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HABILITATION THESIS

Abstract

Multidisciplinary Approaches in Physiotherapy: Integrating
Rehabilitation alongside Technological Innovation

Domain: Medicine

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(A) Abstract

This habilitation thesis addresses a comprehensive and innovative perspective on physiotherapy and the multidisciplinary nature of this domain.

The first step in my academic development was doctoral research, which laid a crucial foundation for my subsequent studies. The early focus on ethical dilemmas in physiotherapy services and the evolution of physiotherapy in Romania established my knowledge and perceptions of physiotherapy's historical and ethical dimensions. These studies were among the first in Romania to contextualize the ethical dimensions of physiotherapy in a post-communist healthcare landscape, emphasizing the need for standardized ethical practices that resonate with global healthcare norms. This research trajectory allowed me to build a solid framework for exploring interdisciplinary approaches and technological innovations in physiotherapy, as seen in my later works involving virtual reality, ethical considerations in patient care, and novel physiotherapy techniques.

My doctoral thesis also laid the groundwork for subsequent investigations into more technologically advanced and interdisciplinary methods in physiotherapy. Integrating ethical considerations into clinical practice and research underpins much of my later work, ensuring that patient care advancements adhere to high ethical standards.

Multidisciplinary research has been a hallmark of my academic career, reflecting a collaborative approach that spans various fields such as materials science, healthcare services, and technology use in physiotherapy. My work during my PhD intersects multiple disciplines besides the doctoral research theme, showcasing my ability to integrate and innovate in collaborative environments.

During my academic career, I have published 40 articles, from which 22 papers were published in Impact Factors Journals, 14 as principal author and 8 as secondary author. Three papers are in quartile 1 (Q1), and 8 papers are in quartile 2 (Q2). I have also published 11 papers in international database indexed journals, 4 in proceeding ISI conferences as extenso papers, and 3 extenso articles in international conferences volumes. By participating in national and international conferences, I published 9 conference abstracts, a book as a single author, and one as a co-author. My Web of Science H-index is 7, and Google Scholar is 8. Therefore, my academic career demonstrates international visibility and underscores the originality of my

research, particularly in the multidisciplinary realm of physiotherapy, where my contributions can significantly impact the development of physiotherapy research and practice.

As the principal author of 14 impact factor journal articles, I have demonstrated my capability to lead rigorous investigations and identify complex concepts that advance the understanding of medical research. My latest contributions are pioneering work integrating digital technologies with traditional rehabilitation methods, a further step in my forward-thinking approach to healthcare.

The thesis section regarding scientific achievements is structured into two distinct chapters, each focusing on different yet interconnected facets of physiotherapy—technological innovation and multidisciplinary approaches.

Chapter I: Technological innovation and standardized assessment in physiotherapy

This chapter depicts the results of investigating the integration of cutting-edge technologies with traditional physiotherapy methods to enhance the assessment and treatment of patients with neurological and musculoskeletal disorders. In this section, the research direction is focused on three sections:

(1) Innovative approaches in functional assessment

This section delves into how technological advancements can refine diagnostic and functional assessment tools. It highlights the importance of adapting manual muscle examination techniques for stroke survivors and developing the Romanian version of the Fugl Meyer Assessment for upper limb functionality. These innovations are critical for effectively tailoring rehabilitation strategies to individual patient needs.

(2) Techniques in physiotherapy for neurological and musculoskeletal disorders

In this subsection, the research direction presents the research results on novel therapeutic techniques, including FES for motor neuron disorders and the use of thermal and electro-physical agents applied to reduce spasticity. This section underscores my approach to combining traditional physiotherapy techniques with technological enhancements to improve treatment outcomes.

(3) Technological Innovation in Rehabilitation

Focusing on the synergy between technology and rehabilitative therapy, this section covers the results of another research direction regarding the impact of mixed virtual reality

exergaming and occupational therapy on improving limb functionality. My work on non-immersive virtual reality as therapeutic tools in post-stroke rehabilitation exemplifies my pioneering research in integrating advanced technologies into clinical practice.

Chapter II: Multidisciplinary approaches in physiotherapy

The second chapter of the thesis expands on the interdisciplinary nature of modern physiotherapy by exploring how various medical and therapeutic disciplines intersect to provide holistic patient care, particularly in the context of chronic conditions and healthcare services.

(1) Clinical research in chronic conditions

The research results examine the intersection of physiotherapy with managing chronic diseases such as diabetes and systemic lupus erythematosus, addressing both the physical and psychological aspects of chronic disease management.

(2) COVID-19 Pandemic: navigating challenges

This section reflects on the adaptability of the physiotherapy domain during the COVID-19 pandemic. The research results review my work on developing protective equipment solutions for respiratory masks and the implications of research on pediatric COVID-19 cases. Furthermore, later research depicts the results of digitalization and tele-education, emphasizing the need for continuity and increased quality of medical education and practice in online environments.

Throughout my thesis, I present a comprehensive review of my previous work and set the stage for future research directions.

Chapter III: Future Development Perspectives

In the last chapter, five main research directions emerged as a continuity of my previous research, in association with professional and didactic skills acquired during my professional and academic career:

(1) Integration of new technologies and tailored rehabilitation: Examines the fusion of emerging technologies with personalized rehabilitation approaches to optimize functional rehabilitation. It involves using innovative technologies like virtual reality systems and robotic exoskeletons, developing individualized rehabilitation protocols, and strategizing the seamless integration of technology-driven interventions into clinical practice.

(2) Identifying the optimal intensity training for neurological and locomotory impairments: This topic focuses on intensity training in neuro-locomotor rehabilitation. It includes prospective observational studies to understand the relationship between intensity and functional outcome, randomized controlled trials to evaluate different training protocols, and the development of standardized protocols to maximize treatment efficacy.

(3) Multidisciplinary research on ethical and deontological aspects of physiotherapy: This research addresses ethical considerations in physiotherapy, aiming for individualized patient care and promoting functional independence. It explores ethical dilemmas, patient education strategies, and collaborative decision-making processes in physiotherapy interventions.

(4) Interdisciplinary collaboration for holistic management of progressive chronic conditions: Advocates for a holistic approach to managing chronic pathologies with locomotor impairments through interdisciplinary collaboration. It involves developing comprehensive treatment protocols and implementing secondary prevention strategies to optimize long-term health outcomes.

(5) Multidisciplinary collaboration for technology development and rehabilitation programs: This section highlights collaboration in developing innovative technologies for individuals with locomotor impairments. It focuses on designing new devices, materials, and applications to enhance functional independence and overall quality of life.

These research directions aim to advance rehabilitation practices, optimize patient care, and improve the quality of life for individuals with locomotor impairments.

The clinical hospital where I work offers a wide range of advanced rehabilitation technologies that provide the necessary infrastructure for clinical research activities and the development of professional practices at high standards. The equipment includes advanced technology devices like virtual reality rehabilitation systems, functional electrical stimulation orthosis for upper and lower extremities, arm and hand rehabilitation exoskeleton devices, body weight support, stabilometry for balance and proprioception training, and robotic gait training devices. Through clinical and academic experience, along with the current infrastructure, I intend to develop rehabilitation protocols using advanced technologies based on clinical research to maximize patient outcomes and to develop best practice guidelines for the use of advanced technologies in medical rehabilitation and adapted to the functional needs

of patients with neurological sequelae. With my clinical and academic experience, access to this infrastructure constitutes dynamic and impactful opportunities for future doctoral research and training using the latest and most advanced rehabilitation and physiotherapy techniques.

Furthermore, my future didactic development is focused on developing a post-university learning setting for physiotherapists, ensuring ongoing professional growth and adaptation to emerging technologies and methodologies.

In conclusion, effectively combining technological advancements with a multidisciplinary approach aims at physiotherapy practice and significantly contribute to the broader medical community's efforts to provide comprehensive, patient-centered care.

The thesis provides a visionary approach to physiotherapy research, emphasizing the significance of technological innovation, interdisciplinary collaboration, and patient engagement.

Embedded within this scholarly work is an introspective reflection on the scientific and professional milestones achieved through this research, providing a roadmap for future endeavors in the field of physiotherapy. The thesis highlights the evolution of rehabilitation practices in response to technological and interdisciplinary advancements. It posits a forward-looking perspective on the role of physiotherapy in healthcare, advocating for a proactive and integrated approach to patient care and rehabilitation services.