PSO-HNS COVID-19 ADVISORY
Appendix D

Strategies to Mitigate Aerosolization and Infection Risk

May 20, 2020

PART 1: ENGINEERING CONTROLS

The ventilation design of any health care facility greatly affects disease transmission by aerosols. Considering the existing COVID-19 pandemic and that numerous Otolaryngologic procedures may potentially generate aerosols, the PSO-HNS COVID-19 advisory committee highly recommends to review, examine and modify if necessary each clinic set-up to achieve a safer workplace for everyone.

A. Airborne Infection Isolation Room (AIIR)

The United States Centers for Disease Control and Prevention (CDC) recommends performing Aerosol Generating Procedures (AGP) in AIIRs. These are single-patient rooms at negative pressure relative to the surrounding areas, and capable of achieving *12 air changes per hour (ACH)*. Air from these rooms should be exhausted directly to the outside or be filtered through a high-efficiency particulate air (HEPA) filter directly before recirculation. Room doors should be kept closed except when entering or leaving the room, and entry and exit should be minimized. Facilities should monitor and document the proper negative-pressure function of these rooms.

B. Physical Arrangement and Active Ventilation

Ideally, the out-patient clinic, along with the entire health facility, should have a Heating, Ventilation, and Air Conditioning (HVAC) system designed to protect susceptible staff and patients from airborne pathogens. The system should also minimize the risk for transmission of these pathogens from infected patients. Air quality standards are achieved by addressing air entry/exit flow directions, utilization of various filtration devices and setting minimum ACH appropriate for the clinic.

In the absence of a proper HVAC system, modifications in the physical arrangement and ventilation of the clinic may be done. These are best carried out based on basic principles that would address both tiny and large droplet transmission.

Principles:

1. Infectious particle movement and transmission are influenced by the location of air supply and exhaust vents, thermodynamic factors (i.e. temperature, humidity, air currents), orientation of objects in the room, and type of surfaces.
2. Control of particle path from contaminant source to the exhaust is more important than increase in the number of ACH.
3. The amount of viral load that the physician and staff are exposed to is directly proportional to the length of exposure time to an infected patient.
4. Environmental and equipment conditions can pose risks (i.e age and functionality of ventilation equipment, unmodified open system suction machines, electric fan use, dust).

Recommendations:

1. Place the patient (contaminant source) as close as possible to the exhaust system.
2. No obstructing object or person must be between the patient and the exhaust system.
3. Do not use electric fans as these create air currents that compete with airflow towards the exhaust.
4. The source of clean air supply should be directed away from the path of the contaminant particle as it travels towards the exhaust.

How do we modify the physical arrangement of the clinic?

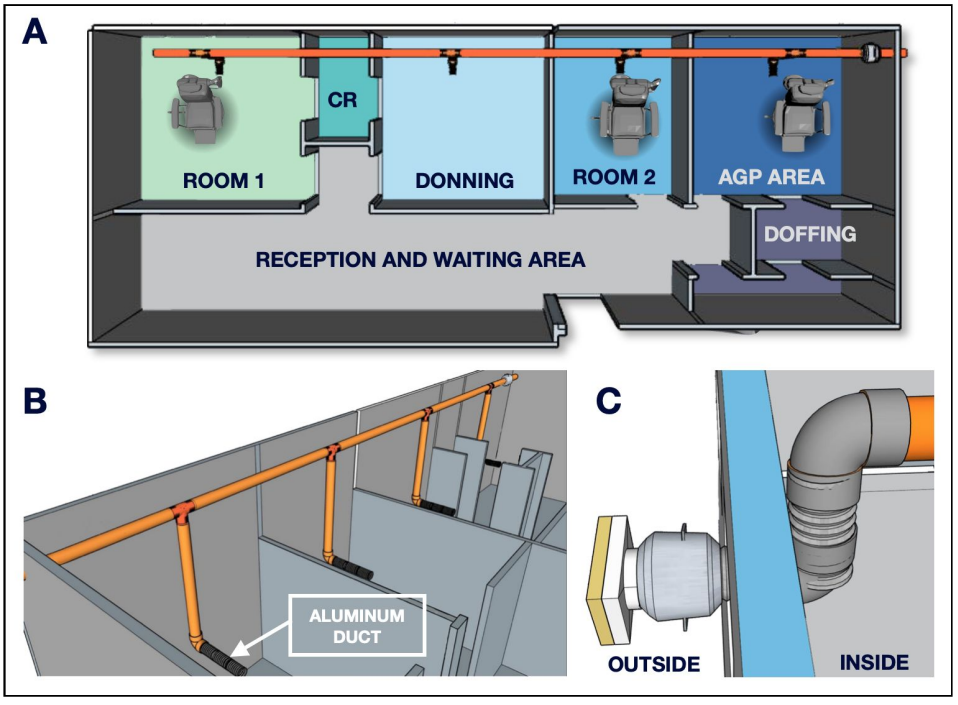
Minimize the number of furniture and equipment in the room for ease of movement, distancing and decontamination. Arrange equipment, instruments and furniture to facilitate quick but efficient patient consultation, examination, and performance of clinic procedures. Remove clutter and maintain the barest minimum to enable quick surface cleaning and disinfection of tabletops, chairs, etc. If possible, install partitions to create separate rooms for PPE donning and doffing, reception area, non-AGP area, and an AGP area which should be nearest the exhaust fan (Figure 1A).

How do we modify the ventilation and redirect airflow?

A simple cost-effective means of redirecting airflow in the clinic may be employed (Figures 1B). A large polymerizing vinyl chloride (PVC) pipe may be used as ducting material in place of more expensive manually fashioned galvanized iron (GI) sheets or stainless steel. Use of PVC material ensures solid piping with no risk of air leaks at the joints. Where the ENT chair is located, a movable aluminum duct may be attached to the PVC pipe allowing placement of the exhaust intake close to the area of the procedure (e.g. ear, nose, mouth). Similar aluminum ducts connected to the main exhaust pipe may be placed in the other rooms. Rooms not in use may be closed temporarily to retain a strong flow of air towards the exhaust exit onto the outside environment. Exhausted air should go into an area with absent or little human activity. A HEPA filter is placed inline attached before the exhaust fan. When there is no consistent source of clean air entering the clinic, an ingress fan with a HEPA filter may also be installed (Figure 1C). With good ventilation design, a portable HEPA filtration device may be unnecessary.

Natural ventilation may also be utilized. This is cheaper but more readily affected by outdoor weather conditions. Consistent airflow direction is difficult to achieve. An open window does not necessarily ensure sufficient ACH. There should be an open door or another opening opposite the window so that there will be a pathway for outside air to go indoors then out again. Where aerosol generating procedures are conducted, the ventilation rate should be 80 liters/second/patient to 160 liters/second/patient as recommended by the World Health Organization (WHO). For airborne agents, the overall flow of air should be from the contaminant source to an area where dilution can occur, preferably the outdoor air.

Figure 1. Modified Clinic Ventilation. A.Sample clinic floor plan showing the layout of PVC ducts, B. Perspective view, showing the downpipes connected to the movable aluminum ducts, and C. Ingress fan with HEPA filter.



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