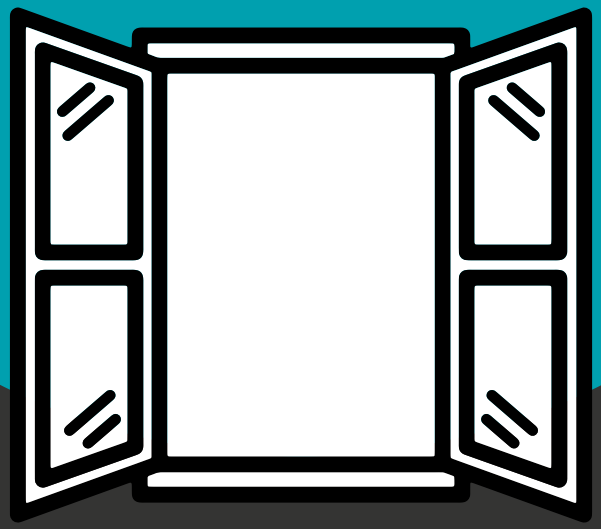
Ventilation and Air Purification



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Along with general recommendations for hand hygiene, respiratory hygiene and social distancing, the early response to COVID-19 centred around cleaning and disinfection of the clinic environment to prevent fomite transmission of the virus.

As new evidence emerges, there is now **scientific consensus** that COVID-19 can be contracted via airborne transmission of microdroplets from normal breathing, speaking, singing etc. This is one of the reasons for **government recommendations about wearing masks** in settings where there is community transmission of COVID-19 and social distancing cannot be maintained.

Airborne transmission of COVID-19 through normal breathing and talking has obvious implications for risk management in all clinic settings, but particularly for environments with poor or no ventilation, because the airborne droplets will continue to circulate around the space for several hours.

Ventilation is a critical consideration in mitigating the risk of transmission of COVID-19 in the clinic setting. The safest indoor space has natural ventilation, which means that lots of outside air is constantly replacing the stale air inside through open doors and windows.

Some types of air-conditioning may actually increase the risks of airborne transmission of COVID-19. The less control you have over the ventilation and air-conditioning system in your working environment, the greater the risk of airborne transmission of COVID-19, particularly with more transmissable variants such as the Delta strain.

Mechanical ventilation can be achieved through a portable HEPA-based air purifier with a Clean Air Delivery Rate (CADR) that creates at least 9 air exchanges per hour.

If you are considering this option in a room that does not have natural ventilation, ask the manufacturer/salesperson to do the calculation for you based on your room specifications. It may be advisable to consider two smaller units placed at either end of the room rather than a single large unit but seek advice on this. Air purifiers should always be supplemented by natural ventilation wherever practicable.

Air exchange rate

Environmental engineers quantify how much outside air is getting into a building using ‘air exchange rate’ (AER). It is a measure of the number of times the air inside a space gets replaced with air from outside in a single hour.

Around 6 air exchanges an hour for a 3 by 3 metre room with 2 people in it is considered good ventilation. However, during a pandemic, you should aim for at least 9 air exchanges per hour.

Monitoring carbon dioxide CO_2

There are obviously many factors that influence the level of ventilation in a space, such as position and aspect of windows, amount of breeze etc. If you are unsure about whether your clinic is well ventilated, you can use carbon dioxide levels as a proxy measurement of ventilation. Outdoors, CO_2 levels are just above 400 parts per million (ppm). A well-ventilated room will have around 800 ppm of CO_2 but during COVID, aiming for 600 ppm would be the risk mitigation goal. You can purchase room CO_2 monitors online for around $50-$150. One of these will be a far more important risk mitigation strategy in your COVID response than a scanning thermometer. Just make sure that the CO_2 monitor you choose uses a non-dispersive infrared sensor (NDIR) as these give the most accurate readings.

A well-ventilated space has 9 to 12 air exchanges per hour via either natural or mechanical ventilation. The size of your room, aspect, and the number and size of windows and doors will dictate the rate of air exchange from natural ventilation. For example, a 3 by 3 metre room with a 2.5 metre ceiling would need an outside opening (open windows and / or doors) of at least 0.7 square metres (i.e. 1 m by 0.7 m) to facilitate 9 air exchanges per hour.

If the weather does not permit natural ventilation throughout the treatment, external windows or doors must be open for at least half an hour between clients. Placing a portable fan in the window or door facing outwards can significantly increase the rate of air exchange in the space as well. However, only using between-client ventilation still exposes both practitioner and client to significant risks of virus transmission during the treatment.

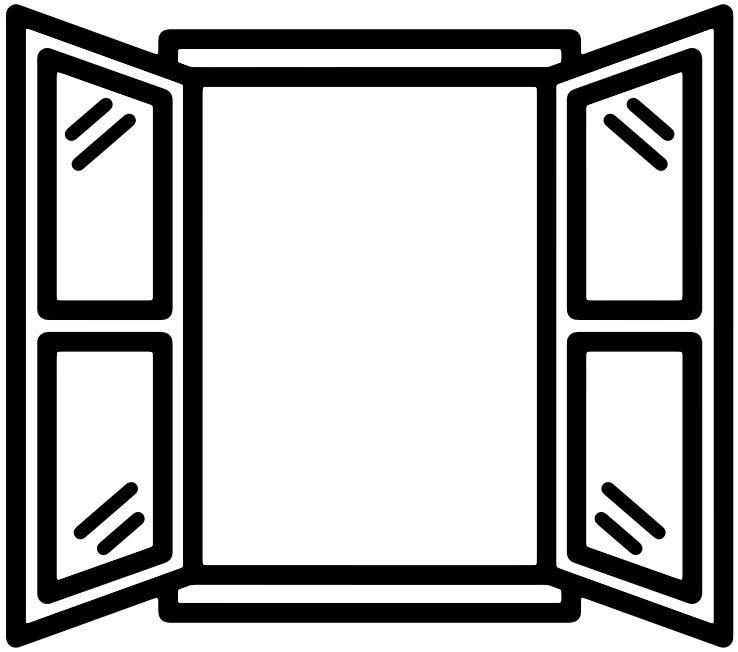
The table on page 7 is a rough guide to calculate whether natural room ventilation can meet the requirement for around 9 air exchanges per hour, based on the least favourable wind conditions and two occupants in the room.

You can also use AMT's air exchange calculator for air purifiers to help you calculate whether a particular model air purifier will provide enough air exchanges for your clinic.

Room volume	Room dimensions	Window/door opening required
18.5m^2	3m x 2.5m x 2.5m	0.6m^2
22.5m^2	3m x 3m x 2.5m	0.7m^2
30m^2	3m x 4m x 2.5m	0.8m^2
35m^2	3.5m x 4m x 2.5m	1m^2
40m^2	4m x 4m x 2.5m	1.1m^2

Natural ventilation

Outdoor settings have proven to be far less risky overall than indoor settings. Natural ventilation from fresh air is the gold standard for ventilation in the clinic setting.



ADVICE

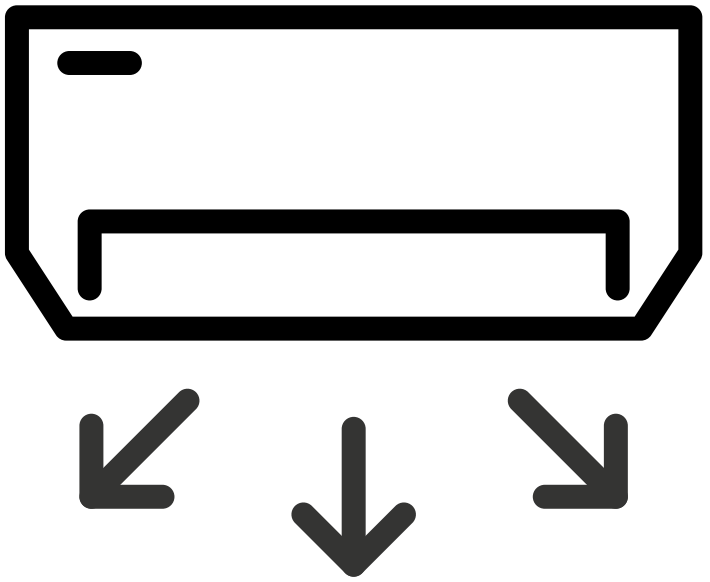
Use window-driven natural ventilation as much as possible. If you cannot keep windows open during treatment, allow at least 30 minutes to open windows between appointments. Open window(s) and door(s) if possible to allow air flow. Also consider having a fan venting out the open window or door, blowing air outside.

Air conditioning systems

Split systems

In a small clinic environment, the most common air conditioning type will be a wall-mounted split system or multi-head split system.

These systems ***recirculate*** the air within a room. The air gets sucked in through the top, filtered, blown through the evaporator, and then finally blown out the bottom into the room. The "filtering" that occurs is for larger dust and pollen particles, not viruses like COVID-19.



ADVICE

Split system air-conditioning is not a form of ventilation and should not be used when there is community transmission of COVID-19. If the split system is running continuously and the virus is present, it is simply being recirculated, thereby increasing the risk of transmission.

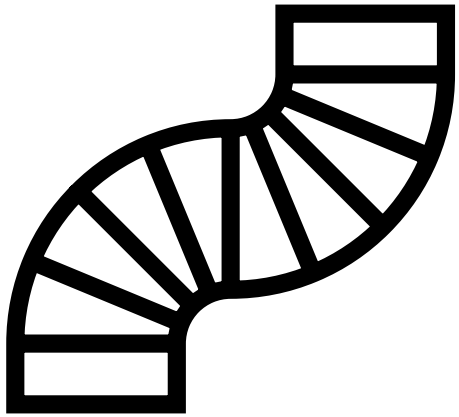
If essential for heating or cooling, use the split system for brief periods AFTER the treatment room has been well ventilated via open windows or doors.

Consider another method of ambient heating and cooling.

Ducted systems

A ducted system involves a large compressor on the outside of the building, an internal evaporative unit, and ducts that bring conditioned air to various rooms through vents.

The internal air is actually recirculated continuously, as with split air-conditioning systems.



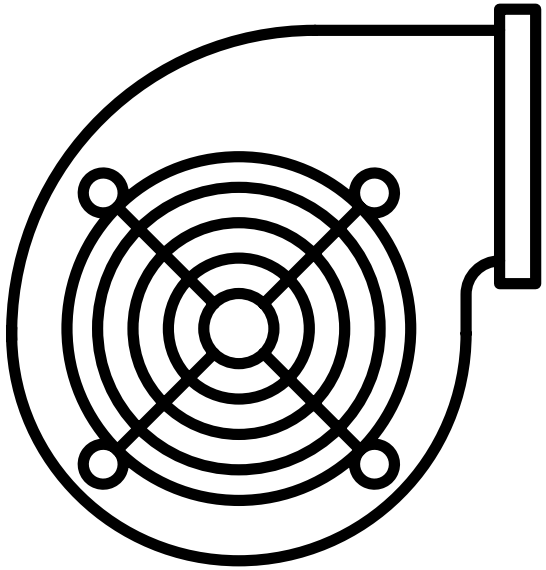
ADVICE

Ducted systems should not be used when there is community transmission of COVID-19. Consider another method of ambient heating and cooling.

Commercial HVAC systems
(**H**eating, **V**entilation, **A**ir **C**onditioning)

If the clinic is part of a large complex, it may share its ventilation system with the rest of the building. This would be a large, commercial HVAC system and may involve cooling towers.

HVAC systems can potentially spread a virus across rooms when high-speed air flows past an infected person to others. This was shown with Severe Acute Respiratory Syndrome in 2004.

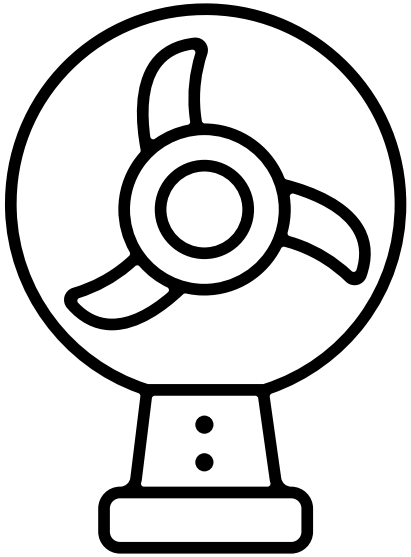


ADVICE

Speak to your building facilities manager to ensure that the "dampers" are on "winter mode" (this means more fresh air is circulated). Be aware that the risk may increase in summer when the system recirculates more cool air as an energy saving measure.

Fans

Fans could potentially spread droplets further than they would normally travel and thus facilitate the dispersion of infected droplets.



ADVICE

Position the fan so it is pointing out of an open window or an external door.

Never point a fan out an internal door as that is only moving the problem to another area, not ventilating. Never point a fan directly at yourself or a client

HEPA filtration air purifiers

There is **increasing scientific evidence** that portable HEPA (High Efficiency Particulate Air) purifiers can play an important role in reducing the transmission of COVID-19. Air scrubbing through HEPA filtration should be central to the ongoing risk management strategy for all clinics.

How to choose a good HEPA filtration air purifier:

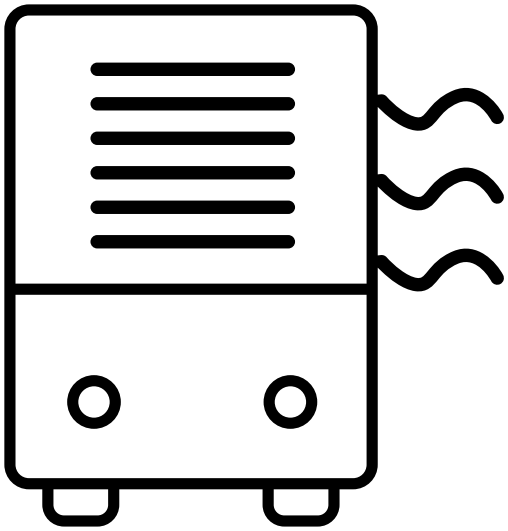
Choose a HEPA purifier that has:

- a high CADR (Clean Air Delivery Rate)
- low noise level on the highest setting
- relatively low velocity fan, preferably directed upwards
- high energy efficiency

Carbon filters do not achieve filtration (they are designed to stop odours), and can actually make the fan blow harder.

Beware of false marketing: HEPA-like, HEPA-style 99%, HEPAsilent (tm), HEPA Ultra Ionic, HEPAFast, HEPA Efficiency, HEPA Function, HEPA Action Plasma, HEPA Super, HEPA Hyper and HEPA HEMPA are all sub par versions of what constitutes a HEPA air filter.

Avoid unproven air cleaning technologies (e.g. electronic air cleaners or additive air cleaners produce free radicals and ozone).



ADVICE

You need to select a unit that is the right size for your clinic. One way to do that is to select a model with a CADR (Clean Air Delivery Rate) that exceeds the recommendations for the room. The larger the CADR, the faster it will clean the air.

Some models of HEPA air purifiers advertise the CADR, some advertise the square meterage of the room it is designed to clean.

Please refer to AMT's **air exchange calculator** to help you work out whether a particular model of purifier will provide at least 9 air exchanges per hour.

Further resources

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/Improving-Ventilation-Home.html

https://medium.com/@jjose_19945/how-to-quantify-the-ventilation-rate-of-an-indoor-space-using-a-cheap-co2-monitor-4d8b6d4dab44

https://smartairfilters.com/en/blog/open-window-door-help-covid/

Air cleaner value comparisons

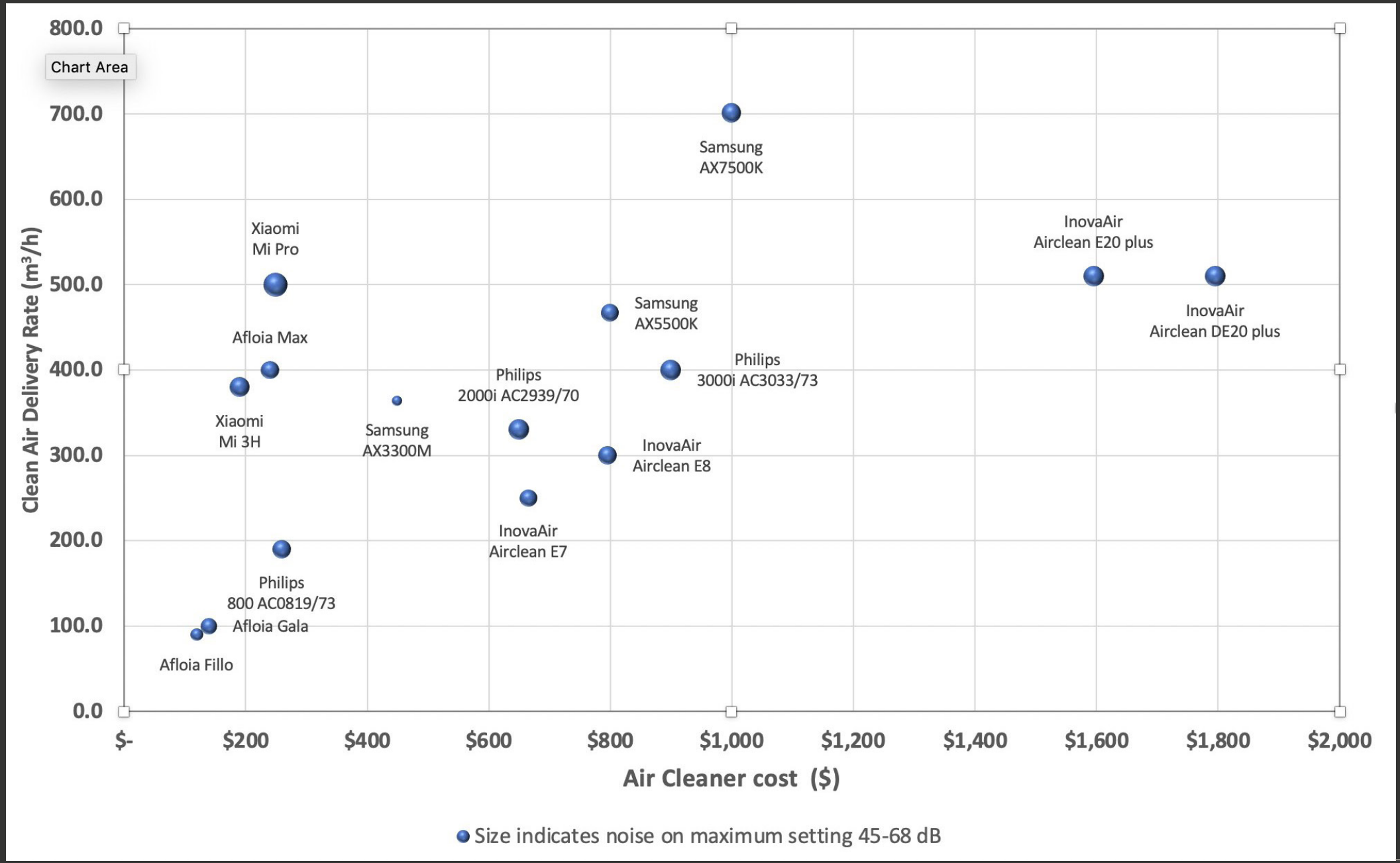
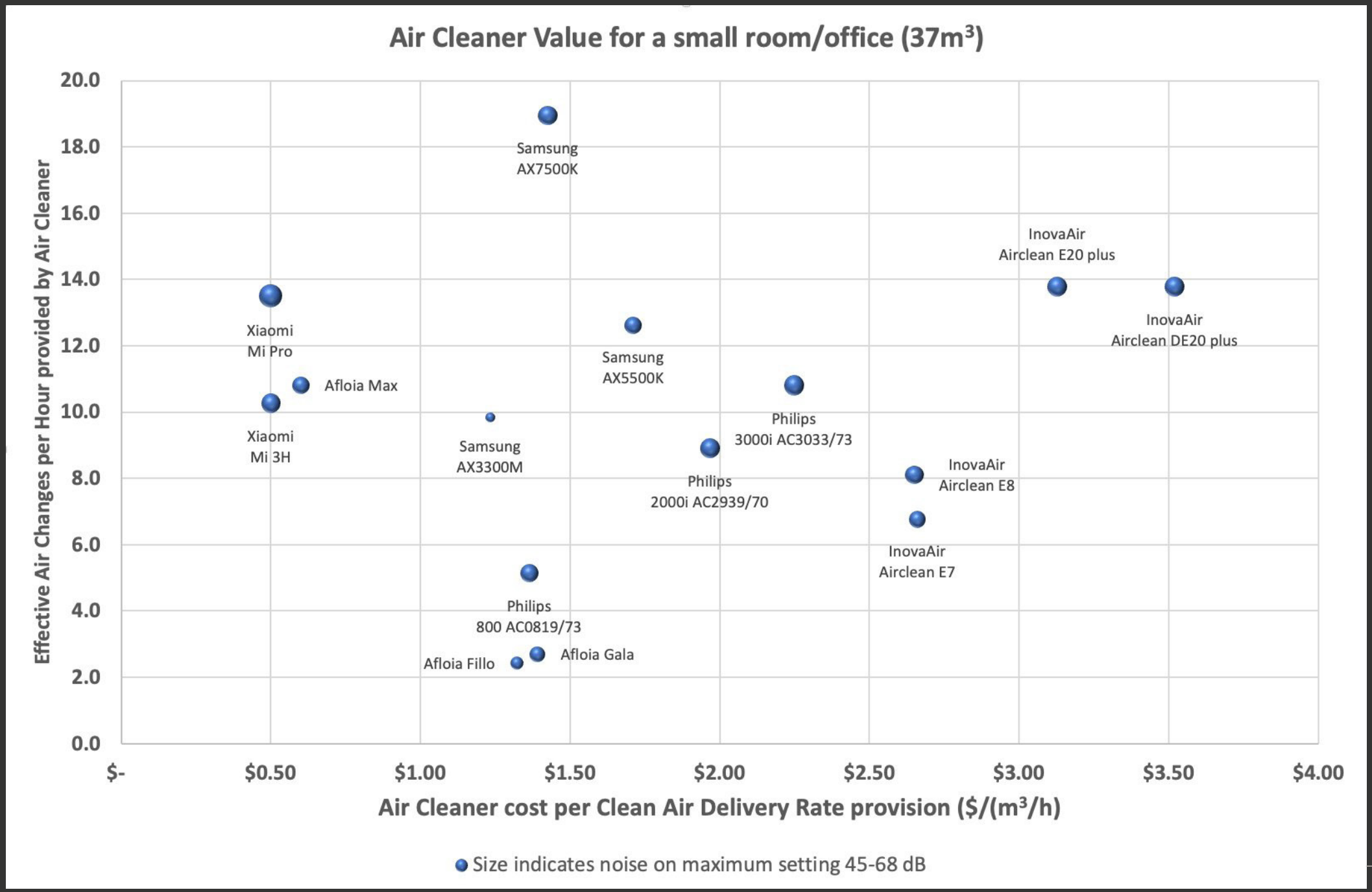


Chart Area
Clean Air Delivery Rate (m³/h)
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
$-
$200
$400
$600
$800
$1,000
$1,200
$1,400
$1,600
$1,800
$2,000
Air Cleaner cost ($)
Samsung AX7500K
Xiaomi Mi Pro
InovaAir Airclean E20 plus
InovaAir Airclean DE20 plus
Samsung AX5500K
Afloia Max
Philips 3000i AC3033/73
Philips 2000i AC2939/70
Xiaomi Mi 3H
Samsung AX3300M
InovaAir Airclean E8
InovaAir Airclean E7
Philips 800 AC0819/73
Afloia Gala
Afloia Fillo
Size indicates noise on maximum setting 45-68 dB


Air Cleaner Value for a small room/office (37m³)
Effective Air Changes per Hour provided by Air Cleaner
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
$-
$0.50
$1.00
$1.50
$2.00
$2.50
$3.00
$3.50
$4.00
Air Cleaner cost per Clean Air Delivery Rate provision ($/(m³/h)
Samsung AX7500K
InovaAir Airclean E20 plus
InovaAir Airclean DE20 plus
Xiaomi Mi Pro
Samsung AX5500K
Afloia Max
Philips 3000i AC3033/73
Xiaomi Mi 3H
Samsung AX3300M
InovaAir Airclean E8
Philips 2000i AC2939/70
InovaAir Airclean E7
Philips 800 AC0819/73
Afloia Fillo
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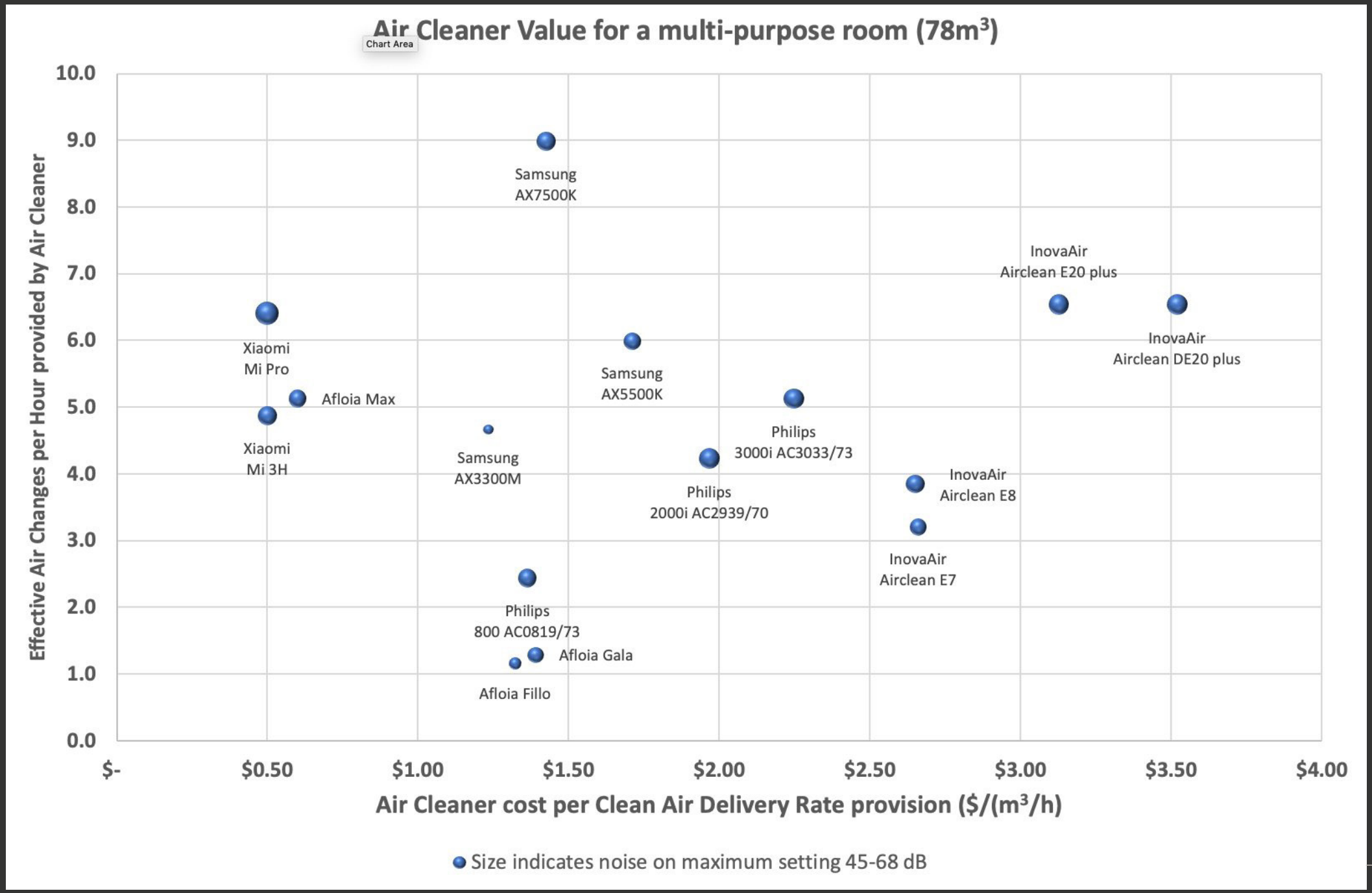
Air Cleaner Value for a multi-purpose room (78m³)
Chart Area
Effective Air Changes per Hour provided by Air Cleaner
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
$-
$0.50
$1.00
$1.50
$2.00
$2.50
$3.00
$3.50
$4.00
Air Cleaner cost per Clean Air Delivery Rate provision ($/(m³/h)
Samsung AX7500K
InovaAir Airclean E20 plus
InovaAir Airclean DE20 plus
Xiaomi Mi Pro
Afloia Max
Samsung AX5500K
Philips 3000i AC3033/73
Xiaomi Mi 3H
Samsung AX3300M
InovaAir Airclean E8
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