IHI Call Days | Call 9

AI-Driven Predictive Models for Surgical Outcome and performance Enhancement in Colorectal Surgery

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Challenges and objectives

o **Problem**:

Post-operative (PO) complications after colorectal surgery for malignant tumours still afflict a population as high as the 20% of the patients undergone this type of surgery. Among this, anastomotic leak (AL) plays a pivotal role in worsening the post-operative course increasing the length of stay, need of reintervention, mortality rate and, consequently, costs related to the management of these patients. However, There is still a lack in knowledge about the risk factors leading to this dreadly complications and, consequently, a substantial lack in the possibility to effectively predict their occurrence.

o **Challenge**:

Improve patient outcomes and surgical performance with the combined application of machine learning (ML), Generative AI (LLM) and computer vision (CV).

o **IHI Objective Addressed**:

SO1 - Better Health through Innovative Therapies

SO2 - Boosting innovation through better integration of fragmented health R&I efforts

SO4 - Boosting innovation through exploitation of digitalisation and data exchange in healthcare

SO5 - Boosting innovation for better assessment of the added value of innovative integrated healthcare solutions

o **Unmet Public Health Need**:

Better knowledge of risk factors related to PO complications

Better patient selection

Standardize the surgical practice and its evaluation

Improve surgical learning curve

Improve surgical performance

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Your approach to solve the problem

- **Approach**:

Utilize a combination of AI tool based on the analysis of patient data, radiological imaging and video output in order to:

A- develop a ML model to predict the occurrence of AL

B- evaluate the surgical performance

C- boost the surgeon's learning curve

- **Industry Collaboration**:

A public-private collaboration is crucial to harness resources from both the medical device industry and healthcare ICT for real-time predictive tool integration.

- **Industry Contribution**:

Technological support for data analysis, integration and tool development and deployment in the clinical setting

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Is your project suitable for IHI?

- **Expected Results and Impact**:
  - **Outcomes**:

    Primary: A validated predictive model for anastomotic leaks.

    Secondary: a model for evaluating surgical performance

  - **Impact**:

    Improved patient outcomes

    decreased hospital costs

    faster recovery times

    Faster surgical learning curve

  - **Healthcare Ecosystem Integration**:

    The model would be adaptable for integration in surgical planning software, directly impacting clinical decision-making.

- **Contribution to Health Industry Competitiveness**:

  Positions the EU at the forefront of innovative healthcare technologies, enhancing the global competitiveness of its health sector.

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Outcomes and Impact

- **Patient Benefits**: Reduces the risk of life-threatening postoperative complications and improves recovery after surgery and surgical performance
- **Strengthening Competitiveness**: Establishes the EU as a leader in AI-driven healthcare innovations, contributing to the broader adoption of predictive analytics in surgery.

Predictive Model for Surgical Complications:

The development and validation of a machine learning-driven model for predicting anastomotic leaks and other complications in colorectal surgeries. This model would be a pioneering tool in surgical oncology, allowing for more precise patient risk stratification.

Enhanced Preoperative Planning:

By identifying patients at higher risk of complications, the model will allow surgeons to tailor preoperative and intraoperative plans more effectively. For instance, it could help in decisions around using a protective stoma or choosing alternative surgical techniques to minimize risk.

Data-Driven Clinical Decision Support System (CDSS):

The predictive model could serve as a foundational element for a broader clinical decision support system, which would integrate seamlessly into electronic health records (EHR) and provide real-time analytics for surgical teams.

Pilot Testing in Multi-Center Settings:

The outcomes would also include pilot testing across multiple high-volume surgical centers to ensure robustness, usability, and adaptability in various clinical environments.

Repository of Clinical Data for Continuous Learning:

Establishment of a data repository of anonymized clinical records that will continuously improve the model through ongoing machine learning processes, adapting to new data and improving accuracy over time.

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Expertise and resources
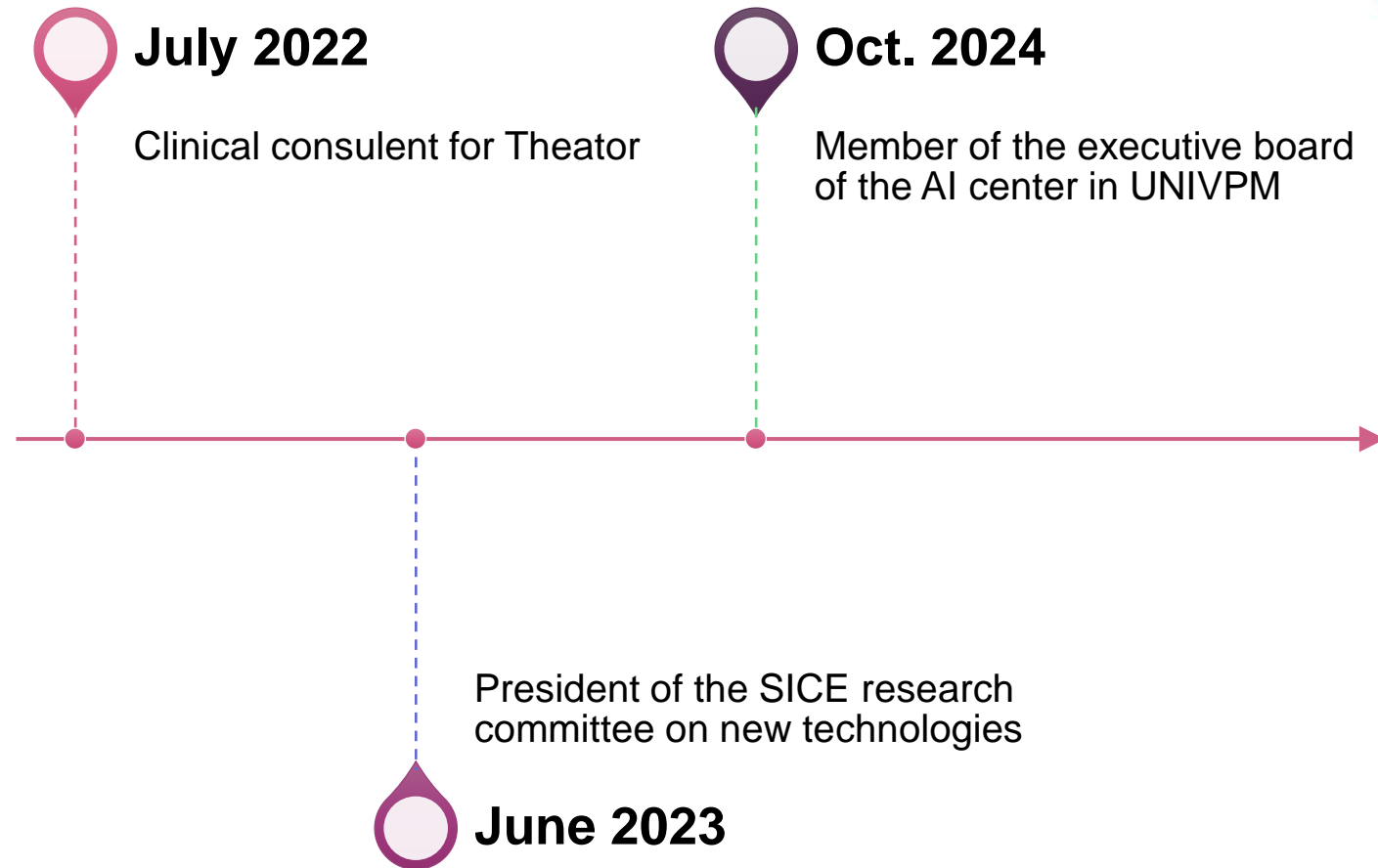
- **Current Team and Expertise**:

Monica Ortenzi (lead in surgical oncology and predictive model development)

Partners in machine learning, clinical data analysis, and healthcare ICT.

- **Seeking Expertise in**:

Medical device integration

data interoperability

health ICT to scale the model for clinical applications

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Supporting documents

CHART Collaborative. Protocol for the development of the Chatbot Assessment Reporting Tool (CHART) for clinical advice. BMJ Open. 2024 May 21;14(5):e081155. doi: 10.1136/bmjopen-2023-081155. PMID: 38772889; PMCID: PMC11110548.
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https://pubmed.ncbi.nlm.nih.gov/38842169/

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