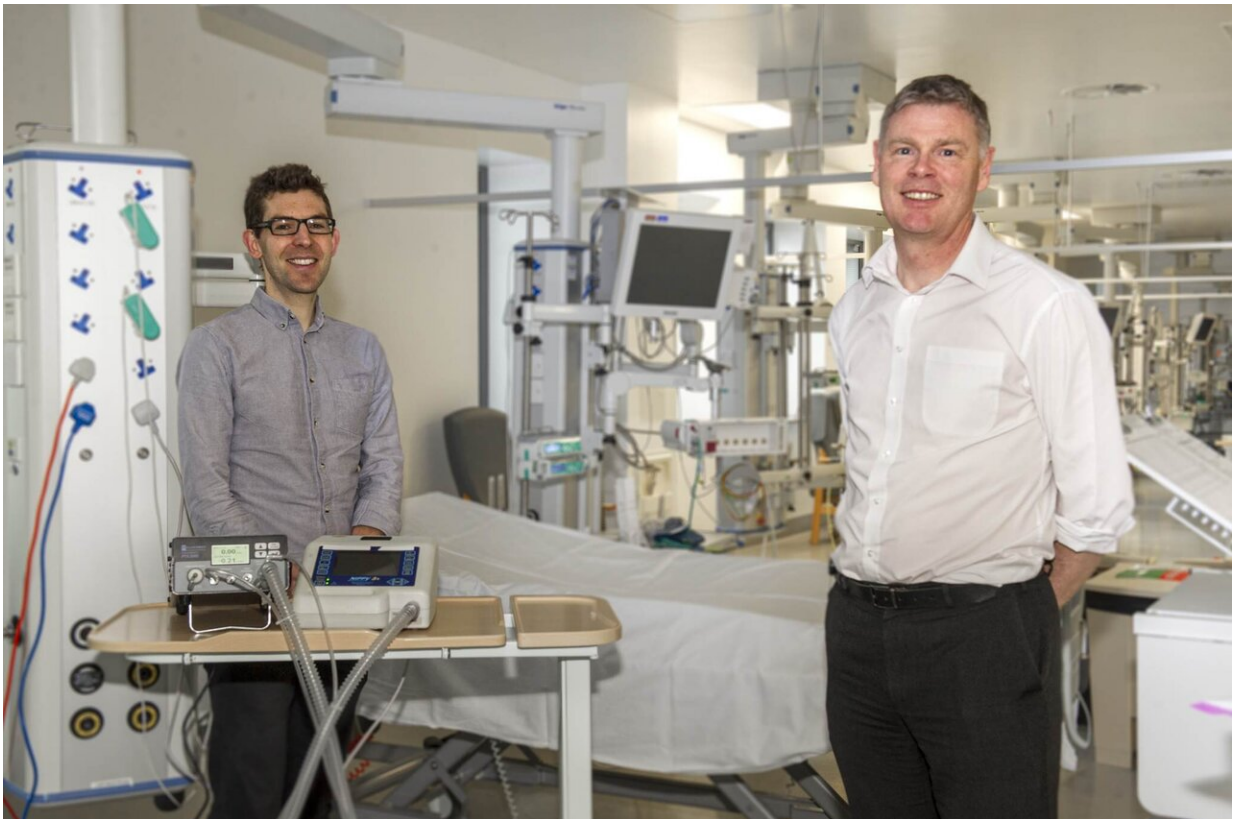


A quick fix to significantly increase breathing devices to treat coronavirus

April 9 2020



On the left, Dr Pete Culmer and Dr David Brettle, members of the team that devised the way to adapt the sleep apnoea machine. Credit: University of Leeds

Engineers and scientists in Leeds, UK, have developed a way to turn a sleep apnea machine into a ventilator to treat people with COVID-19.

The modification—in this case on a [device](#) known as a Nippy3+, which are being phased out of service—came about following a collaboration between clinical staff, engineers and physicists at Leeds Teaching Hospitals Trust (LTHT) and academics and technologists at the University of Leeds.

It has been estimated that there are thousands of similar devices across the NHS, and their rapid modification has the potential to significantly increase the respiratory support available to very ill patients across the UK. There are around 100 of the devices in Leeds hospitals.

The modification is straightforward and involves changes to the device's settings and reconfiguring the supply of oxygen so it flows to the face mask worn by the patient.

The machine operates in a mode called CPAP: constant positive airway pressure. That means the pressure inside the mask is slightly raised, keeping the patient's airway open and making it easier for them to breathe.

It provides enriched oxygen of between 40 to 60 percent and because it is a modification to a device, it does not have to go through a full regulatory approval process.

Dr. David Brette, Head of the Medical Physics team at LTHT and Honorary Professor at the University of Salford, said: "This is another example of the long-standing collaboration we have between our Trust and the University of Leeds. We know there could be pressure on the NHS for more ventilators during the current [coronavirus](#) outbreak and this was a way of coming up with a potential solution.

"Scientists and clinicians working with academics and technicians have made it happen."

Professor Nikil Kapur, from the School of Mechanical Engineering at Leeds and who led the University team, said: "The collaboration showed how the University of Leeds was able to support colleagues at LTHT who had brilliant ideas but insufficient time to investigate them because they were having to prepare their hospitals to deal with the unfolding pandemic."

How the idea developed

Working on a suggestion that initially came from the medical physics department at LTHT, the University team—in four days—came up with a ventilator based on a conversion of a Nippy 3+ device. That working model had both air and oxygen being fed into the device and then onto the patient.

It was evaluated at LTHT last week but the medical physics team wanted to reconfigure it further, to achieve more efficient use of hospital oxygen supplies. The clinical team, with the engineers, decided that the patient's mask would receive air from the device and oxygen directly from the hospital's supply system.

Also, there was evidence from China that many seriously ill patients did not need full ventilation, which requires sedation, but an intermediate level of support which could be provided by a CPAP device.

Professor Nikil Kapur, said: "The decision was then to move onto the next iteration of the re-modeled device, and the changing requirements actually made those modifications easier.

Dr. Pete Culmer, Associate Professor in the School of Mechanical Engineering at Leeds and a member of the team, added: "Previously we had been looking at having to fit each machine with seven new components—and that would have required a system to manufacture

those new components.

"Instead, the solution we eventually arrived at is much simpler. You have to change some of the settings, filters and the way oxygen reaches the patient. It is now a fix that hospital teams can undertake themselves using equipment which is readily available."

Last week, engineers at University College London and Mercedes announced that they had successfully reverse engineered a CPAP device that had widely been used in China. Reverse engineering involves taking a device apart, seeing how it is made—and then rebuilding it with improvements. They said they have a device that has regulatory approval and can be rapidly manufactured.

The modifications suggested by the team at Leeds provides a complementary and immediate solution to supplement the ventilation equipment available.

More information: A technical note written by the expert team has been submitted to MedRxiv, an online platform that allows researchers to rapidly disseminate important findings ahead of peer review. The note is currently in the process of being submitted for peer review and publication in a journal. The technical note can be downloaded from AlphaGalileo: www.alphagalileo.org/DTControl...ntrol/Images/pdf.png

Provided by University of Leeds

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