

A low-cost pulmonary function test laboratory setup for infection control during COVID-19

Dear Editor,

The rapid spread of COVID-19 has affected not only the health-care sector but also has languished the economic and social lives, especially in developing countries.^[1] Various outpatient services including pulmonary function testing have been suspended due to the risk of spread of infection.^[2] Although various organizations have formulated operational measures for resuming functioning of pulmonary function test laboratories (PFT labs),^[3] the practical organization depends upon the local policies, funds, and population burden. It is difficult to practice all the measures in countries with low income and high population density. We hereby propose an economic and appropriate low-cost design of a PFT lab for infection control. However, the outpatient services including PFTs should be resumed depending on the status of institutional resources and prevalence of the disease in the community.^[4]

Patient flow should ideally be unidirectional that is making separate check-in and check-out points.^[3] The already functioning PFT lab can be partitioned with a plexiglass wall into two parts that are procedure and instruction areas with the patient performing the test on the one side and the operator instructing the patient on the other side of the wall.^[2] The room should have minimum furnishings (no carpets or curtains) and adequate ventilation (6–12 air changes/h) with exhaust fan installed in the procedure area.^[3]

At our center, a closed cabin of 1.1 m × 1.2 m was designed for patients in a room of 4.2 m × 2.4 m. The cabin has two openings, one inlet for fresh air and other outlet which has exhaust fan to push the cabin air for decontamination into 1% sodium hypochlorite solution filled tank through airtight duct. The air duct has another exhaust fan. Furthermore, a suction pump is placed at the end of airtight duct where it enters the tank which has been placed on the rooftop [Figure 1]. We are using flow sensing device (ultrasonic or pneumotach) for spirometry, which is portable and connect through universal serial bus (USB) port. Extension of USB port is connected to the patient cabin. Treatment of exhaust air carrying infected aerosols can be done by high-efficiency particulate air (HEPA) filters, portable HEPA filters, chemical disinfection or by creating an upward plume 3 m above the tallest point of the building. UV systems can be used as a substitute to HEPA filters. Although HEPA filters have high efficiency, the installation and maintenance cost are high and require uninterrupted power supply for operation.^[5] Chemical disinfection of the exhaust air can be done by bubbling the air through a diffuse air aerator tank (prefer a nonmetallic tank) containing 1% sodium hypochlorite solution.^[6] Sodium hypochlorite is relatively cheaper, has low maintenance cost, and does not require continuous power supply.

The testing equipment should be divided into semicritical (those coming in contact with mucous membrane

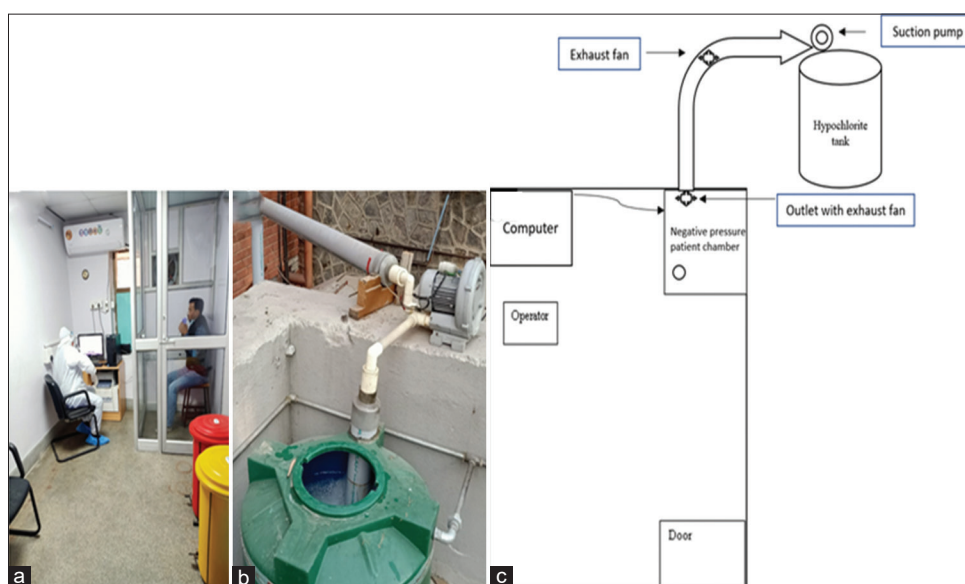


Figure 1: (a) Pulmonary function test laboratories with negative pressure patient chamber, (b) Suction pump duct and 1% sodium hypochlorite solution tank on roof, (c) Pictorial representation of the pulmonary function test laboratories setup

like mouthpieces) and noncritical (not coming in direct contact with mucous membrane like breathing hoses distal to the breathing valve) items and should be cleaned with 70% ethanol and detergent water, respectively. This will help to prevent overconsumption of alcohol-based disinfectants. Preference for the single-use equipment, negative pressure testing room, and use of disposable inline bacterial and viral filter has been suggested for pulmonary function testing during COVID-19 pandemic.^[7] We use disposable integrated mouthpiece with inline bacterial/viral filter for each patient, and PFT lab is being sanitized after every test. The technician wears personal protective equipment and the patient is instructed through two-way microphone system.

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Conflicts of interest

There are no conflicts of interest.

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