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Short Communication

Inlet Filters For Oxygen Concentrators Made Of 3d-Printed Activated Charcoal

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INTRODUCTION

As of May 2021, the current COVID-19 epidemic is still wreaking havoc on the planet, posing a threat to all countries and their health systems. In this context, issues common in low-resource settings (e.g., a lack of vital medical equipment, resources, etc.) appeared in high-resource settings, exacerbated in already resource-scarce situations due to COVID-19. This is the situation with oxygen concentrators, which are a first-line medical equipment for COVID-19 patients. Their demand has been steadily increasing across the world since the beginning of 2020, exacerbating the situation in low-resource areas, where the supply of equipment that provide oxygen-enriched air was already limited. Oxygen concentrators are frequently discovered damaged or not operating effectively in these settings due to their fragility, a shortage of spare parts, and a lack of an appropriate health technology management system. The fundamental issues have a long history. The present regulatory frameworks and standards, which are developed by high-income nations, are excessively strict and do not take into consideration the limited resources available in low-income countries. As a result, they are frequently inapplicable non such situations. One of the most serious problems with oxygen concentrators is the filters, which are intended to filter out dust, particles, and germs and to be utilised in medical settings that meet international requirements (e.g., the air filtration level in a surgical theatre in Italy is at 99.97 percent). These filters have a substantially shorter lifespan when utilised in low-resource environments that do not meet these criteria and face a variety of obstacles (e.g., dust).

APPLICATIONS OF 3D PRINTED ACTIVATED CHARCOAL

When compared to high-income nations, the industrial and public healthcare sectors of low-income countries (LMICs) rely on insufficient funding in the twenty-first century. As a result, medical devices (MDs) are in short supply, and the poorest people are denied access to essential health care. As a result, hospitals and other healthcare facilities frequently lack adequate MDs to efficiently manage healthcare resources, ranging from pricey equipment like X-ray machines to even the most basic MDs.

This large amount of donated equipment, in theory, could greatly increase the performance of medical sectors in Sub-Saharan Africa and other low-income countries. However, numerous important elements continue to stymie development, and MD contributions have shown to be ineffective. The most major difficulties include a lack of a comprehensive health technology management programme, as well as the extreme environmental conditions that are typical of these areas (e.g., dust, high temperatures, high humidity) and inefficient supply chains. Furthermore, the World Health Organization has estimated that roughly 40% of donated medical equipment is non-functional. Because many hospitals in LMICs do not keep up-to-date inventory data, this estimate can also be considered conservative. While this figure is worrisome, the actual situation is considerably more so. Low funding levels in these environments have resulted in personnel shortages in hospitals and other medical facilities. Owing to a shortage of competent workers permitted to use modern MDs and perform preventative maintenance, MDs are frequently under utilised due to defective components or, in the worst-case scenario, irreversible equipment damage.

Donors and other groups are working to address the issue of non-functioning MDs in a number of ways, including offering free information and staff training on how to operate and maintain donated devices. However, as the multiple issues outlined above demonstrate, this will not be sufficient to address the issue of donated equipment that is not made in/for LMICs. In reality, in addition to the scarcity of experienced personnel to perform repairs, spare parts are frequently unavailable, resulting in one faulty component obstructing the usage of the complete system.

Despite the WHO's designation of medical oxygen as a "essential medication," access to it is still vital in most LMIC healthcare systems. The spread of the COVID-19 pandemic is now exacerbating the problem. In fact, the demand for oxygen concentrators and ventilators has surged dramatically in the previous year, since they can play a significant role in the treatment of COVID-19-infected critical-condition patients.

Oxygen concentrators are now on the WHO's priority medical devices list for the COVID-19 response. Oxygen concentrators are medical devices that supply oxygen to patients who have blood oxygen levels that are below normal. They are used to treat people who have breathing problems, such as asthma attacks, pneumonia, and respiratory stress syndrome. Four 3D printers were examined in order to determine which one best met the requirements for our application. Overall, obtaining a 3D printer only to produce new filters for oxygen concentrators would be impractical, but as previously discussed in this study, 3D printers may be employed in a variety of medical applications, including the production of small-scale MDs. Finally, the 3D printer Fortus 360mc (or a comparable model) was chosen since it was thought to be more appropriate for an LRS medical institution. It was less expensive than the other choices, and it traded resin printing for other benefits more relevant to MD production, such as interchangeable printing tips of varied diameters and a bigger build area.