

Computer simulators show how to reduce damage to lungs of children in intensive care

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Credit: University of Warwick

Changing the ventilation settings for children on life support can reduce the risk of damage to their lungs, researchers at the University of Warwick and the Children's Hospital of Philadelphia have found on computer simulated patients.

Paediatric Acute Respiratory Distress Syndrome (PARDS) is one of the most challenging diseases for doctors to manage in the [pediatric intensive care unit](#), and can arise due to several different causes, such as pneumonia, sepsis, trauma, and drowning.

Mechanical ventilation is a life-saving medical intervention for many such patients, but the forces and stresses applied by the ventilator can themselves further damage the lungs (so-called ventilator induced lung injury—VILI).

Using [patient data](#) collected by Dr. Nadir Yehya, an attending physician in the paediatric [intensive care unit](#) at the Children's Hospital of Philadelphia, researchers from the Department of Engineering at

the University of Warwick have developed a computer simulator that predicts how different ventilator settings affect the lungs of individual child patients in the ICU.

This simulator was then used to safely investigate whether, and how, ventilator settings can be changed to be more "protective", i.e. to lower the risk of causing VILI in different patients, while still maintaining adequate ventilation.

The researchers identified several strategies that, in simulated patients, led to significant reductions in variables that are associated with VILI, such as tidal volumes (the volume of air displaced between inhalation and exhalation) and driving pressures.

The next stage of this research will be to test these strategies in patients in formal prospective trials in order to evaluate the clinical benefits of more protective ventilation in real hospital environments.

Professor Declan Bates from the School of Engineering at the University of Warwick commented:

"It has been incredibly exciting to see the potential of computer simulators being realised to develop safer treatment strategies for critically ill children in the intensive care unit. We are sure that combining the expertise of medical doctors and engineers will bring about radical improvements in patient care and medical outcomes over the coming years."

Dr. Nadir Yehya from the Division of Critical Care Medicine at the Children's Hospital of Philadelphia commented:

"Collaborations such as these are essential for providing safe care for our sickest children. Computer simulations have been relatively under-

utilised in paediatric intensive care, and we are excited about the opportunities to address critical areas of research using these technologies."

More information: Sina Saffaran et al, High-fidelity computational simulation to refine strategies for lung-protective ventilation in paediatric acute respiratory distress syndrome, *Intensive Care Medicine* (2019). DOI: [10.1007/s00134-019-05559-4](https://doi.org/10.1007/s00134-019-05559-4)

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