

# Integrating Stress Monitoring and Augmented Reality in Perfusionist Training: A New Frontier for Enhancing Simulation-Based Learning

Dear Editor,

I would like to extend my compliments to Adnaldo da Silveira Maia et al.<sup>[1]</sup> for their insightful and timely review titled "Cardiac Surgery Training in Brazil – What Are We Discussing in Our Journal?". This review provides an overview on cardiovascular surgery training of residents in the face of new technologies in the specialty. This article discusses the challenges in this scenario as well as the current training in cardiovascular surgery in Brazil. One promising application of this technology would be in medical simulations for perfusionists, particularly in extracorporeal circulation (ECC) scenarios such as cardiopulmonary bypass (CPB). In these high-stress environments, non-technical skills such as decision-making, communication, and teamwork are critical for managing emergencies like equipment failure, oxygenator malfunctions, or excessive bleeding. The incorporation of stress monitoring through wearable devices, such as smartwatches, into these simulations would provide valuable data on how stress affects a perfusionist's performance in real time. In this context, the study by Zaheer U D Babar et al.<sup>[2]</sup> titled "Virtual reality simulation as a training tool for perfusionists in extracorporeal circulation: Establishing face and content validity" offers a forward-thinking approach to perfusion training through augmented reality (AR). By integrating wearable devices for stress monitoring with AR simulations, we could develop a more comprehensive training platform (Figure 1). This combination would allow for real-time feedback on the participants' physiological responses to stressful situations, providing both trainees and trainers with insights into how stress impacts performance during critical ECC scenarios. For example, stress indicators such as the stress index, calculated using heart rate variability data through a formula like:

$$\text{Stress index} = \text{RR}_{90} / \text{RR}_{10} \times 1 / \text{Mean RR}$$

Where:

- $\text{RR}_{90}$  is the 90<sup>th</sup> percentile of the RR intervals (the time between heartbeats).
- $\text{RR}_{10}$  is the 10<sup>th</sup> percentile of the RR intervals.
- Mean RR is the average RR interval.


This could be integrated into simulations to track autonomic nervous system responses and would provide perfusionists with real-time metrics on how their stress levels fluctuate during high-pressure moments, such as during a CPB or in cases of oxygenator failure. Furthermore, integrating AR into these simulations, as described in the study by Zaheer U D Babar et al.<sup>[2]</sup>, creates a highly immersive environment that closely mirrors the challenges



**Fig. 1** - Perfusionist training with augmented reality.

faced in actual clinical scenarios. Monitoring stress levels via smartwatches in this context would add another dimension to the training, allowing participants to work on not only technical skills but also stress management, which is essential in high-stakes medical procedures. By combining stress monitoring and AR, we can provide perfusionists with a deeper understanding of how their emotional and physiological states impact their decision-making and operational skills during critical moments. This would represent a significant advancement in medical training, ensuring that healthcare professionals are better prepared to manage both the technical and psychological demands of real-world emergencies. In conclusion, I believe that integrating stress monitoring through wearable devices into AR simulations for perfusionists could significantly improve training outcomes. I would like to commend both et Adnaldo da Silveira Maia et al. and Zaheer U D Babar et al. for their valuable contributions to this field<sup>[1,2]</sup>. These innovations are essential steps toward creating more effective and comprehensive training environments for medical professionals.

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**Integrating Stress Monitoring and Augmented Reality in  
Perfusionist Training: A New Frontier for Enhancing  
Simulation-Based Learning**

*Brazilian Journal of Cardiovascular Surgery*

vol. 40, no. 6, e20240346, 2025

Sociedade Brasileira de Cirurgia Cardiovascular,

**ISSN:** 0102-7638

**ISSN-E:** 1678-9741

**DOI:** <https://doi.org/10.21470/1678-9741-2024-0346>