“CAROL DAVILA” UNIVERSITY OF MEDICINE AND PHARMACY, BUCHAREST

GRADUATE SCHOOL

FIELD OF MEDICINE

"From evidence-based medicine to artificial intelligence in ischemic heart disease."

- Summary of the habilitation thesis -

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The summary of the habilitation thesis entitled **„From Evidence-Based Medicine to Artificial Intelligence in Ischemic Heart Disease”** summarizes the main scientific, academic, and professional achievements subsequent to obtaining the title of **Doctor in Medicine** with the thesis entitled „Myocardial Reperfusion Injury Syndrome: Clinical and Experimental Study”, obtained in 2009. The thesis is structured into two major chapters, each containing subchapters and bibliographic sources.

The first chapter refers to professional, academic, and scientific achievements.

My professional career has followed the natural stages of development, becoming a specialist in cardiology in 2007, a board-certified cardiologist in 2015, and since 2020, I have been the Head of the Cardiology Department of the Emergency Clinical Hospital in Bucharest. Given the profile of the hospital, my professional interests have been primarily focused on "emergency" cardiology, specifically on ischemic heart disease represented by acute coronary syndromes, mainly acute myocardial infarction.

In 2003, I was admitted through a competition in the position of assistant lecturer in the Cardiology Clinic of the Emergency Clinical Hospital in Bucharest. In 2008, I became a lecturer, and in September 2014, I was promoted to the position of senior lecturer. Since February 2023, I have held the position of associate professor."

In recent times, I have focused my attention towards research, particularly about **artificial intelligence (AI)** in cardiology, with a specific focus on ischemic heart disease. I consider the possibilities of AI development in assisting doctors and benefiting patients to be extraordinary and still in the early stage of its development. Of course, decision-making limits and ethical aspects should be considered when using artificial intelligence algorithms in current medical practice. My current interest focuses on the potential benefits of AI-based applications and the opportunities offered by telemedicine for cardiac patients in complementing the concept of precision (personalized) medicine."

I have won **14** research projects through competitions, as follows: **7** as a project manager, **2** as a coordinator on behalf of the partner, and **5** as a member of the research team.

As a result of these research projects, in addition to disseminating the obtained results through article publications and conference presentations, I have registered a patent and won

several diplomas and awards (including winning the Best Research Project of the Year 2022 with ATHEROSLEROSYS).

My research activity has materialized as the **primary author of 17 articles** and as a **co-author of 24 articles** published in Thomson Scientific ISI Web of Knowledge indexed journals with the impact factor calculated by Thomson, the majority of them being published after obtaining my doctor in medicine degree. Currently, I have the following scientometric indices: **Hirsch index of 7** (Web of Science Core Collection) with 118 citations.

My activity will be presented based on the projects I have won, the concepts underlying them, as well as the articles considered impactful and relevant to my career.

The concept of personalized medicine for patients with ischemic heart disease proposes the generation of targeted therapies customized for specific patient groups, but it can also lead to an individualized therapeutic approach based on the clinical, genetic, and genomic uniqueness of each individual. I have applied this approach in several projects, ranging from clinical studies on "Quality of Life in Patients with Infarction Treated with Primary Angioplasty - an Achieved Objective?" to genomic research on "Modulating Factors of Progenitor Stem Cell Kinetics in STEMI Patients Undergoing Primary Angioplasty - A Pilot Study."

The possible applications of artificial intelligence in the invasive evaluation of coronary lesions created the premise of several projects, for example, "Functional evaluation of complex coronary artery lesions using optical coherence tomography and routine angiography (FUNCTIONAL-OCT)" proposed the development, implementation, testing and validation of a customized hemodynamic model for calculating the fractional flow reserve (FFR) from medical images acquired by optical coherence tomography (OCT) and classical angiography and from routine measurements.

A step forward was represented by **the development of applications based on artificial intelligence used for therapeutic decision in patients with known coronary anatomy**, where we conducted a study entitled „Artificial intelligence-based assessment of coronary anatomy and the evolution of coronary lesions using routine angiography (AI-CAD- PREDICT)" which proposed the development, implementation, testing and validation of an artificial intelligence and

cloud computing platform to automatically generate the optimal angioplasty strategy using medical images acquired by coronary angiography.

We identified **methods to support teaching activity using artificial intelligence (educational platform)** that was designed to simulate real-life clinical scenarios in which the student performs an examination on a virtual patient.

I believe it is important to recall **the ethical elements of the use of artificial intelligence in medical practice**, in a point of view in a material under the auspices of UNESCO.

The second chapter includes the milestones of **professional, academic and scientific development.**

My short and medium-term goals will focus on completing ongoing projects, and in the long term I aim to access new funding opportunities for research. I believe that there are three main directions in which I propose to continue my research activity in the next period:

- ischemic heart disease – acute and chronic coronary syndromes, using modern approaches, advanced imaging methods, the use of AI in determining risk scores,

- using the resources offered by **digitization, artificial intelligence and telemedicine** in various fields of cardiology (e.g. heart failure)

- updating modern teaching methods and finalizing the **virtual educational platform (the virtual patient).**

In order **to improve the risk and prognostic scores in patients with myocardial ischemia using artificial intelligence**, we have the ongoing project "Clinical decision cloud support system for improving the evolution of atherosclerotic lesions in acute coronary syndromes" (ATHEROSCLEROSYS), the most complex study so far .

Another theme of the future, **using the elements of "big data", telemedicine and artificial intelligence as part of personalized medicine** can be performed through 2 projects: "DataTools4Heart" aims to facilitate navigation through multi-source cardiology data on a wide scale while respecting European regulations and data processing standards can bring new perspectives in research; "Intelligent monitoring of heart failure to improve therapeutic

management (My AI Heart)" will propose a risk stratification system using advanced machine learning techniques.

Academic performance will be enhanced by **the development and improvement of the concept of an educational platform** through a new research project "The virtual patient - Learning system based on artificial intelligence for training in diagnosis and treatment of cardiovascular diseases", based on the consideration that virtual environments are becoming a safe and practical solution for training medical skills and enhancing doctor – medical student interactions.

One of my personal goals and obligations is **creating professional development opportunities** for colleagues regardless of age, even towards of thoroughgoing study in niche areas of cardiology.

I have mentioned the numerous projects and studies, but all of them are based on human resources. One of my future priorities is establishing and developing research teams.

In terms of **academic development**, I will continue to prioritize the daily work with medical students and residents. I believe that a good teacher must know how to offer what he has tought and what he has learned from his own experience. The future objectives regarding the didactic activity will mostly follow the route I have followed so far.

Regarding the university path, I will try to point out certain aspects that I consider to be important:

- **increasing the quality** of teaching activities for the theoretical and practical training of students and resident doctors, using state-of-the-art technological resources;

- developing **optional courses** on fields of interest that exceed the level of regular internships for students/residents who wish to practice their skills;

- **including medical students** in faculty research projects and involving residents in writing medical students' undergraduate theses;

- promoting feedback and transparency in the educational and professional training process

- organizing workshops and specializing courses, if possible, involving student associations and the residents;

- supporting **mentoring activity** at all levels

- maintaining and **strengthening the already formed research teams**

- developing interdisciplinary and transdisciplinary collaborations with other higher education institutions research teams from the country and abroad, but also with partners from the private sector.

- writing specialized medical books for recognized publishing houses from abroad and article publishing in well-rated international magazines.

- an important aspect is the active involvement in the **preparation and training of graduate school (PhD) students.**

Promotion to higher university degrees comes with higher responsibilities and cannot occur without being supported by adequate professional development and sustainable research projects.

The last section contains bibliographic references, generally describing the evolution of my career from a professional, academic, and scientific point of view.