

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

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

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.



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.



Expertise and resources

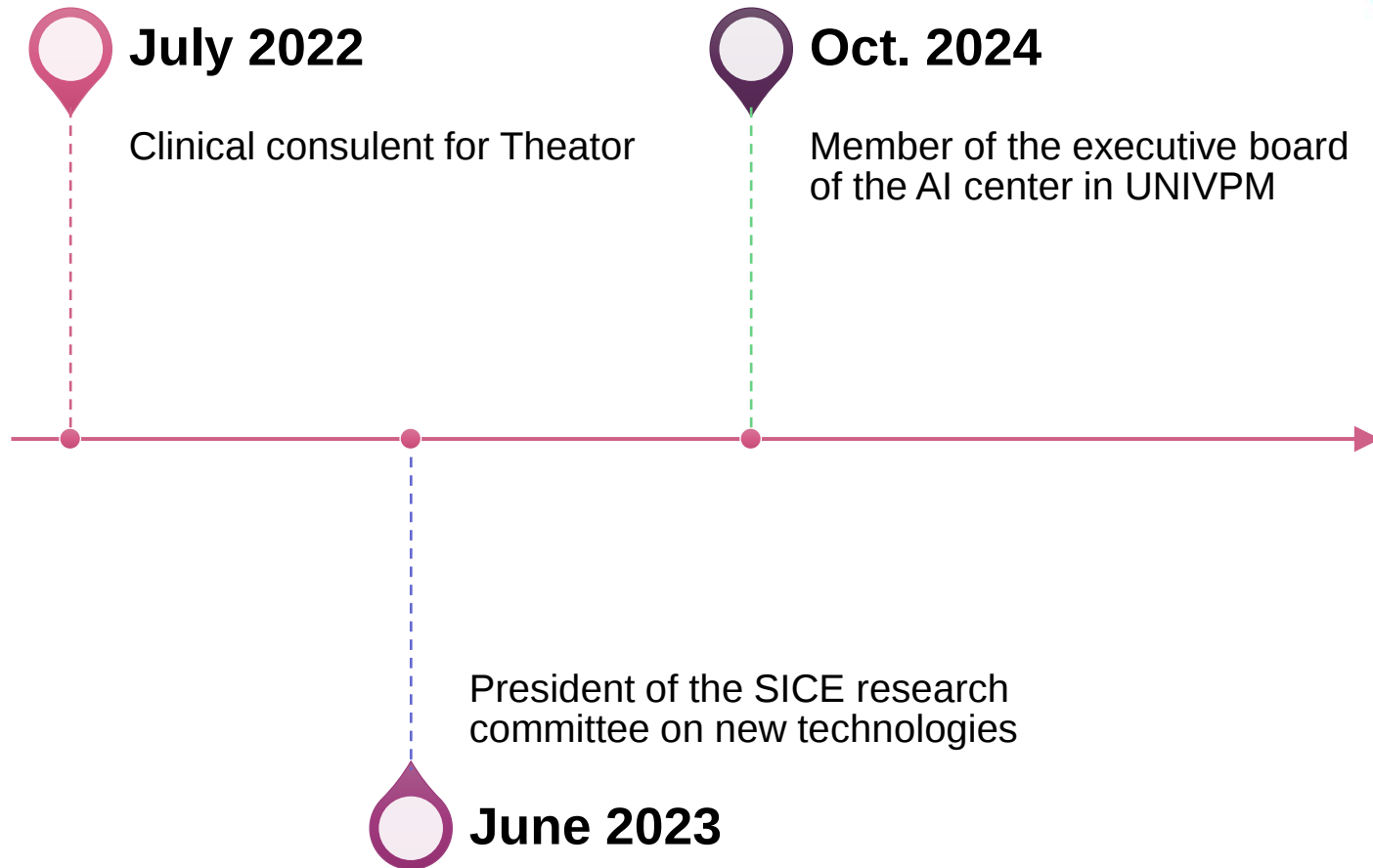
- **Current Team and Expertise:**

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

Additional Information



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.
<https://pubmed.ncbi.nlm.nih.gov/38772889/>

Ortenzi M, Rapoport Ferman J, Antolin A, Bar O, Zohar M, Perry O, Asselmann D, Wolf T. A novel high accuracy model for automatic surgical workflow recognition using artificial intelligence in laparoscopic totally extraperitoneal inguinal hernia repair (TEP). Surg Endosc. 2023 Nov;37(11):8818-8828. doi: 10.1007/s00464-023-10375-5. Epub 2023 Aug 25. PMID: 37626236; PMCID: PMC10615930.
<https://pubmed.ncbi.nlm.nih.gov/37626236/>

Fried GM, Ortenzi M, Dayan D, Nizri E, Mirkin Y, Maril S, Asselmann D, Wolf T. Surgical Intelligence Can Lead to Higher Adoption of Best Practices in Minimally Invasive Surgery. Ann Surg. 2024 Sep 1;280(3):525-534. doi: 10.1097/SLA.0000000000006377. Epub 2024 Jun 6. PMID: 38842169.
<https://pubmed.ncbi.nlm.nih.gov/38842169/>