersonal spread of COVID infection via airborne transmission. A recent report of the unfortunate results of a choir practice in Washington State brings this point home. - This remarkable example of interpersonal 'super spreading' is best explained by the enhanced aerosolized transmission that resulted from enthusiastic singing. And the spread to so many, despite distancing, argues that transmission was not due solely to localized droplet dispersion, but more likely to*	

						wider dispersion of aerosolized droplet nuclei. *- These observations and findings raise concerns that COVID-19 may spread widely via fine aerosolized droplets. That, in turn, poses two more questions that need answers. First, does the finding of COVID RNA indicate the presence of viable virus, or only the remnants of non-viable virus? In other words, it is not yet known whether such wider airborne dispersion will necessarily lead to greater spread of infection. Second, if fine COVID-related aerosols are infectious, then what is the most appropriate respiratory protection for healthcare workers and others with likely exposure?*	
(Rahmani et al., 2020)	*https://www.sciencedirect.com/science/article/pii/S0048969720337281*	*Sampling and detection of corona viruses in air: A mini review*	*Yes*	*Review on air sampling*	*Review*	*- SARS-Cov-2 was present in some air samples that were collected from patients' rooms in hospitals.* *- Factors like patient distance from the sampler, having a protective or oxygen masks, patient activity, coughing and sneezing during sampling time, air movement, air conditioning, patient density in the sampling site, temperature and humidity, sampler type, sampling conditions, storage and transferring conditions, and detection method can influence the results.*	*Since the samples were collected in patients' rooms, it is not clear whether the presence of SARS-Cov-2 is due to airborne presence or through respiratory droplets.*
(Correia et al., 2020)	*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7182754/*	*Airborne route and bad use of ventilation systems as non-negligible factors in SARS-CoV-2*	*Yes*	*Review*	*Review*	*The hypothesis – Airborne transmission is possible for SARS-CoV-2 and the bad use of ventilation systems may contribute to its propagation.* *Heating, Ventilation and Air Conditioning Systems (HVAC) are used*	

		transmission				as a primary infection disease control measure. However, if not correctly used, they may contribute to the transmission/spreading of airborne diseases as proposed in the past for SARS. The authors believe that airborne transmission is possible and that HVAC systems when not adequately used may contribute to the transmission of the virus, as suggested by descriptions from Japan, Germany, and the Diamond Princess Cruise Ship. Previous SARS outbreaks reported at Amoy Gardens, Emergency Rooms and Hotels, also suggested an airborne transmission. The authors address HVAC as major source for indoor and environmental contamination that can explain the swift viral spread. The confirmation of such way of transmission can constitute a major shift in the battle against the pandemic.	
(Buonanno et al., 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7211635/	Estimation of airborne viral emission: Quanta emission rate of SARS-CoV-2 for infection risk assessment	Yes	-	Estimation of the quanta emission rate, demonstration application	High emission values have been found for an SARS-CoV-2 asymptomatic subject both in the light exercise condition during speaking and in the heavy exercise with oral breathing. The proposed approach is of great relevance as it represents an essential tool to be applied in enclosed space and it is able to support air quality experts and epidemiologists in the management of indoor environments during an epidemic just knowing its viral load, without waiting for the end of the outbreak. The results obtained from the simulations clearly highlight that a key	

						role is played by proper ventilation in containment of the virus in indoor environments.	
(Morawska & Cao, 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7151430/	Airborne transmission of SARS-CoV-2: The world should face the reality	yes	-	Review	It is therefore extremely important, that the national authorities acknowledge the reality that the virus spreads through air, and recommend that adequate control measures be implemented to prevent further spread of the SARS-CoV-2 virus, in particularly removal of the virus-laden droplets from indoor air by ventilation. To summarize, based on the trend in the increase of infections, and understanding the basic science of viral infection spread, we strongly believe that the virus is likely to be spreading through the air. If this is the case, it will take at least several months for this to be confirmed by science. This is valuable time lost that could be used to properly control the epidemic by the measures outlined above and prevent more infections and loss of life. Therefore, we plead that the international and national authorities acknowledge the reality that the virus spreads through air, and recommend that adequate control measures, as discussed above be implemented to prevent further spread of the SARS-CoV-2 virus. ()	
(Allen & Marr, 2020)	https://onlinelibrary.wiley.com/doi/epdf/10.1111/ina.12697	Recognizing and controlling airborne transmission	Yes	Editorial	Editorial	- A study of over 7000 cases found that all outbreaks involving three or more people occurred indoors - SARS-COV-2 viral RNA in air has been detected in several studies in hospitals,	

		of SARS-CoV-2 in indoor environments				*including at distances greater than 2 m from patients and in outdoor air in crowded areas near a hospital and a department store.* *- Concluding that transmission of SARS -COV-2 can occur via large droplet spray requires an assumption that the virus survives in such droplets. It is also reasonable, then, to assume the same for virus survival in aerosols. This is supported by empirical evidence. Previous studies have shown that other viruses survive equally well, if not better, in suspended aerosols compared to large droplets on surfaces.* *- a physics-based simulation suggests that the majority of exposure at close range occurs by inhalation of small droplets rather than by contact with large droplets that land on the mouth, nose, and eyes, unless the people are closer than 30 cm or the droplets are very large* *- Evidence is emerging indicating that, in addition to transmission via large droplets and fomites, SARS-CoV-2 is also transmitted via inhalation of aerosols. Recognition of this transmission route is critically important because there are measures we can take to reduce the risk of airborne transmission. These include:* *- increasing outdoor air ventilation rates above current minimums* *- using high-efficiency filtration for recirculated air (MERV 13 or greater)* *- verifying that sensitive areas, such as bathrooms and rooms where infected patients are cared for in hospitals and senior homes, are negatively*	

						pressurized relative to adjacent areas - managing air flow direction and speed to prevent spread of aerosols across occupants - consideration of additional technological controls, such as UV germicidal irradiation and portable air purification, in areas and situations where typical building-level controls are not sufficient - using N95 respirators in healthcare settings.	
(Feng et al., 2020)	https://www.sciencedirect.com/science/article/pii/S0021850220300744	Influence of wind and relative humidity on the social distancing effectiveness to prevent COVID-19 airborne transmission: A numerical study	Yes	-	A validated computational fluid-particle dynamics (CFPD) model was employed	- recent studies (van Doremalen et al., 2020, Van Doremalen et al., 2020) demonstrate that aerosols containing SARS-CoV-2 remained infectious in air, on surfaces, and in tissue-culture assays with only a slight reduction in infectivity for hours of observation.	
(Jayaweera et al., 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7293495/	Transmission of COVID-19 virus by droplets and aerosols: A critical review on the unresolved dichotomy	Yes	Review	Review	- The case studies found worldwide indicate that the behavior of the SARS-CoV-2 virus has been unprecedentedly unique with more survival and viable rates in the air and believed to linger in the air for an extended period. - The behavior of virus-laden aerosols resulted from a cough-jet has not yet been aerodynamically modeled with reasonable accuracy; hence, the actual level of impact that a single cough-jet envisages could not be simulated well. However, there exists evidence to showcase a profound risk of COVID-19 being spread in an aircraft when a	

						symptomatic or even asymptomatic patient is on board. Further, the environmental factors such as moderately low relative humidity (50%), low temperature (< 25 °C), and moderate ACH (< 30 per hour) would set the platform for the SARS-CoV-2 to sustain for extended periods within the cabin. Strict guidelines for the minimization of such pandemic events are, therefore, paramount. *- Researchers have speculated that both droplets and aerosols generated from non-violent and violent expirations of SARS-CoV-2-infected people may be responsible for the airborne transmission of COVID-19 disease. However, more research work should be conducted to understand the behavior of virus-laden droplets and aerosols in different environmental settings, especially confined spaces so that the transmission of COVID-19 pandemic in the built environment could be fully ascertained.*	
(Prather et al., 2020)	*https://science.sciencemag.org/content/368/6498/1422/tab-pdf*	*Reducing transmission of SARS-CoV-2*	*Yes*	*Editorial*	*Editorial*	*- Airborne transmission was determined to play a role during the SARS outbreak in 2003. However, many countries have not yet acknowledged airborne transmission as a possible pathway for SARS-CoV-2. Recent studies have shown that in addition to droplets, SARS-CoV-2 may also be transmitted through aerosols.* *- increasing evidence for SARS-CoV-2 suggests the 6 feet CDC recommendation is likely not enough under many indoor conditions, where aerosols can remain airborne for hours, accumulate over time, and follow airflows over distances further than 6*	

						feet. *- Airborne transmission could account, in part, for the high secondary transmission rates to medical staff, as well as major outbreaks in nursing facilities. The minimum dose of SARS-CoV-2 that leads to infection is unknown, but airborne transmission through aerosols has been documented for other respiratory viruses, including measles, SARS, and chickenpox.* *- Aerosol transmission of viruses must be acknowledged as a key factor leading to the spread of infectious respiratory diseases. Evidence suggests that SARS-CoV-2 is silently spreading in aerosols exhaled by highly contagious infected individuals with no symptoms. Owing to their smaller size, aerosols may lead to higher severity of COVID-19 because virus-containing aerosols penetrate more deeply into the lungs (10). It is essential that control measures be introduced to reduce aerosol transmission*	
(Mittal et al., 2020)	*https://www.cambridge.org/core/journals/journal-of-fluid-mechanics/article/flow-physics-of-covid19/476E32549012B3620D2452F30F2567F1/core-reader*	*The flow physics of COVID-19*	*Yes*	*Review*	*Review*	*- The transport of droplet nuclei over larger distances is primarily driven by ambient flows, and indoor environments such as homes, offices, malls, aircraft and public transport vehicles pose a particular challenge for disease transmission. The importance of ventilation in controlling airborne transmission of infections is well known and much of the recent work in this area has exploited the power of computational fluid dynamic (CFD) modelling. However, indoor spaces can have extremely complex flows, due not only to the presence of recirculatory flows driven by ventilation systems but*	

						also to anthropogenic thermally driven flow effects. COVID-19 transmission from asymptomatic hosts makes it more critical than ever that we develop methods of analysis that provide better prediction of these effects. *- Fogging machines provide an effective means for disinfecting large spaces, such as hospitals, nursing homes, grocery stores and airplanes. Fogging machines that rely on the dispersion of a fine mist of disinfectants in the air have proven their performance in the healthcare sector*	
(Dhand & Li, 2020)	*https://www.atsjournals.org/doi/pdf/10.1164/rccm.202004-1263PP*	*Coughs and Sneezes: Their Role in Transmission of Respiratory Viral Infections, Including SARS-CoV-2*	*Yes*	*Review*	*Review*	*- By using a laser light scattering method, one minute of loud speaking was estimated to produce thousands of fluid droplets from the oral cavity per second, of these at least 1,000 droplet nuclei contain virions and under the conditions of the experiment they could remain airborne for more than 8 min.* *- Some preliminary evidence supports airborne transmission of SARS-CoV-2 virus. ... Most environmental sampling studies reported detection of viral RNA, but few studies demonstrated a recovery of viable virus, which limits the interpretation for the risk of airborne transmission.* *- Current evidence does not establish effective spread of SARS-CoV-2 virus via airborne route between individuals. At the time of writing, WHO's opinion is that SARS-CoV-2 is transmitted by respiratory droplets and by contact and the virus could become airborne during procedures or treatments that generate aerosols*	

(Stadnytskyi et al., 2020)	https://www.researchgate.net/publication/341377113_The_airborne_lifetime_of_small_speech_droplets_and_their_potential_importance_in_SARS-CoV-2_transmission	The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission	Yes	Review	Review	- Our laser light scattering method not only provides real-time visual evidence for speech droplet emission, but also assesses their airborne lifetime. This direct visualization demonstrates how normal speech generates airborne droplets that can remain suspended for tens of minutes or longer and are eminently capable of transmitting disease in confined spaces. - The droplet nuclei observed in our present study and previously by APS are sufficiently small to reach the lower respiratory tract, which is associated with an increased adverse disease outcome.	- Our current setup does not detect every small particle in each frame of the movie, and our reported values are therefore conservative lower limit estimates. - airborne droplets pose a significant risk only if IAH (independent action hypothesis) applies to human virus transmission. Kleinste druppels waren ≥12µm, dus geen aerosolen
(Yu et al., 2020)	https://www.biorxiv.org/content/10.1101/2020.06.13.150243v1.full	Catch and kill airborne SARS-CoV-2 to control spread of COVID-19 by a heated air disinfection system	No	Review	demonstrates the possibility of applying commercial Ni foam as an air-conditioner filter for use in airplanes, airports, hospitals, schools, office buildings, restaurants, hotels, cruise ships, etc. for 100% removal of SARS-CoV-2 in cycling air, thus slowing the spread of COVID-19, as well as to prevent transmission of other	- Simple filtration cannot completely stop the spread. Fortunately, most viruses, including SARS-CoV-2, are not resistant to high temperature. It has been demonstrated that the time needed for SARS-CoV-2 inactivation is reduced to 5 minutes when the incubation temperature is increased to 70 °C. Therefore, if a filter in an air conditioner can be heated to a high temperature (e.g., up to 250 °C), any SARS-CoV-2 in the cycling air can be efficiently killed in a very short time. - Commercial Ni would be good. It is conductive, flexible, effective in catching particles, heat transfer to air is minimal. However, it is really hard to make such a filter. They have designed a filter of their own. - this innovative technology will (a) improve the safety for frontline workers in essential industries by minimizing the risk of SARS-CoV-2 exposure, (b) make it possible for non-essential workers to safely return to	

					airborne highly infectious agents like anthrax spores.	public work spaces by reducing their risk of exposure, and (c) allow for the general public to more safely re-engage with their own communities through the creation of mobile air-purification devices that can be carried on one's person in order to maintain clean personal air space. These outcomes will enable resilience in the battle against COVID-19, in which the front lines are everywhere and rapidly changing.	
(Di Carlo et al., 2020)	https://www.biorxiv.org/content/10.1101/2020.06.26.173146v1.full	Air and surface measurements of SARS-CoV-2 inside a bus during normal operation	No	Chieti, bus	Surface and air samples were collected and analysed after RT-PCR was done	- we can argue that the requirements of wearing gloves and cleaning up hands, using a dispenser of alcohol-based sanitizer at the bus entrance door, seem to keep the surfaces and the air inside the bus safe and free from SARS-CoV-2 virus. At the same time the rules of wearing a facial mask during travelling, and the recommendation to keep the windows open during bus riding to allow high air ventilation, probably prevent the virus diffusion in the air inside the bus. These results are in agreement with different model simulations that recommend facial masks to combat the SARS-CoV-2 virus spread in aerosols and droplets by asymptomatic people. Moreover, the air ventilation, that model simulations showed to be important to reduce the risk of virus transmission in different indoor environments, is confirmed to be essential also in a more confined location like inside a bus. - Our observations inside a bus showed that the air and all the surfaces samples were not infected by SARS-CoV-2 virus. Even if it was not possible to test the passengers to SARS-CoV-2 but	They did not test the passengers for covid, so they don't know how many infected people were in the bus.

						considering that the asymptomatic people infected could be more than 30% [18], we can expect a potential infection inside the bus. Whether or not the number of infected passengers was about 30%, our findings confirm that the measures established for public transport in terms of sanitation, air ventilation and interpersonal precautions (facial mask, distancing, hands hygienisation) are effective, at least during this study, to make healthy and COVID-free the environment inside the buses.	
(Horve et al., 2020)	https://www.medrxiv.org/content/10.1101/2020.06.26.20141085v1	Identification of SARS-CoV-2 RNA in Healthcare Heating, Ventilation, and Air Conditioning Units	No	OHSU hospital in Portland	Sample collection from air handling units (AHU). RT-PCR and analysis for presence of sars-cov-2 virus.	- This study demonstrates SARS-CoV-2 RNA contamination throughout several AHUs path of flow, including return air, two filtration stages, and supply air, for multiple floors of the hospital and serves as the first evidence of the potential for SARS-CoV-2 RNA (and possibly virus), irrespective of viability, to enter into and travel throughout HVAC systems. - While there is still a paucity of information on the potential viability and infectivity of the present SARS-CoV-2, this paper demonstrates that actions to protect against the potential for SARS-CoV-2 aerosolized travel, and subsequent transmission, should be taken into account in built environment mitigation strategies. Specifically, the data suggest that actions should be taken by healthcare facilities immediately in order to avoid or minimize potential future SARS-CoV-2 healthcare associated infection given that risks increase as more extreme weather conditions force a reduction in the outside air admitted to buildings.	

(Jankovic, 2020)	https://www.mdpi.com/2071-1050/12/12/5204/htm	Experiments with Self-Organised Simulation of Movement of Infectious Aerosols in Buildings	Yes	-	bottom-up emergent modelling of the movement of infectious aerosols in internal space using a physics engine	- As shown in Figure 8, Figure 9 and Figure 10, the droplets suspended in still air reach well beyond the widely used recommendation for social distancing of 2 m. This safety distance recommendation therefore does not work in buildings where there is a risk of infectious aerosols. The lesson learnt for sustainable design is therefore to use high-quality filtering of air in buildings, such as HEPA filters that eliminate 99.97% of particles greater than or equal to 0.3 μm - under a uniform air flow introduced from one side of the room to another, as shown in Figure 16, Figure 17 and Figure 18 both the smaller droplets at high level and larger droplets near the floor level start converging towards one side of the room, from where they can be expelled through high- and low-level vents. The lesson learnt for sustainable design is to use a unidirectional low velocity flow of air, combined with high- and low-level exhaust air vents.	
(Beggs & Avital, 2020)	https://www.medrxiv.org/content/10.1101/2020.06.12.20129254v1	Upper-room ultraviolet air disinfection might help to reduce COVID-19 transmission in buildings	No	-	Mathematical analysis of existing data	We have been able to demonstrate that the UV-C susceptibility constant, Z, for SARS-CoV-2 is likely to be similar to that exhibited by the SARS-CoV-1 and MERS-CoV viruses. Furthermore, we have found evidence suggesting that SARS-CoV-2 when suspended in air is reasonably easy to inactivate using UV light at 254 nm. As such, this suggests that upperroom UVGI may have great potential as an intervention to inhibit the transmission of COVID19 in buildings, especially in situations	

						where achieving high ventilation rates might otherwise be impractical.	
(L. Morawska & D. K. Milton, 2020)	https://pubmed.ncbi.nlm.nih.gov/32628269/	It is Time to Address Airborne Transmission of COVID-19	Yes	Commentary / review	Commentary / review	- They appeal to the medical community and all relevant national communities that have any say in the covid-19 situation to recognize the potential airborne spread. They advocate for preventive measures for this route of transmission. - Several studies have proven that micro virus droplets are expelled by infected people that are able to travel through air and infect people at a distance beyond 1 or 2 meters. - many studies on airborne transmission of other infectious agents like Sars-Cov-1, MERS and influenza are conducted and there is a strong reason to believe that Covid-19 is no exception. - The current measures focus on hand-washing and social distancing, as most international entities do not recognize airborne transmission. The author's view is that these measures are insufficient to combat the Sars-cov-2 virus. - The most problematic situations for airborne transmission are overcrowded and enclosed indoor situations where ventilation is inadequate. - Some argue that the evidence for airborne transmission is incomplete, yet the same holds for the evidence for droplet transmission. - We should take the following precautions: 1. Provide sufficient ventilation (provide outdoor air and minimize recirculation of air) in large (public)	

						buildings *2. Supplement existing ventilation systems with airborne infection controls such as local exhaust, high efficiency air filtration, and germicidal ultraviolet lights.* *3. Prevent overcrowding* *- Most of these measures are cheap and easy to implement. ASRAE and REHVA already have guidelines to prevent/minimize airborne transmission.* *- There seems to be enough evidence to take precautionary measures, yet not many do. This could have serious consequences. Since many countries and facilities are re-opening now, we should act.*	
(Hossain et al., 2020)	*https://www.sciencedirect.com/science/article/pii/S1684118220301470?via%3Dihub#bib28*	*SARS-CoV-2 host diversity: An update of natural infections and experimental evidence*	*Yes*	*Review*	*Review*	*Transmission via cats (and other animals?) is suggested to be airborne*	
(Razzini et al., 2020)	*https://pubmed.ncbi.nlm.nih.gov/32619843/*	*SARS-CoV-2 RNA Detection in the Air and on Surfaces in the COVID-19 Ward of a Hospital in Milan, Italy*	*Yes*	*RNA detection in air samples through an RT-PCR*	*Hospital in Milan, Italy*	*- This study provides the first report on the SARS-CoV-2 shedding in the air and on object surfaces in a hospital in northern Italy with important implications for the patients and medical staff protection as well as for the management of hospitals and public health.* *- it demonstrated that both air and surfaces within areas designated for patients were contaminated by SARS-CoV-2 RNA. This finding suggests that strict structural and personal protection measures as well as systematic disinfections should be*	- RT-PCR is commonly used and it detects presence of the virus well, yet it does not prove viability of the virus. Thus, the samples should actually be cultured too. - Only a limited number of rooms were sampled and sampling was not repeated.

						implemented to reduce the risk of infection for healthcare professionals working in these areas. - the airborne spread of the viral RNA did not involve the areas where patients do not have access indicating the effectiveness of the physical barriers and staff behavioral precautions.	
(Bays et al., 2020)	https://pubmed.ncbi.nlm.nih.gov/32618530/	Investigation of Nosocomial SARS-CoV-2 Transmission from Two Patients to Health Care Workers Identifies Close Contact but not Airborne Transmission Events	Yes	A community hospital and medical center in the US. February and March 2020	Exposed staff were identified by analyzing the EMR and conducting active case finding in combination with structured interviews. Staff were tested for COVID-19 by obtaining oropharyngeal /nasopharyngeal specimens, with RT-PCR testing to detect SARS-CoV-2.	- In all 8 cases, the staff had close contact with the index patients without sufficient personal protective equipment. Importantly, despite multiple aerosol generating procedures, there was no evidence of airborne transmission. - These observations suggest that, at least in a healthcare setting, a majority of SARS-CoV-2 transmission is likely to take place during close contact with infected patients through respiratory droplets, rather than by long-distance airborne transmission.	
(Gehanno et al., 2020)	https://pubmed.ncbi.nlm.nih.gov/32606018/	How Should Data on Airborne Transmission of SARS-CoV-2 Change Occupational Health Guidelines?	Yes	Letter to journal	Letter to journal	- there is now increasing evidence suggesting that SARS-CoV-2 may also be found in droplet nuclei, defined by WHO as respiratory droplets smaller than 5 µm, which can travel on long distances and remain in suspension in the air for a long time. - Two studies performed in medical units where patients with COVID-19	

						were hospitalized have found SARS-CoV-2 on surfaces and in the air of patients' rooms, and even in the medical staff office, with peaks in the submicrometric size. Although it is widely acknowledged that the identification of viral RNA does not necessarily imply the presence of an infectious virus, experimental data have demonstrated that SARS-CoV-2 can survive in an aerosol for up to 3 hours. - Furthermore, investigations of COVID-19 clusters in various environments such as restaurants, ships or buses have concluded that direct contact transmission was insufficient to explain all cases and that airborne transmission was likely. - Systematic use of N95 or FFP2 respirators should be discussed when caring for a patient with COVID-19, as a piece of a broader strategy that must include education, fit-checking, frequent hand hygiene, respiratory etiquette, organizational factors and engineering controls (maximizing ventilation and avoiding recirculation).	
(Schijven et al., 2020)	https://www.medrxiv.org/content/10.1101/2020.07.02.20144832v1.article-info	Exposure assessment for airborne transmission of SARS-CoV-2 via breathing, speaking, coughing and sneezing	No	-	Exposure model	- there is ample evidence that indoor dispersion of aerosol droplets occurs. Generally, in more recent studies, smaller aerosol droplets, up to the submicron level, could be detected. Several studies have measured SARS470 CoV-2 in the air, of which two showed infectious virus particles. Detection of viruses particles in the air is hampered by the fact that concentrations are commonly low, as was demonstrated in this study. Nevertheless, such concentrations may	- heterogeneity could be added to the model

						still give rise to significant probabilities of exposure (10 persons may inhale 5000 litres of air per hour). To conclude: aerosol transmission of SARS-CoV-2 is possible and should not be disregarded. - According to our results, sneezing leads to highest probabilities of exposure, followed by coughing and speaking and lastly breathing in the selected scenarios. - As long as it is uncertain what fraction of the airborne RNA copies relate to virus particles and how much of these are infectious and as long as a dose response relation is lacking, it is recommended to be precautious	
(Shao et al., 2020)	https://arxiv.org/abs/2007.03645	Risk assessment of airborne transmission of COVID-19 by asymptomatic individuals under different practical settings	No		Combining in Situ measurements and numerical simulations, we quantify the exhaled aerosols from normal respiratory behaviors and their transport under elevator, small classroom, and supermarket settings to evaluate the risk of inhaling potentially virus-containing	- Specifically, although ventilation enables the removal of virus-containing aerosols, it can help spread aerosols to larger spaces beyond the proximity of asymptomatic individuals. Inappropriate ventilation can also lead to local hot spots with risks that are orders of magnitude higher than other places depending on the relative positioning of aerosol emitter, ventilation, and space settings. - ventilation at a single location, even at the highest rate in the current practice, is highly inefficient at removing aerosols, due to the presence of relatively stable flow circulation zones in the space and the large amount of aerosol deposition on surfaces. This result suggests that improvements to air filters alone are not enough to reduce the aerosol concentration. - our results suggest that optimizing ventilation settings (e.g., adding more	

					aerosols.	sites of ventilation and/or more turbulence to disrupt stable circulation zones) even under the current ventilation capacity can significantly improve the efficiency of aerosol removal. Adjusting the placement of occupants (e.g., students or cashier in our cases) in the room to avoid hot spots and frequent cleaning of surfaces prone to contamination can reduce the risks. Wearing masks to cut down the source of aerosol generation can significantly lower the risks of airborne infection	
(Carducci et al., 2020)	https://www.mdpi.com/2073-4433/11/7/710	Covid-19 Airborne Transmission and Its Prevention: Waiting for Evidence or Applying the Precautionary Principle?	Yes	Review	Review	- Although many of the revised studies partially validated the hypothesis of airborne transmission, none of them alone were sufficient to provide conclusive evidence, probably because airborne transmission is generally a minority component, combined with droplet and contact transmission. However, our review, as a whole, supports this kind of transmission and induces a reflection on the ways of making preventative decisions	
(Klompas et al., 2020)	https://jamanetwork.com/journals/jama/fullarticle/2768396	Airborne Transmission of SARS-CoV-2 Theoretical Considerations and Available Evidence	?	Viewpoint	Viewpoint	- If, however, SARS-CoV-2 is carried by aerosols that can remain suspended in the air for prolonged periods, medical masks would be inadequate (because aerosols can both penetrate and circumnavigate masks), face shields would provide only partial protection (because there are open gaps between the shield and the wearer's face), and 6 feet of separation would not provide protection from aerosols that remain suspended in the air or are carried by currents.	

						- available data suggests that airborne transmission may be possible, even in absence of aerosol-generating procedures. *- speaking can produce both droplets and aerosols that can travel up to 27 feet (8.2 meters), remain in the air for several hours, and contain viable virus. Moreover, RNA was found in hospital air samples, and poor ventilation seems to prolong the time that an aerosol remains airborne.* *- However, these characteristics do not necessarily prove infection via the airborne route.* *- The reproduction number of covid-19 is small (2.5 for covid is small compared to 18 for measles) and even was before all measures were taken. Therefore, either the amount of covid-19 virus that is required to infect a person is extremely large, or aerosols are not the main transmission route.* *- also, among health care workers taking care for a covid-patient while only wearing a mask transmission rates were rather low. Infected people might be constantly producing droplets and aerosols, yet these do not seem to infect many other people. An exception seems to be prolonged exposure in poorly ventilated rooms.* *- transmission during choir practices seem to be more of and exception than a rule.* *- current understanding of the covid-19 transmission remains limited. There is no perfect experimental evidence that proves or disproves airborne transmission. The balance of evidence, however, seems inconsistent with*	

						aerosol-based transmission of SARS-CoV-2 particularly in well-ventilated spaces. What this means in practice is that keeping 6-feet apart from other people and wearing medical masks, high-quality cloth masks, or face shields when it is not possible to be 6-feet apart (for both source control and respiratory protection) should be adequate to minimize the spread of SARS-CoV-2 (in addition to frequent hand hygiene, environmental cleaning, and optimizing indoor ventilation). *- It is impossible to conclude that aerosol-based transmission never occurs and it is perfectly understandable that many prefer to err on the side of caution, particularly in health care settings when caring for patients with suspected or confirmed COVID-19. However, the balance of currently available evidence suggests that long-range aerosol-based transmission is not the dominant mode of SARS-CoV-2 transmission.*	
(Kohanski et al., 2020)	*https://onlinelibrary.wiley.com/doi/epdf/10.1002/alr.22661*	*Review of Indoor Aerosol Generation, Transport and Control in the Context of COVID-19*	*Yes*	*Review*	*Review*	*- In the indoor environment, bulk airflow is impacted largely by two forces; one is the movement from thermal buoyancy of equipment and occupants, and the other is the forced-air movement of the heating, ventilation, and air-conditioning (HVAC) system. For aerosols, these mechanisms greatly increase the distance exhaled particles can spread indoors (62, 63). An HVAC system conditions and distributes air around a building using various amounts of recirculated and ventilation (fresh outdoor) air, and an aerosol emission can be transported from its point of*	

						origin to the entire HVAC zone or building due to the recirculation, though the concentration will diminish due to dilution and filtration (64). In one documented example from Guangzhou, China, Li et al. (30) observed that in a poorly ventilated space, the transmission of SARS-CoV-2 could be traced to localized airflow, highlighting the importance of indoor local airflow patterns for COVID-19 transmission. - While long-range viral respiratory pathogen aerosol transmission is controversial and has not been definitively established as a common mechanism of SARS-CoV-2 transmission to-date, principles associated with bulk airflow can be used to help minimize risks of aerosol transmission. Reducing infectious aerosols can be achieved by increased the building ventilation (dilution) rate and using higher efficiency filtration.	
(El-Baz et al., 2020)	https://link.springer.com/article/10.1007/s41062-020-00334-7		Yes	Review	Review	- The effect of weather on COVID-19 spread is poorly understood. Recently, few studies have claimed that warm weather may possibly slowdown the global pandemic. - Inhaling small airborne droplets is probable as a route of infection, in addition to more widely recognized transmission via larger respiratory droplets and direct contact with infected people or contaminated surfaces. While uncertainties remain regarding the relative contributions of the different transmission pathways, we argue that existing evidence is strong enough to warrant engineering controls aimed at airborne	

						transmission as part of a comprehensive indoor infection risk reduction strategy. *- Suitable building engineering controls include adequate and effective ventilation, possibly enhanced by particulate filtration and air disinfection, avoiding recirculation of air and avoiding overcrowding. These interventions can also be introduced quickly and at no expense, but only if they are regarded as important in contributing to the objectives of infection control. We believe that the use of engineering controls in public buildings, in parallel with the effective application of other controls (including isolation and quarantine, social distance, and hygiene of hands) would be an additional significant global measure to reduce the risk of transmission and thereby shielding healthcare staff, patients, and the general public.*	
(Almilaji & Thomas, 2020)	*https://www.medrxiv.org/content/10.1101/2020.07.08.20148775v1*	*Air recirculation role in the infection with COVID-19, lessons learned from Diamond Princess cruise ship*	*No*	*Princes Diamond*	*analysis of count data that has been collected by the onboard clinic up to the 20th February 2020*	*- the possible precautions that should be taken against airborne transmission in indoor setting. These precautions include increased ventilation rate, using natural ventilation, avoiding air recirculation, avoiding staying in another person's direct air flow, and minimizing the number of people sharing the same environment.* *- On airplanes, proper ventilation and high-efficiency particulate (HEPA) filters have shown to help reducing airborne transmission. In cruise ships, researchers have concluded that the higher the ventilation rate, the lower the number of new ill cases would be.* *- Ventilation system design, filters, and*	- the incompleteness and quality of the published data that is used in this study in which only summary data were available, data on different cofounders were not available - the fact that some counts were approximate when reported such as the "1600" number which is reported as "over 1600". - though we are not discounting other important transmission modes such as close-contact droplets and fomites, in this study, we only considered the airborne transmission mode to explain the infection with COVID-19 in passengers' cabins during the QP.

						upgrades; natural ventilation (just using outside air and not recirculating it); and airflow (direction/speed) should be all considered and evaluated when deciding what intervention measure(s) is appropriate to reduce exposure and limit the transmission of COVID-19 in a confined setting	
(Azimuddin et al., 2020)	https://www.preprints.org/manuscript/202007.0194/v1	Shifting Approach to Environmentally Mediated Pathways for Mitigating COVID-19: A Review of Literature on Airborne Transmission of SARS-CoV-2	No	Review	Review	- Recent literature has suggested that an increasing number of SARS-CoV-2 cases occur via inhalation of aerosols produced by asymptomatic carriers. - For the general public, a 2-meter spatial separation is recommended to limit the possibility of droplet transmission. Unfortunately, even droplets (> 5 µm) have been shown to spread up to 8 meters, suggesting that the current recommendation of 2-meter distance may have limited effectiveness even for droplet transmission. - Leveraging research advancements in UV, heat inactivation, and improved ventilation technologies are vital to creating sustainable methods in virus spread mitigation indoors.	
(Hota et al., 2020)	https://www.medrxiv.org/content/10.1101/2020.07.15.20154567v1.full.pdf	Estimate of airborne transmission of SARS-CoV-2 using real time tracking of health care workers.	No	-	Healthcare worker interaction with SARS-CoV-2 infected patients were tracked using a real time location system between	- the airborne transmission rates are shown to be lower than those of Rhinovirus, TBC and Sars-cov-1. - they also found that adequate ventilation systems and ventilation controls were most effective to reduce airborne transmission. - aspects that remain unknown: size of droplets and nuclei; the effect of humidity and temperature; viability of the virus over time;	- no data about the masks that the healthcare workers wore. - they could not completely account for covid acquisition through community exposure. - their reach was limited to workers that were included in the RTLS system. - results are applicable to health care settings, and not in the community

					March 18 and March 31.	- however, data from other studies (some not peer-reviewed) shows that Sars-cov-2 does remain airborne and even viable up to three hours. - superspreading events like choir practices and family gatherings have been identified in other studies. However, airborne transmission is not likely the main mode of transmission in these events. - while several studies suggest airborne transmission, a lack of direct evidence remains. - the authors suggest that airborne transmission might be opportunistic and that the main mode of transmission is droplet trasnsmission.	
(Sun & Zhai, 2020)	https://www.sciencedirect.com/science/article/pii/S2210670720306119	The efficacy of social distance and ventilation effectiveness in preventing COVID-19 transmission	Yes	model	This study introduced two new indices into the popular while perfect-mixing-based Wells-Riley model for predicting airborne virus related infection probability–the underlying reasons for keepingadequate social distance and space ventilation. The distance indexPdcan be obtained by	- The projected probability of infection (PI) demonstrates that social distancing and ventilation play an important role in preventing the risk of COVID-19 outbreak - The minimum safe distance for regular social activities (e.g., breathing and talking) was 1.6–3 m (5.2–9.8 ft), while the maximum transmission distance could be up to 8.2 m (26 ft) and its probability was 5%. These findings also explain that extended social distancing can effectively mitigate the risk of infection. - However, studies demonstrated that 1 m is not enough for infection controlling. They proposed that 2–6 m is the safe distance because > 0.1 mm droplets may evaporate or fall to a surface within 2 m, depending on size, air humidity and temperature, but droplets can reach distances as far as 6 m away when coughing or sneezing with spray velocity up to 10–50 m/s.	This study has several imitations. First, the modified model was developed in the case of virus transmission by droplet. In fact, direct contact has been confirmed as another significant path to spread virus. Besides, the droplet nuclei is also considered as a potential carrier of respiratory virus. Secondly, the initial infection probability for calibration was hypothesized as 2.8 %synthesizing the antibody test results and one real vehicle case in this study, which may bring the deviation of the projected infection prob-ability and related required minimum ventilation rate. Thirdly, social distance in practical condition is unknown and the average value based on the space area and passengers' number was hypothesized and employed. This estimation method may present its limitation for spaces with strong population mobility or irregular space shape in practice.

					theoretical analysis ondroplet distribution and transmission from human respiration activities, and the ventilation indexEzrepresentsthe system-dependent air distribution efficiency in a space.	-	
(Liu et al., 2020)	https://www.nature.com/articles/s41586-020-2271-3	Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals	Yes	Two Wuhan hospitals	RNA analysis in air samples.	In patiënttoiletruimte (1 m^2) zonder ventilatie hoogste concentratie partikels. In sommige luchtmonsters (andere ruimtes) wel virus RNA aangetroffen, in andere niet. - The concentration of SARS-CoV-2 RNA in aerosols that was detected in isolation wards and ventilated patient rooms was very low, but it was higher in the toilet areas used by the patients. Levels of airborne SARS-CoV-2 RNA in the most public areas was undetectable, except in two areas that were prone to crowding; this increase was possibly due to individuals infected with SARS-CoV-2 in the crowd. - We found that some medical staf areas initially had high concentrations of viral RNA with aerosol size distributions that showed peaks in the submicrometre and/or supermicrometre regions; however, these levels were reduced to undetectable levels after	This study had its inherent limitations in small sample size and representation of sample viral RNA instead of virus infectivity,

						implementation of rigorous sanitization procedures. Although we have not established the infectivity of the virus detected in these hospital areas, we propose that SARS-CoV-2 may have the potential to be transmitted through aerosols. - Our results indicate that room ventilation, open space, sanitization of protective apparel, and proper use and disinfection of toilet areas can effectively limit the concentration of SARS-CoV-2 RNA in aerosols. Future work should explore the infectivity of aerosolized virus.	
(Yao et al., 2020)	https://www.sciencedirect.com/science/article/pii/S0048969720326954	On airborne transmission and control of SARS-Cov-2	Yes	Review	Review	- It is important not to neglect the airborne transmission in order to prevent the spread of covid-19. - several studies suggest that airborne transmission is one of the modes of transmission. However, environmental factors seem to play a role as well. Factors like temperature, relative humidity & observed ozone concentration seem to influence the transmission ability of covid-19. - these observations imply that these factors could be controlled in indoor spaces like hospitals to prevent spread of the virus. Eg. the use of ozone generators to inactivate covid-19. - If possible, proper airflow and ventilation, together with air sterilization are strongly encouraged to minimize the spread.	
(Santarpia et al., 2020)	https://www.medrxiv.org/content/10.1101/2020.07.13.	The Infectious Nature of Patient-Generated	No		Collection of aerosol samples and rt-PCR	The results of this study, along with the evidence of the stability of SARS-CoV-2 in aerosol and that SARSCoV-2 infects respiratory tissue provide indications	Only used 6 patients.

	20041632v1	SARS-CoV-2 Aerosol				that SARS-CoV-2 may be transmitted via the airborne route. Our results demonstrate that SARS-CoV-2 RNA exists in respired aerosols less than 5 µm in diameter; that aerosols containing SARS-CoV-2 RNA exist in particle modes that are produced during respiration, vocalization, and coughing; and that some fraction of the RNA-containing aerosols contain infectious virions. Given the infectious nature of aerosol collected in this study, taken with the other lines of evidence presented, further suggests that airborne transmission of COVID-19 is possible, and that aerosol prevention measures should be implemented to effectively stem the spread of SARS-CoV-2, particularly in crowded settings.	
(Kumar & Morawska, 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7245210/	Could fighting airborne transmission be the next line of defence against COVID-19 spread?	Yes	Review / letter	Review / letter	- evidence for the airborne spread of covid-19 has emerged, yet not enough measures are taken to prevent it. - It is important to learn lessons from past outbreaks and associated knowledge bases, as well as to understand and acknowledge the emerging challenge of airborne transmission under eased movement restrictions in the near future.	
(Johnston et al., 2020)	https://www.biorxiv.org/content/10.1101/2020.06.26.174128v1.full.pdf	Development of a Coronavirus Disease 2019 Nonhuman Primate Model Using Airborne Exposure	No		A comprehensive and comparative evaluation of COVID-19 in African green monkeys,	- Airborne transmission is expected in humans, and has been investigated in African green monkeys (primates). However, this study also looked at non primates. - Regardless of species, the present study demonstrated that macaques can be successfully infected by airborne	

					rhesus macaques, and 5 cynomolgus macaques following airborne exposure to SARS-CoV-2 was performed.	SARS-CoV-2. Considering relevance to human disease, this study demonstrated that airborne nonhuman primate models should be strongly considered for any future countermeasure evaluations.	
(M.D.J. Peters & C. Marnie, 2020)	https://search.proquest.com/openview/799bf453bc792a07a73246238f2ed3dc/1?pq-origsite=gscholar&cbl=33490	Using evidence to make a difference in infection control and COVID-19	Yes	Letter	Letter	- While airborne transmission via small droplets has not been ruled out completely, it has also not been confirmed or fully understood. As aerosols exist on a continuum with droplets, identifying the pathogenicity of the SARS-CoV-2 virus in air samples is neither straightforward nor easily achieved independently of other potential transmission factors, particularly in real-world scenarios. - While saliva and mucus droplets and aerosols can travel beyond two metres from an uncovered sneeze or cough combined with cough/sneeze etiquette the recommendations encourage people to remain a reasonable, but practical distance from one another to reduce the risk of transmission particularly in poorly ventilated, indoor environments.	
(Fernandes Santos et al., 2020)	https://preprints.scielo.org/index.php/scielo	Best Practices on HVAC Design to	No	Review	Review of policy and guidelines	- In addition to blocking splashes, sprays and large droplets, the respirator is also designed to prevent	

	/preprint/view /956	Minimize the Risk of COVID-19 Infection within Indoor Environments				the wearer from breathing in very small particles that may be in the air. While the ultimate effectiveness of these respirator masks is debated, respirator masks are believed to be the best currently available method of protecting against inhalation of highly infectious airborne particles. - Poorly ventilated buildings affect air quality and can contribute to the spread of the disease, as microorganisms, can be transmitted by air-conditioning systems. In health facilities where there is a high concentration of infectious patients, evidence shows that poorly ventilated buildings have higher risks of infectious disease transmission for patients, workers, and visitors. - Although there is insufficient data to specify and quantify the minimum ventilation requirements particularly in hospitals and isolation rooms in relation to spread of infectious diseases via the airborne route, that study supports the use of negatively pressurized isolation rooms in hospitals for patients with these diseases. - The role of infection control in the design of hospitals is increasing every day. HVAC systems play an increasingly important role to minimize the risk of infection from airborne transmission within the built environment. - These strategies: 1) UVC lamps, 2) Pressure control and air renewal/filtration, 3) Restroom actions, 4) Humidity Control to prevent contagion were evaluated in terms of the contagion sources.	
(Dominski &	https://link.spr	Do the	Yes	Letter to	Letter to	- Besides, infection spread by direct	

Brandt, 2020)	*inger.com/article/10.1007/s11332-020-00673-z*	*benefits of exercise in indoor and outdoor environments during the COVID-19 pandemic outweigh the risks of infection?*		*editor*	*editor*	*contact, the airborne transmission of SARS-CoV-2, should be considered, especially in indoor environments. Small particles (< 5 mm), known as aerosols, can result in airborne transmission potentially over longer distances because these particles can remain suspended in the air for prolonged periods, especially the smaller droplets that can travel tens of meters.* *- The literature suggests that indoor environments have the greatest risk of infection, due to the larger density of people, the possible buildup of airborne virus-carrying droplets, and the likely higher stability of the virus in indoor air. The risk of infection for individuals exercising indoors increases during the peak of occupancy when the ventilation required by those training is greater. Thus, indoor exercise in places with a higher number of people is an activity with a high risk of infection at this moment and should be avoided.* *- In summary, the benefits of exercise during the COVID-19 pandemic may outweigh the risks of infection; however, caution is needed in both indoor—where contamination could be airborne and through touching potentially contaminated materials—and outdoor environments.*	
(European Center of Disease Prevention and Control, 2020)	*https://www.ecdc.europa.eu/sites/default/files/documents/Ventilation-in-the-context-of-COVID-19.pdf*	*Heating, ventilation and air-conditioning systems in the context of COVID-19*	*?*	*Report ECDPC / Review*	*Report ECDPC / Review*	*- The role of ventilation systems in the spread or control of covid-19 is not well-documented.* *- Several outbreak investigation reports have shown that COVID-19 transmission can be particularly effective in crowded, confined indoor spaces such as workplaces (offices,*	

						factories) and during indoor events - e.g. churches, restaurants, gatherings at ski resorts, parties, shopping centres, worker dormitories, dance classes, cruise ships and vehicles. There are also indications that transmission can be linked to specific activities, such as singing in a choir or during religious services that may be characterised by increased production of respiratory droplets through loud speech and singing. *- evidence indicates that: Transmission of COVID-19 commonly occurs in closed indoor space; There is currently no evidence of human infection with SARS-CoV-2 caused by infectious aerosols distributed through the ventilation system ducts of HVACs. The risk is rated as very low.; Well-maintained HVAC systems, including air-conditioning units, securely filter large droplets containing SARS-CoV-2. It is possible for COVID-19 aerosols (small droplets and droplet nuclei) to spread through HVAC systems within a building or vehicle and stand-alone air-conditioning units if air is recirculated.; Air flow generated by air-conditioning units may facilitate the spread of droplets excreted by infected people longer distances within indoor spaces.; HVAC systems may have a complementary role in decreasing transmission in indoor spaces by increasing the rate of air change, decreasing recirculation of air and increasing the use of outdoor air.*	
(Sommerstein et al., 2020)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7336106	Risk of SARS-CoV-2 transmission by aerosols,	Yes	Lit review	Lit review	- A recent laboratory study showed that artificially aerosolized SARS-CoV-2 survived in the air as long as SARS-CoV-1 and persisted even longer on	

	/	the rational use of masks, and protection of healthcare workers from COVID-19				surfaces, from where it might become resuspended by turbulent air. However, these in vitro results are not consistent with the observation of R0 around 2, and the rapid decrease of the incidence of SARS-CoV-2 after limiting socializing in Switzerland to less than 5 individuals. - Several clinical studies have identified SARS-CoV-2 RNA in air samples and significant environmental contamination, yet without documentation of viable virus]. This indicates that SARS-CoV-2 is shed to the environment as small, virus-laden particles, during toileting, through contact with fomites and from infected patients, but again this does not prove that it corresponds to infectious aerosols. Accordingly, airflow can disperse particles with viral RNA in a room; however, this does not prove COVID-19 to be a truly aerosol-transmitted disease. - In January 2020, a COVID-19 outbreak occurred in an air-conditioned restaurant in Guangzhou, China. It involved three family clusters > 2 m apart, suggesting aerosol transmission. However, when considering airflow direction and air exchange rates, findings were compatible with droplet transmission.	
(Aggarwal et al., 2020)	https://journals.sagepub.com/doi/pdf/10.1177/1010539520944725	High Viral Load and Poor Ventilation: Cause of High Mortality From COVID-19	Yes	Short report	Short report	- In a review article by Morawska and Cao, it was emphasized that the airborne transmission route of SARS-CoV-2 has been underplayed so far. The authors stressed on the role of increasing ventilation rate using natural ventilation, avoiding air recirculation, avoiding staying in	

						another person's direct air flow, and reducing the number of people sharing the same room. The absence of efficient fresh air ventilation in the homes, offices, and hospitals leads to enhanced risk of transmission of viruses including SARS, SARS-CoV-2. This appears to be the key factor determining the cumulative viral load in the nasal cavity and nasopharynx of the people living or working in poorly ventilated closed spaces. - Our review of literature suggests that many people living in higher income countries spend more time indoors (offices and homes) often in centrally heated or air-conditioned premises where they could be exposed to a higher viral load. This is especially true if there are asymptomatic COVID-19-infected individuals in the immediate environment. Under these conditions, the virus may persist in respiratory droplets or in the environment for a long time. - By contrast, people in low-income countries (south and southeast Asian countries) are not exposed to such viral concentrations due to their traditional lifestyle of residing in homes and working in offices with open air ventilation (partly due to lack of resources). For this reason, the viral load in the nasal cavity and the nasopharynx could be lower and result in a less severe disease.	
(Fennelly, 2020)	Particle sizes of infectious aerosols: implications for infection	Particle sizes of infectious aerosols: implications for infection	Yes	Viewpoint	Viewpoint	- Similar to that seen with SARS-CoV, there was only a mild reduction in viability over a 3-h period in an experimental aerosol generated in a laboratory, consistent with a potential	

	control	control				for airborne spread. - To date, there are no published reports of cough aerosol or exhaled breath sampling from patients with COVID-19, but SARS-CoV-2 has been detected in the air of hospitals in China and the USA. - Air sampling for SARS-CoV-2 was negative in three studies, but two included small numbers of patients in rooms with high rates of dilution ventilation, and one study included a small number of air samples using inefficient impinger devices. - The outbreaks of COVID-19 in nursing homes, choirs, and correctional facilities are reminiscent of tuberculosis outbreaks and suggestive of both traditional airborne transmission and so-called super-spreading epidemiology. Experiments using the golden hamster model have shown 100% efficient aerosol transmission among animals caged separately as well as by direct contact.	
(Michael Schuit et al., 2020)	https://pubmed.ncbi.nlm.nih.gov/32525979/	Airborne SARS-CoV-2 Is Rapidly Inactivated by Simulated Sunlight	Yes		This study examined effect of simulated sunlight, relative humidity, and suspension matrix on stability of SARS-CoV-2 in aerosols.	- The present study examined the influence of simulated sunlight and relative humidity on the stability of SARS-CoV-2 in aerosols generated from virus suspended in either simulated saliva or culture medium at 20°C. Simulated sunlight rapidly inactivated the virus in aerosols in either suspension matrix, with half-lives of less than 6 minutes and 90% of the virus inactivated in less than 20 minutes for all simulated sunlight levels tested. - While it has been reported previously that UVC can inactivate aerosolized	- It should be noted that many additional factors beyond the relative stability of the virus in an aerosol contribute to the potential for aerosol transmission of disease. These include the amount of virus present in an aerosol, the size and infectious dose of aerosol particles, the distance and airflow dynamics between infected and uninfected individuals, and the presence of mitigation measures such as personal protective equipment. Therefore, while the results of the present study provide novel data regarding the stability of SARS-CoV-2

						coronaviruses, the present study is the first to demonstrate that simulated sunlight, with UVA and UVB levels similar to natural sunlight, is also able to inactivate airborne coronaviruses. - Relative humidity alone did not significantly affect decay of the virus, although there were interactions identified between relative humidity and the other factors. However, the magnitude of these interactions was minor compared to the magnitude of the effect of simulated sunlight.	aerosols in the environment, additional data are needed to provide a comprehensive assessment of the potential for aerosol transmission.

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