

Meeting the need for ventilators in low- and middle-income countries

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Essential new guidelines to design mechanical ventilators that can work in low- and middle-income countries (LMICs) have been proposed.

The guidelines are based on the results of an original survey of more than 50 expert anaesthetists and intensivists from 23 LMICs in Africa, Asia, Central and South America, and on a critical analysis of the published literature.

The findings of the study, published today in the *British Journal of Anaesthesia* and led by King's College London, are vital for countries that have few mechanical ventilators, as low ventilation capacity limits access to critical care and surgery. The guidelines were produced to define the key design features for a mechanical ventilator to be usable and sustainable in [low-resource settings](#).

The COVID-19 pandemic highlighted the lack of ventilators in many LMICs, and this study sought to characterize the infrastructure in which ventilators are needed. Ventilators produced for [high income countries](#) might not be sustainable in LMICs, because they may be too difficult or expensive to repair.

Survey responses by larger LMICs hospitals show [electricity supply](#) was interrupted daily (19%) and weekly (25%), but three quarters of these outages lasted less than two hours. As such, a relatively small battery in the ventilator could bridge the gaps in electricity availability.

The study suggests that the design of a mechanical ventilator would also need to include an air compressor, and either a gas cylinder or an oxygen concentrator.

The analysis highlighted that there is a wide range of infrastructure within low- and middle-income countries. A [ventilator](#) developed according to these guidelines, is likely to meet the demand in many of these countries.

Dr. Federico Formenti, Reader in Physiology from King's College London, said: "The pandemic highlighted the lack of mechanical ventilation capacity in many low and middle-income countries, where the use of ventilators designed for wealthier countries is not sustainable for technical and financial reasons. Our study systematically investigated the infrastructure and context where ventilators are required and, based on a survey and expert opinion, we identified the fundamental guidelines that could enable the design of a context-specific and sustainable [mechanical ventilator](#) for larger hospitals in LMICs."

Dr. Mpoki Ulisubisya, Permanent Secretary at the Ministry of Health in Tanzania and co-author of the study, said: "The global unreliability of electric power supply in low- and middle-income countries calls for designs of medical commodities and equipment to be customized. This customisation is essential if patient care is to be optimized and of a quality to meet patient's needs. The pandemic exacerbated this need when mechanical ventilation equipment was in question hence this study and the raised recommendations for equipment meant for low- and [middle-income countries](#)."

Co-author Professor Madiha Hashmi, from Ziauddin University in Pakistan, said: "COVID19 pandemic has highlighted the dearth of respiratory support equipment in low resource countries. Even when available these complex machines are unable to save lives when operated

by untrained persons. Simple ventilators with auto-modes may bridge the equipment and human resource gap."

Provided by King's College London

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