

## Are We Keeping Our Nebulizers Clean?

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Recurrent wheezing occurs in a large proportion of children, often with viral upper respiratory tract infections. Many of these children, particularly in developing countries like ours, are administered bronchodilators at home by parents by means of nebulizers. These medications and devices are easily available over-the-counter across the country. Nebulizers are at times the only viable drug delivery system for young children who cannot be taught effective use of spacers. Nebulizers are also indispensable for the care of children with certain chronic diseases like cystic fibrosis (CF) and other chronic suppurative lung diseases. As part of their airway clearance therapy, these children require daily nebulization with mucolytic agents like hypertonic saline that cannot be delivered via pressurized metered dose inhaler (MDI). These patients are also frequently prescribed nebulized antibiotics and anti-fungal agents for microbial eradication.

It is a cause of concern that the nebulizers used on domiciliary basis have been found to be contaminated by several microorganisms, which predisposes these patients to frequent pulmonary exacerbations. A study on CF patients demonstrated that 70.5% of the home nebulizers were contaminated, with *Pseudomonas aeruginosa* being the most commonly isolated organism [1]. They also found a significant increase in number of pulmonary exacerbations in these patients. Another study highlighted the risk of acquisition of colistin-resistant, gram-negative bacteria like *Burkholderia cepacia* and *Stenotrophomonas maltophilia* from contaminated home nebulizers [2]. They also found a similar proportion of nebulizers (69%) to be contaminated. Similar studies have also been conducted on asthmatic children who use home nebulizers. The nebulizers were shown to be contaminated in 66.7% children and filters of 78.3% nebulizers were found to be contaminated [3].

In this regard, the study by Ranjan, et al. [4] published in this issue of *Indian Pediatrics* is highly commendable. They studied the bacterial colonization of home nebulizers and assessed the robustness of cleaning practices

using a physician-administered questionnaire. About 20% of the samples from nebulizers showed bacterial growth, predominantly drug-resistant gram-negative bacteria [4].

It would be logical to wonder if the nebulizers are the primary sources of these organisms or are contaminated secondarily from the patients' secretions. Hutchinson, et al. [2] showed that in six CF patients whose nebulizers yielded *B.cepacia* and *S. maltophilia*, the same organisms were not isolated from concurrent sputum samples, indicating that nebulizers were likely primarily contaminated. This is further supported by the finding that a similar rate of contamination of home nebulizers is seen in asthmatic children, whose airways are not likely to be chronically colonized with bacteria [3,4]. In addition to microbial colonization, home nebulizers can also get contaminated with common indoor allergens in homes with pet dogs and cats, and these may lead to adverse consequences in sensitized individuals [5].

There is a wide variation in the maintenance practices of home nebulizers. Frequency of cleaning the nebulizer parts varies from none to once a week to daily [2,6,7]. Cleaning and drying the reservoir after each use leads to significantly lesser contamination [3]. Technique of cleaning and drying the nebulizer parts is also highly variable. Lower rates of contamination have been seen on cleaning with soap and water than with tap water alone [3]. Nebulizers with visible moisture have been shown to yield the heaviest growths of bacteria, as Gram-negative bacteria survive better in a moist environment [2]. Infrequent changing of nebulizer circuits has also been frequently observed, although the duration of use has not been shown to correlate with the degree of contamination [2].

The ideal standards and methods for cleaning the nebulizers have not been established [8]. However, a study has shown similar efficacy with both tap water and sterile distilled water, and a better efficacy with soak-then-rinse method (soaking for 10 minutes, followed by rinsing for 30 seconds in tap water) [9].

There is a pressing need to enhance awareness about this potentially serious problem of infections caused by contaminated nebulization equipment. The study by Ranjan, et al. [4] showed that about one-fifth of the parents used nebulizers on advice of friends or family. This makes them prone to improper handling and suboptimal hygiene practices, owing to a lack of appropriate advice from healthcare personnel. An even more alarming observation made was that even amongst those who were using nebulizers on the advice of a physician, only a third receiving instructions on cleaning the equipment [4]. Another study on asthmatic children showed that only a fifth of the parents received instructions on maintenance of nebulizers from healthcare personnel.

All the stakeholders – the patients, caregivers and healthcare personnel, need to be educated about the need and techniques of proper cleaning and maintenance of these devices. These instructions need to be reinforced to the caregivers at every follow-up visit to ensure maximal compliance.

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