

## Advancing Intensive Care Rehabilitation in Pakistan through Interactive Game-based Technology: Addressing the Growing Demand

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Respected Editor,

Integrating rehabilitation into the health care system of Pakistan is a crucial need as, according to the World Health Organization (WHO), non-communicable diseases will account for 80% of the total disease burden in low-and-middle income countries (LMIC) by 2030<sup>1</sup>. Furthermore, demographic shifts are expected to increase the ageing population in these regions to 200% by 2050<sup>1</sup>. Trauma and injury, along with these trends, create an urgent need for advanced intensive care unit (ICU) rehabilitation.

Technology-assisted rehabilitation has shown promising therapeutic tools for various musculoskeletal and neurological conditions. Digital mobile games and open-source technologies have demonstrated promising results in delivering effective health interventions for rehabilitating hand dysfunctions, Parkinson's disease (PD), stroke, joint disorders, and post-amputation recovery primarily due to significant patient engagement and motivation<sup>2,3</sup>. Conversely, most ICUs in Pakistan are currently working on traditional strategies such as passive range of motion, positioning, neuromuscular electrical stimulation and early mobilization to prevent ICU-related complications<sup>4</sup>.

Patients with prolonged stay in ICU often suffer from long-term impairments termed as Post Intensive Care Syndrome (PICS), defined as a worsening physical, cognitive and psychological well-being. They can last for weeks to a year<sup>5</sup>.

Moreover, studies have concluded that around 50-70% of ICU survivors experience at least one complication related to PICS. Furthermore, reduced mobility leads to a 3-11% decline in muscle strength per day during the first week of immobility in ICU, which affects musculoskeletal, respiratory and cardiac functions, leading to poor quality of life<sup>6</sup>.

Prompt rehabilitation is essential in improving recovery outcomes such as muscle strength, pain, exercise capacity, functional status and reducing the length of stay<sup>7</sup>. Recent advancements involve integrating technology to promote engaging, enjoyable, and patient-centered approaches. Due to diversified treatments and marked variability in patients' conditions, customized games can make the treatment more accessible and practical. Emerging technologies such as artificial intelligence (AI) supported rehabilitation, virtual reality (VR), gaming, robotics-assisted therapy, and telerehabilitation positively enhance patient engagement and assist physical therapists in designing focused and goal-oriented interventions<sup>8,9</sup>.

Digital games are currently utilized in many outpatient settings for stroke and PD rehabilitation and promoting general physical fitness<sup>4</sup>. However, its application in the ICU remains limited. In Pakistan, rehabilitation predominantly relies on conventional techniques, which, while beneficial, may not fully address the complex needs of critical patients due to poor infrastructure, lack of awareness, and insufficient training of healthcare professionals.

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Therefore, this is a time for healthcare institutions and policymakers in Pakistan to recognize the gap and address rehabilitation through effective digital transformation. These approaches include training rehabilitation professionals, refurbishing ICU infrastructure, and facilitating interdisciplinary teamwork. There is a need to initiate pilot and feasibility studies to assess the cost-effectiveness and the clinical impact. This method could pave the way for appropriate scalable models for public and private sector hospitals. It is time to move beyond conventional practices and align physical therapy strategies with global standards for better recovery in critically ill patients.

## REFERENCES

1. Ndubuisi NE. Noncommunicable diseases prevention in low-and middle-income countries: an overview of health in all policies (HiAP). *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*. 2021 Aug;58:0046958020927885.  
**DOI:** <https://doi.org/10.1177/0046958020927885>
2. Pillai, M., Yang, Y., Ditmars, C. and Subhash, H., 2020, March. Artificial intelligence-based interactive virtual reality-assisted gaming system for hand rehabilitation. In *Medical imaging 2020: imaging informatics for healthcare, research, and applications* (Vol. 11318, pp. 147-155). SPIE.  
**DOI:** <https://doi.org/10.1117/12.2549372>
3. Chaplin E, Karatzios C, Benaim C. Clinical applications of virtual reality in musculoskeletal rehabilitation: A scoping review. *InHealthcare* 2023 Dec 15 (Vol. 11, No. 24, p. 3178). MDPI.  
**DOI:** <https://doi.org/10.3390/healthcare11243178>
4. Othman SY, Elbiaa MA, Mansour ER, El-Menshawy AM, Elsayed SM. Effect of neuromuscular electrical stimulation and early physical activity on ICU-acquired weakness in mechanically ventilated patients: A randomized controlled trial. *Nursing in critical care*. 2024 May;29(3):584-96.  
**DOI:** <https://doi.org/10.1111/nicc.13010>
5. Bienvenu OJ, Friedman LA, Colantuoni E, Dinglas VD, Sepulveda KA, Mendez-Tellez P, Shanholz C, Pronovost PJ, Needham DM. Psychiatric symptoms after acute respiratory distress syndrome: a 5-year longitudinal study. *Intensive care medicine*. 2018 Jan;44:38-47.  
**DOI:** <https://doi.org/10.1007/s00134-017-5009-4>
6. Marusic U, Narici M, Simunic B, Pidot R, Ritzmann R. Nonuniform loss of muscle strength and atrophy during bed rest: a systematic review. *Journal of Applied Physiology*. 2021 Jul 1;131(1):194-206.  
**DOI:** <https://doi.org/10.1152/japplphysiol.00363.2020>
7. Gomes TT, Schujmann DS, Fu C. Rehabilitation through virtual reality: physical activity of patients admitted to the intensive care unit. *Revista Brasileira de terapia intensiva*. 2020 Jan 20;31:456-63.  
**DOI:** <https://doi.org/10.5935/0103-507X.20190078>
8. Winskill K, Sabben G, Akelo V, Ondeng'e K, Obong'o C, Stephenson R, Warhol D, Mudhune V. A smartphone game-based intervention (Tumaini) to prevent HIV among young Africans: pilot randomized controlled trial. *JMIR mHealth and uHealth*. 2018 Aug 1;6(8):e10482.  
**DOI:** <https://doi.org/10.2196/10482>
9. Sumner J, Lim HW, Chong LS, Bundele A, Mukhopadhyay A, Kayambu G. Artificial intelligence in physical rehabilitation: A systematic review. *Artificial Intelligence in Medicine*. 2023 Dec 1;146:102693.  
**DOI:** <https://doi.org/10.1016/j.artmed.2023.102693>