Human powered nebulizer

Country of origin | United States of America

Health problem addressed

Respiratory diseases—COPD, TB and lower respiratory infections (LRIs)—cause significant mortality in developing countries. Together they account for 14.3% of deaths worldwide (8.2 mil people/year), and over 30% of deaths in low-middle income countries. The use of readily available treatments is limited due to cost and lack of reliable electricity.

Product description

The HPN generates a constant flow of air at sufficient pressure to operate a nebulizer mouthpiece. Human power, generated either by pedaling or hand cranking, causes air flow via pistons. The output of the pistons is connected via tubing and one-way valves with a flow regulator. The flow regulator constrains the air flow rate to be within a small range.

Product functionality

The HPN exploits mechanical advantage of gearing to make the frequency of human power (about 60 rpm) adequate to make the pistons produce enough air flow to drive the nebulizer. The lever arm of the hand crank (22 cm) or the pedals assure a light effort.

Developer’s claims of product benefits

The HPN's main advantage: it is a single platform for treating multiple conditions (COPD, TB, LRIs, asthma). This reduces the need for multiple devices and simplifies health worker training. Additional benefits include: no compliance or technique issues associated with inhalers; lower cost and maintenance than existing nebulizers; electricity-free and portable. Nebulization can relieve tolerance of oral TB medications, while reducing waste and risk of HIV infection associated with injection.

Operating steps

A health provider places medicine or hypertonic saline in the cup of the nebulizer mouthpiece. The patient puts the mouthpiece on and breathes normally through the mouth. The provider or an assistant then pedals or cranks the HPN until a hiss is heard and mist is seen. The HPN is designed to work at the right air flow rate or not at all.

Development stage

The HPN was shown to be equivalent to an electric nebulizer in quality of induced sputum for TB diagnosis [IJTLD 15(8):1077-81, 2011]. Particle size distribution, pressure and flow, and volume of liquid delivered between HPN and an electric nebulizer is equivalent. A study of the HPN in the treatment of asthma is beginning in Spring 2012 in El Salvador, and will also be deployed to Malawi in Summer 2012.

Future work and challenges

In the future, clinical trials will be continued and good manufacturing practices for the scaled up version will be developed. Business model(s) to mass-deploy the HPN exist, but initial funding for manufacturing and FDA approval is yet necessary. There is also a need to secure consistent revenue streams, along with context-dependent training programs with community health workers who will be the ultimate users.

User and environment

User: Physician, technician, nurse, family member, community health worker
Training: We are working with local Ministries and NGOs to develop training modules based on existing models.
Maintenance: Replace filter every 6 months

Environment of use

Settings: Rural, urban, ambulatory, at home, primary (health post, health center)
Requirements: None

Product specifications

| Dimensions (mm): | 180 x 150 x 130 |
| Weight (kg): | 4.5 |
| Consumables: | Air intake filters, liquid medicine, mouthpieces and tubing (reusable) and cleaning solution |
| Life time: | 10 years |
| Shelf life: | 10 years |
| Retail Price (USD): | 30 |
| List price (USD): | N/A |
| Other features: | Portable, reusable |
| Year of commercialization: | N/A |
| Currently sold in: | N/A |

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