

HEALTHCARE 4.0: DEVELOPING MANAGEMENT SCIENCE AND ANALYTICS MODELS AND TOOLS TO SUPPORT THE DESIGN AND IMPLEMENTATION OF GENOMIC-RELATED POLICIES AND SERVICES IN PORTUGAL

UNITE! PhD PROPOSAL BY Mónica Oliveira (Técnico, ULisboa); JOINT PROPOSAL WITH Astrid Vicente (INSA) & Paul Lillrank (Aalto University)
PhD HOST INSTITUTION: Instituto Nacional de Saúde Ricardo Jorge (INSA)

Description of the project

Context:

- The healthcare sector is adopting the principles of Industry 4.0 to create a Healthcare 4.0 environment. Scalable and on-demand computation and incremental data storage capabilities aligned with artificial intelligence allow processing a big amount of healthcare information from different sources and formats (e.g. EHRs, medical images or genomics information) which will enable the implementation of real-time healthcare platforms for patients, professionals, and caregivers.
- This will enable healthcare systems to implement personalized medicine services which use extensive characterization of individuals, including genomics, to deliver more precise and timely prevention, diagnostics, and treatment. As an example, personalized medicine allows the use of pharmacogenomics in medical decisions, providing targeted therapies that increase the patients' positive response to the therapeutic regime and decrease the very high incidence of adverse drug reactions (ADRs).
- However, despite the efforts to democratize the access to genomic data throughout safe federated data platforms in order to create a more efficient healthcare system, the application of genomics into routine care remains limited

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Objectives:

- This research aims to support decision-making by developing management science and analytics approaches to inform the design and implementation of genomics-related policies and services in the Portuguese healthcare system under the Healthcare 4.0 paradigm.
- To reach the above overall aim, research will be harbored at the Instituto Superior Técnico (ULisboa) and developed at Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA), and will be conducted to answer the following objectives:
 - **Objective 1:** Learn from literature by synthesizing available evidence on the successful implementation of genomic-related policies and services.
 - **Objective 2:** Understand and estimate the potential demand for distinct types of genomic-related services and care in Portugal using large-scale databases and predictive analytics and spatial statistics techniques.
 - **Objective 3:** Understand how distinct policies for genomic-related services adoption impact the delivery in networks of care in Portugal for specific areas (e.g. oncology care, rare diseases) through the development of dynamic simulation models.
 - **Objective 4:** Make use of data analytics and the management science models previously developed, as well as consulting relevant health stakeholders and experts, so as to evaluate the overall impact of adopting distinct genomic-related policies and services in Portugal through multicriteria decision modeling, and integrating all the information within a decision support system.

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Methods:

- Methods will involve predicting demand for genomic-related services using predictive and spatial analytics, analyzing policy impacts on care networks through dynamic simulation models, evaluating the overall impact of policies with multicriteria decision modeling, and constructing a decision support system.
- Innovative statistical techniques such as predictive modeling and data mining to develop models to understand the demand for WGS services for distinct disease areas will be used using current and historical clinical data:
 - Predictive analytics is an indispensable tool to analyze a large proportion of structured and unstructured clinical data, and will be used to predict demand.
 - To understand how distinct policies for WGS adoption impact the delivery in networks of care, we will use Dynamic simulation models which allow to simulate nonlinear and interdependent behaviors between several healthcare agents and providers.
 - Making use of data and of health stakeholders and experts' views, multicriteria modeling can be used to understand how to measure the value of alternative networks of care, policies and services, as well as to capture relevant dimensions such as innovation and societal impact to consider in the evaluation.