Modeling and Engineering an Electricity Free Nebulizer

Tayag, Nicole (School: Baton Rouge Magnet High School)

Respiratory diseases present a challenge to public health in both industrialized and developing countries due to their frequency, economic impact, severity and projected trends. Additionally, developing countries are faced with the issue that most patients have poor or limited access to health care and medicinal treatment. Developing a device that can be constructed out of common, non-expensive materials and is not powered by electricity, makes treatment easier for respiratory disease patients living where electricity is scarce or traditional medical equipment is too expensive to purchase. The electricity free nebulizer is tested to investigate whether the device is capable of delivering an effective dosage of albuterol to provide a significant increase in peak expiratory flow rates in patients with respiratory diseases, like asthma and allergic rhinitis. It was found that the electricity free nebulizer increased the patients' peak expiratory flow rate by 22.45% on average (71.36 L/minute), surpassing the 20% improvement indicating the electricity free nebulizer's efficacy is comparable to that of standard treatments. Analysis of the data shows that the increase in patients' peak expiratory flow rates is statistically significant and the electricity free nebulizer treatment produced a greater overall percent increase in peak expiratory flow rates than the standard nebulizer treatment, showing that the electricity free nebulizer can be effectively used to deliver therapeutic amounts of albuterol sulfate resulting in statistically significant bronchodilation in respiratory disease patients. Therefore, the electricity free nebulizer is a more cost-effective and viable option for respiratory disease treatments for patients in developing countries.