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Assessing the Asynchrony Event Based on the Ventilation Mode for Mechanically Ventilated Patients in ICU

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Abstract

Respiratory system modelling can assist clinicians in making clinical decisions during mechanical ventilation (MV) management in intensive care. However, there are some cases where the MV patients produce asynchronous breathing (asynchrony events) due to the spontaneous breathing (SB) effort even though they are fully sedated. Currently, most of the developed models are only suitable for fully sedated patients, which means they cannot be implemented for patients who produce asynchrony in their breathing. This leads to an incorrect measurement of the actual underlying mechanics in these patients. As a result, there is a need to develop a model that can detect asynchrony in real-time and at the bedside throughout the ventilated days. This paper demonstrates the asynchronous event detection of MV patients in the ICU of a hospital by applying a developed extended time-varying elastance model. Data from 10 mechanically ventilated respiratory failure patients admitted at the International Islamic University Malaysia (IIUM) Hospital were collected. The results showed that the model-based technique precisely detected asynchrony events (AEs) throughout the ventilation days. The patients showed an increase in AEs during the ventilation period within the same ventilation mode. SIMV mode produced much higher asynchrony compared to SPONT mode ($p < 0.05$). The link between AEs and the lung elastance (AUC Edrs) was also investigated. It was found that when the AEs increased, the AUC Edrs decreased and vice versa based on the results obtained in this research. The information of AEs and AUC Edrs provides the true underlying lung mechanics of the MV patients. Hence, this model-based method is capable of detecting the AEs in fully sedated MV patients and providing information that can potentially guide clinicians in selecting the optimal ventilation mode of MV, allowing for precise monitoring of respiratory mechanics in MV patients.

Keywords

Author Keywords: [mechanical ventilation](#); [lung elastance](#); [asynchrony events](#); [spontaneously breathing](#); [ventilation mode](#)

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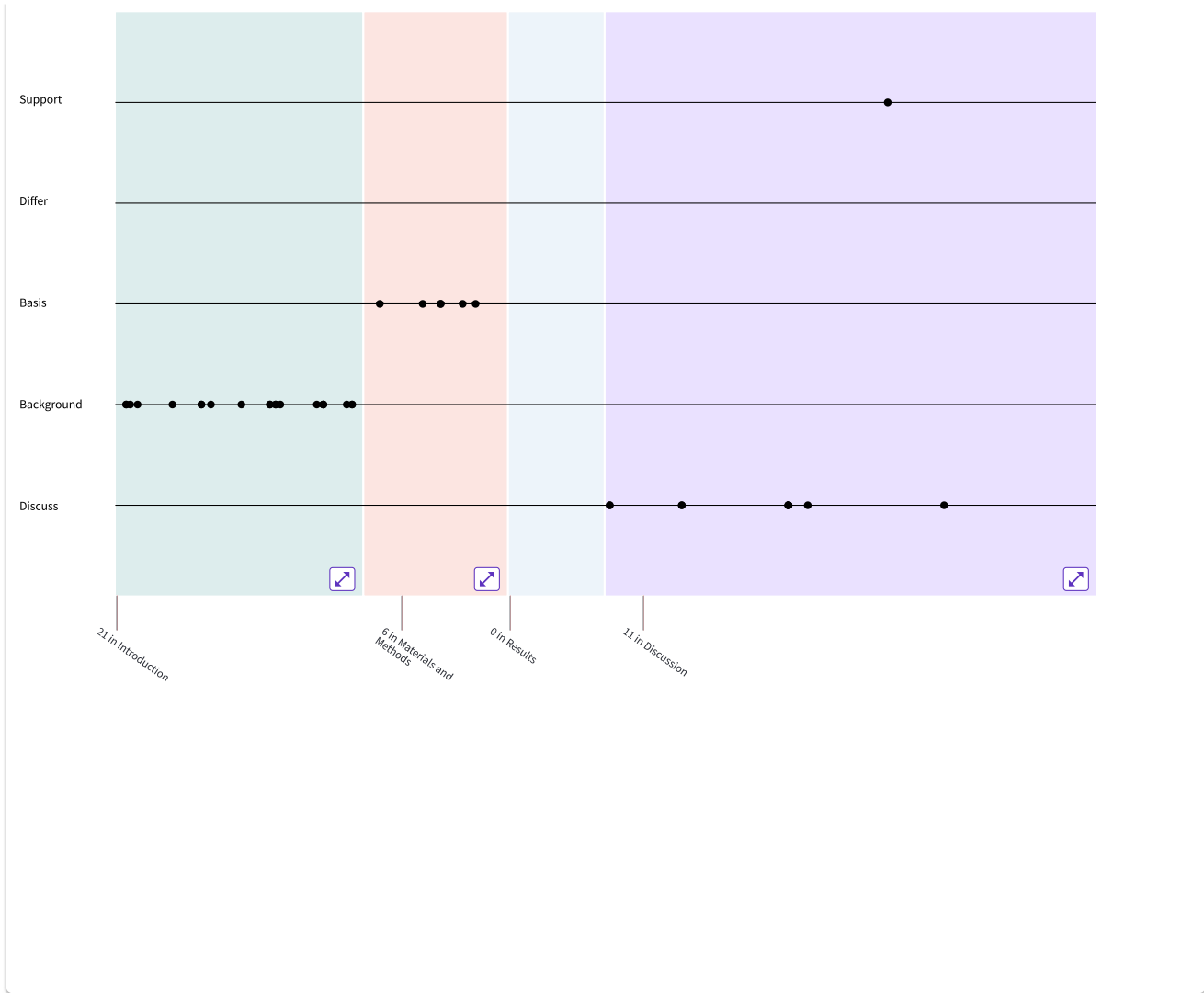
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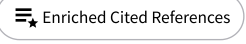
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