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INTEGRATION OF PHYSICAL AND REHABILITATION MEDICINE INTERVENTIONS INTO THE INDIVIDUALIZED MANAGEMENT OF DISABILITY IN PATIENTS WITH CEREBROVASCULAR AND CARDIOVASCULAR DISEASES

ABSTRACT OF HABILITATION THESIS

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Introduction

This habilitation thesis, entitled *Integration of Physical and Rehabilitation Medicine Interventions into the Individualized Management of Disability in Patients with Cerebrovascular and Cardiovascular Diseases*, synthesizes more than two decades of clinical, academic, and scientific activity in the field of Physical and Rehabilitation Medicine (PRM). The work represents a natural continuation of the doctoral research, which focused on early recovery after stroke in patients with concomitant cardiac pathology, and expands its scope toward a holistic and personalized approach to disability management.

The central premise of the thesis is that rehabilitation medicine should no longer be perceived solely as a supportive or ancillary medical discipline, but rather as a strategic field for reducing disability, enhancing participation, and improving the quality of life of patients. This perspective is consistent with the modern biopsychosocial model promoted by the World Health Organization through the *International Classification of Functioning, Disability and Health (ICF)* and the global initiative *Rehabilitation 2030*.

Thematic Contributions

The thesis is structured around several major axes of scientific and clinical contributions:

1. Stroke Rehabilitation and Neuroplasticity

Stroke remains one of the leading causes of disability worldwide, and rehabilitation represents the cornerstone of functional recovery. The research presented in this thesis demonstrates the effectiveness of early, intensive, and personalized rehabilitation strategies in improving motor and cognitive outcomes. Emphasis is placed on the role of neuroplasticity, as well as on the concept of sensory priming, which can potentiate motor relearning.

2. Cardiovascular Comorbidities in Rehabilitation

A distinctive feature of the author's research is the integration of cardiovascular assessment and rehabilitation into neurorehabilitation protocols. Given the high prevalence of cardiac comorbidities in stroke survivors, the thesis highlights the importance of coordinated, multidisciplinary approaches that address both neurological and cardiac impairments. Clinical studies underline that functional recovery is significantly improved when cardiovascular rehabilitation is embedded in the post-stroke pathway.

3. Emerging Technologies in PRM

One of the innovative directions of this work is the use of new technologies in rehabilitation:

- **Virtual and augmented reality** for motor and cognitive training (TRAVEE project).
- **Robotics and sensor-based feedback** to enhance intensity and precision of therapy.
- **Focal vibration and postural feedback** to modulate spasticity and promote cortical reorganization.
- **Brain–computer interfaces (BCI)** as future tools for patients with severe motor impairments.

These technological approaches are not presented merely as experimental, but as practical, validated instruments that can be integrated into routine rehabilitation programs.

4. Standardization of Functional Assessment

Another key contribution is the emphasis on systematic and standardized functional evaluation. The thesis advocates for the large-scale implementation of the ICF model, combined with validated scales such as the Fugl-Meyer Assessment, Action Research Arm Test (ARAT), Modified Ashworth Scale (MAS), and others. Moreover, the development of digital platforms and electronic patient records is proposed, in order to integrate functional assessment into clinical decision-making and health policy.

5. Management of Spasticity

The author's expertise in botulinum toxin injections is supported by clinical protocols developed within national and international projects (e.g., CONTROL). Particular attention is given to ultrasound-guided injections, integration with neuromodulation techniques, and combined therapeutic strategies that address both spasticity and participation. This work illustrates how personalized spasticity management can significantly improve daily functioning and social reintegration.

Educational and Academic Contributions

The habilitation thesis also documents extensive educational activities:

- Development of curricula and teaching modules in PRM at undergraduate, postgraduate, and doctoral levels.

- Coordination of research teams and mentoring of residents, reflecting the author's role in forming new generations of specialists.
- Organization of workshops, summer schools, and interdisciplinary courses, which foster innovation and international collaboration in the field.

These educational contributions are framed within the broader mission of aligning Romanian medical education with European standards.

Future Directions

Based on the research and academic achievements presented, the thesis outlines several strategic directions for future development:

1. **Expansion of multicenter clinical research**, including national registries for stroke and cardiovascular rehabilitation.
2. **Integration of digital health solutions** and tele-rehabilitation to ensure equity of access.
3. **Broader international collaborations** through Horizon Europe projects and WHO/ESO networks.
4. **Strengthening policy impact**, by promoting the cost-effectiveness of rehabilitation and supporting its inclusion in national health strategies.
5. **Continued mentoring** and education of young researchers, ensuring sustainability and innovation in PRM.

Conclusion

This thesis demonstrates a consistent trajectory of scientific and professional development, characterized by original contributions, clinical relevance, and alignment with international priorities. It illustrates the author's ability to generate and lead complex interdisciplinary projects, to integrate innovative technologies into medical practice, and to contribute significantly to the modernization of rehabilitation medicine in Romania.

By bridging neurology, cardiology, technology, and education, the work reaffirms the strategic importance of rehabilitation medicine for public health and positions the author as a leader in the academic and clinical development of the field.