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A reverse-engineered pitch on "Artificial Intelligence–assisted colonoscopy for colorectal cancer screening: A multicenter randomized controlled trial"

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Abstract
This pitching research letter (PRL) employs a reverse-engineering approach to the two-page pitching research template developed by Faff (2015, 2024) and details a personal reflection on the process. The pitch structure underscores a systematic, concise framework for identifying key components of academic research. It serves as a valuable tool to assist both novice and seasoned researchers in developing their scientific or seminal work.

Keywords: Pitching Research, Reverse Engineering, AI-assisted colonoscopy, Conventional Colonoscopy, Adenoma Detection Rate

JEL codes: O33, I19

1. Introduction

This letter presents an extension of Faff's (2015, 2024) original pitching method, applying it within a "*reverse engineering*" context, whereby salient elements are extracted from existing empirical research paper and structured using the pitch framework. While the template was originally designed to assist PhD students and early career researchers in formulating and communicating new research ideas with

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academic experts, it can be similarly employed to reverse-engineer published studies relevant to a prospective thesis or research interest. This exercise aims to foster the essential academic skills of identifying key information from scholarly sources by critically engaging with the existing literature, which is conducive to a higher-quality research output that is of novelty to the advancement of knowledge within the academic field.

Formulating a meaningful research topic can be challenging, particularly for novice researchers, as it requires a robust understanding of the relevant literature and the ability to identify relevant research gaps. During the early stages of my academic journey, my mentor, a PhD researcher who had significantly benefited from using Faff's (2015, 2024) pitching research framework in his pitch research articles (Yong, 2019; Yong & Chu, 2023), introduced me to this template. This concise and well-structured template served as a valuable tool for understanding and distilling pertinent information from scholarly articles to apply to potential research projects.

Colorectal cancer (CRC) is a pressing global health concern, being the third most prevalent cancer globally and the second leading cause of mortality due to cancer worldwide (WHO, 2023; Yong *et al.,* 2024b). Although colonoscopy has been widely utilized for CRC diagnosis, increasing concerns are raised regarding the high miss rate of adenomas, which are precancerous lesions (Xu *et al.,* 2023). Adenoma detection rate (ADR), referring to the proportion of screening colonoscopies wherein a minimum of one adenoma is identified, has become a crucial quality indicator for predicting the risk of post-colonoscopy CRC (Wang *et al.,* 2020). As a result, significant efforts have been made to develop strategies aimed at improving ADR during colonoscopy.

An approach that has recently garnered substantial clinical interest is the integration of artificial intelligence (AI) within colonoscopy. Existing research suggests that AI-assisted colonoscopy has been positively associated with a higher ADR, by minimizing human errors via deep learning and convolutional neural network (Xu *et al.,* 2023). While AI has been increasingly recognized as a crucial advancement, its adaptation into routine clinical practice remains under evaluation (Yong *et al.,* 2024a). Thus, it would be worthwhile examining its role in enhancing patient outcomes via CRC screening and detection.

A recent and relevant empirical study selected to be reverse engineered is by Xu *et al*. (2023), published in the Journal of *Clinical Gastroenterology and Hepatology*. The article compares the efficacy of AI-assisted colonoscopy to conventional colonoscopy regarding its improvement in ADR, in an asymptomatic population eligible for CRC screening, accounting for variability in experience levels among endoscopists.

The letter is organized as follows: Section 2 elucidates the reverse-engineering process. Section 3 describes a personal reflection regarding the experience and knowledge gained from implementing the pitching framework, while Section 4 concludes.

2. The reverse-engineering process

In accordance with the initial pitching framework, the reverse-engineering template in Table 1 is constituted of eleven elements that expand on the individual components of the study, albeit with **Item K: Other Considerations** being replaced by **Three Key Findings** from the paper. Despite the various subcategories being intentionally structured in a sequential manner to clarify the logical progression and interrelation of the pitch elements, it is important to recognize that the pitching process itself often involves a non-linear, iterative endeavor.

The first item is the **Working Title.** It directly references the title of the chosen article, highlighting either the reverse-engineered or pitch process: "A reverse-engineered pitch on 'Artificial Intelligence-Assisted Colonoscopy for Colorectal Cancer Screening: A Multicenter Randomized Controlled Trial'". This working title is concise and effectively encapsulates the purpose of the study, which is to examine the integration of AI within colonoscopy.

The second item is the **Basic Research Question**, deriving from the hypotheses. While some papers explicitly state their research questions, other studies introduce the context, problem and research gap in their introduction or other sections, from which a research question can be framed. The research question for this reverse-engineered process can be deduced from the introduction and background sections.

The third item is the **Key Papers.** The process of identifying key papers is crucial, as they provide context for existing research by outlining prior findings, theoretical viewpoints and methodologies, which can enable researchers to critically assess the novelty, validity and contribution of the study. According to Faff (2015, 2024), key papers should be authored by leading researchers in the field, published in top-tier internationally recognized journals, and be contemporary wherein the reviewed paper should have been published no more than 3 to 5 years prior. For this PRL, one of the key papers is by Luo *et al.* (2021), which was published in the *Journal of Gastrointestinal Surgery.* It explores the potential of AI-assisted colonoscopy in enhancing real-time polyp detection rates in a clinical environment. The second paper was published in the journal *Gut*, by Repici *et al.* (2022); it investigates the possible advantages of real-time deep learning computer-aided detection (CADe) systems on ADR among less experienced endoscopists and compares findings with previous randomized trials involving expert endoscopists. The third research paper was published by Wang *et al.* (2020) in *The Lancet Gastroenterology & Hepatology* journal; it evaluates the efficacy of a CADe system in enhancing colon polyps and adenoma detection while minimizing potential operational biases.

The fourth item is the **Motivation/ Puzzle**, which relates to the background and research gaps that form the purpose of the study. Papers can be motivated by real-world phenomena, unresolved gaps in the literature, or the desire to contribute to the development or refinement of theories and models. This study is motivated by the

prevalence of missed lesions during colonoscopy, which may be attributed to factors including smaller or flatter lesion morphology or diagnostic variability among endoscopists.

The fifth item is the **Idea**, which is the key intellectual drive of the research topic, leading to its core hypotheses to address the gap in existing literature. In qualitative studies, the objectives are typically outlined in the introduction section, whereas in quantitative research, the literature review and methodology sections often present the central hypotheses. This study aims to fill the gap by comparing the efficacy of AI-assisted colonoscopy to conventional colonoscopy on improving ADR in an asymptomatic population, involving endoscopists of varying experience levels.

The sixth item is **Data**, which highlights the appropriate details regarding the data type, sample size and period, data sources, country of origins, and units of analysis. These are often elucidated in the methods section, allowing for evaluation of whether the methods of data collection are scientifically sound and replicable.

The seventh item is **Tools**, which describes the analytical method to obtain the findings. In qualitative studies, a methodological framework involving interviews, open-ended questionnaires and case studies is often used. In quantitative studies, statistical analysis is often employed. With regard to this study, univariate and multivariate regression analyses were utilized to identify predictors of adenoma detection for the conventional and AI-assisted colonoscopy groups. SPSS software was subsequently used to conduct statistical analysis.

The eighth item is **What's New**, outlining the novelty of the paper. This can be the idea of the study, or its contributions to the tools, data and existing research design. As suggested by Faff (2015), the conceptual overlap can be represented using a Mickey Mouse Venn Diagram, wherein the novelty lies at the intersection of three distinct areas of research focus (Figure 1).

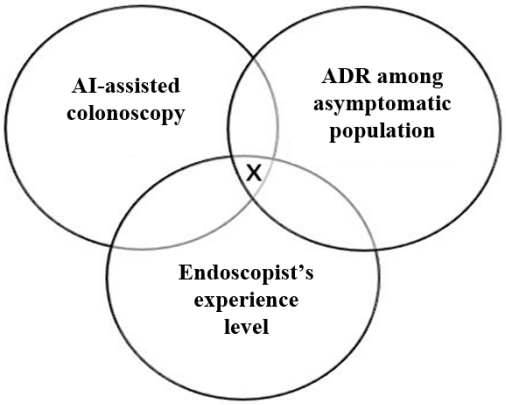

Figure 1. Mickey Mouse Diagram depicting the novelty of Xu *et al.* (2023) paper

The ninth item is **So What?** This component relates to the significance and implications of the research outcomes to stakeholders, regarding the extent to which it influences major decisions, behavior, activity or relevant phenomenon. This study has notable implications in the healthcare and public health sectors. The positive outcomes demonstrating improvement in ADR with AI-assisted colonoscopy may encourage a collaboration between AI researchers, policymakers and healthcare professionals to explore and expand the possibility of routine AI implementation in healthcare.

The tenth item is **Contribution**. This underscores the academic contribution of the research project. It is closely associated with the "What's New?" and "So What?" sections, focusing on the research implications of the study and reflecting on how it may inform future research inquiries and trajectories within the relevant field of enquiry. The study by Xu *et al.* (2023) provides a foundation for evaluating the replicability of similar outcomes in alternative AI models, and for assessing the cost-effectiveness of implementing AI-assisted colonoscopy in clinical and routine practice.

The eleventh item is **Three Key Findings**, summarizing the results that support or refute existing theories or empirical results, or offering new insights into the relevant phenomenon being explored.

3. Personal reflection

Applying the reverse-engineering process to an academic paper has developed my confidence in applying the foundational academic skills in future research projects. Prior to understanding the pitch template, my approach for sourcing and analyzing the relevant literature followed the "old-school method" of having printed articles, highlighting and annotating, which often led to an overwhelming volume of notes. While this practice may appear straightforward initially, when it comes time to draft the papers, a considerable amount of time will have been wasted in re-reading and re-attempting to discern the connections between the various annotated points across multiple papers. This process proved to be both time-consuming and inefficient, as I frequently struggled to recall the reasoning behind why certain sections had been highlighted or considered important in the first reading.

Synthesizing the chosen research work using a reverse-engineered pitch was initially challenging, particularly in distinguishing between items that may have overlapping ideas, notably the "So what?" and "Contribution" sections, which are often not explicitly mentioned in the study itself. However, with the guidance of my mentor and following an iterative, non-linear approach to completing the template, I began to develop effective strategies for extracting key information and conceptualizing research gaps in relation to the existing literature. As a result, the pitch template has

helped streamline my research process and significantly enhanced my research productivity.

The primary benefit from engaging with this learning tool is an improvement in identifying key elements of a research paper and organizing my thought process systematically. This will facilitate efficient delivery of information with colleagues and mentors, enabling valuable feedback to be received. The pitch template is an invaluable and versatile literacy tool for communicating the main ideas of a research project. It is highly recommended for early-career researchers seeking structured support in developing novel research ideas, as well as for seasoned researchers, irrespective of their current research status.

4. Conclusion

This pitch research letter demonstrates the application of the pitching framework outlined by Faff (2015, 2024) in a reverse-engineering exercise on a scholarly article focused on the effectiveness of AI-assisted colonoscopy in improving ADR. In addition to the systematic approach of implementing the template, a personal reflection regarding the newfound insights gained is also included. This exercise serves as a vital foundation for developing an original pitch and research proposal, whereby having an effective grasp of academic literacy skills will contribute to a high-quality, effective research output. Faff's (2015, 2024) structured planning tool is invaluable beyond just novice researchers and PhD students; it provides an excellent platform for refining conceptual and analytical skills, aiding in efficient communication between supervisors, colleagues and mentors.

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Table 1. Completed reverse engineered pitch template for "Artificial Intelligence–Assisted Colonoscopy for Colorectal Cancer Screening: A Multicenter Randomized Controlled Trial"

Pitcher's Name	Elizabeth Yong	FoR category	Clinical Medicine	Date Completed	21 July 2025
(A) Working Title	A reverse-engineered pitch on "Artificial Intelligence–Assisted Colonoscopy for Colorectal Cancer Screening: A Multicenter Randomized Controlled Trial"				
(B) Basic Research Question	To what extent does AI-assisted colonoscopy improve overall adenoma detection rate (ADR), mean number of adenomas per colonoscopy, ADR by non-expert and expert endoscopists, and colonoscopy withdrawal time, in an asymptomatic population, when compared to conventional colonoscopy?				
(C) Key paper(s)	Luo, Y., Zhang, Y., Liu, M., Lai, Y., Liu, P., Wang, Z., Xing, T., Huang, Y., Li, Y., Li, A., Wang, Y., Luo, X., Liu, S. and Han, Z. (2021) 'Artificial Intelligence-Assisted Colonoscopy for Detection of Colon Polyps: a Prospective, Randomized Cohort Study', *Journal of Gastrointestinal Surgery*, 25(8), 2011–2018. Repici, A., Spadaccini, M., Antonelli, G., Correale, L., Maselli, R., Galtieri, P.A., Pellegatta, G., Capogreco, A., Milluzzo, S.M., Lollo, G., Di Paolo, D., Badalamenti, M., Ferrara, E., Fugazza, A., Carrara, S., Anderloni, A., Rondonotti, E., Amato, A., De Gottardi, A., Spada, C., Radaelli, F., Savevski, V., Wallace, M.B., Sharma, P., Rösch, T. and Hassan, C. (2022) 'Artificial intelligence and colonoscopy experience: lessons from two randomised trials', *Gut*, 71(4), 757. Wang, P., Liu, X., Berzin, T.M., Glissen Brown, J.R., Liu, P., Zhou, C., Lei, L., Li, L., Guo, Z., Lei, S., Xiong, F., Wang, H., Song, Y., Pan, Y. and Zhou, G. (2020) 'Effect of a deep-learning computer-aided detection system on adenoma detection during colonoscopy (CADe-DB trial): a double-blind randomised study', *The Lancet Gastroenterology & Hepatology*, 5(4), 343–351.				
(D) Motivation/Puzzle	Colonoscopy with polypectomy has been widely utilized for colorectal cancer (CRC) screening, diagnosis, and polyp detection. While studies have indicated it reduces risks of post-colonoscopy CRC and mortality, missed colorectal neoplasia rates remain prevalent, contributed by factors including polyp size and shape, inadequate bowel preparation and varying diagnosis by endoscopists. Recent technological advancements, integrating AI into colonoscopy, have been evaluated and reported to enhance ADR compared to conventional methods; thus, minimizing risks of post-colonoscopy development by reducing limitations due to human error. However, the findings are primarily based upon mixed populations of both symptomatic and asymptomatic individuals. Given that symptomatic patients are likely to have more advanced polyps or existing cancer, whereby accurate diagnosis and treatment are more pertinent, the added benefit of AI in detecting early-stage lesions may be less significant compared to screening asymptomatic patients. Furthermore, it is unclear whether AI-assisted colonoscopy provides uniform benefits to endoscopists of varying experience levels.				
THREE	**Three** core aspects of any empirical research project i.e. the "**ID**io**T**s" guide				
(E) Idea?	The primary idea is to compare the efficiency of AI-assisted colonoscopy in improving ADR to conventional colonoscopy, in an asymptomatic population eligible for CRC screening, involving non-expert and expert endoscopists. Due to the lower prevalence of advanced lesions in asymptomatic individuals compared to symptomatic populations, a small polyp may be considered a high-risk lesion. Thus, improvements in ADR are likely to be more clinically meaningful, with high ADR translating to a greater reduction in CRC incidence and mortality, as these lesions are potential precursors to cancer.				
(F) Data?	Data sources: From 6 referral centers in Hong Kong, Jilin, Inner Mongolia, Xiamen, and Beijing (2 centers) Study Type: Large scale multicenter randomized controlled trials (RCT); Longitudinal study Sample Period: November 2019 to August 2021 Sample Size: 3059 patients of an asymptomatic population aged between 45 and 75 years, were included in the intention-to-treat (ITT) analysis. Accounting for exclusions due to incomplete colonoscopy and inadequate bowel preparation, 2527 patients remained in the AI-assisted colonoscopy (n=1238) and conventional colonoscopy (n=1289) groups in the per protocol (PP) analysis, and 24 endoscopists.				

Pitcher's Name	Elizabeth Yong	FoR category	Clinical Medicine	Date Completed	21 July 2025
(G) Tools?	1) The AI polyp detection system employed was the Eagle Eye [version 5.1] using YOLOv3 deep convolution neural network trained with 112,199 still colonoscopy images from Zhongshan Hospital affiliated with Xiamen University and fine-tuned by a separate dataset of 21 colonoscopy videos. The AI model had undergone further validation using an independent dataset. 2) Statistical analyses were conducted using SPSS software. 3) Univariate and multivariate regression analyses were employed to identify predictors of adenoma detection for the conventional and AI-assisted colonoscopy groups. Independent variables included AI assistance, gender and age of patients, lifestyle factors (smoking status, alcohol usage, body mass index), comorbidities (aspirin usage, diabetes, ischemic heart diseases, fatty liver), experience of endoscopists (expert, non-expert), withdrawal time and colonoscopy indication.				
TWO	**Two key questions**				
(H) What's New?	The study represents the first large-scale multicenter randomized controlled trial to examine the benefits of AI-assisted colonoscopy on ADR, in an asymptomatic population across 6 university-affiliated endoscopy centers. Additionally, it carefully evaluates whether AI enhances polyp detection in real-time across endoscopists of varying experience levels, including among expert endoscopists.				
(I) So What?	The findings, which demonstrate that AI-assisted colonoscopy increases ADR for both advanced and non-advanced adenoma, independent of endoscopists' expertise and location of lesion in either the proximal or distal colon, can have significant implications in clinical practice and public health sectors. Evidence of AI enhancing ADR uniformly suggests its potential to improve patient outcomes through reducing interval CRC and improving screening quality at scale. This may encourage collaboration among AI researchers, policymakers and healthcare professionals to explore the integration of real-time AI assistance into routine colonoscopy for adenoma detection.				
ONE	**One bottom line**				
(J) Contribution?	The study provides a foundation for future research to evaluate whether the observed benefits of AI-assisted colonoscopy generalize to other AI models, including those using different algorithms, trained on larger and more diverse datasets, or deployed in varied clinical settings. The findings may support the development of clinical guidelines and routine adoption of AI-assisted colonoscopy, while enabling further investigations into its cost-effectiveness across healthcare systems with varying resources and endoscopist experience.				
(K) Three Key Findings	1) In the ITT analysis, with similar baseline characteristics and bowel preparation quality, overall ADR was higher for AI-assisted colonoscopy (39.9%) compared to conventional colonoscopy (32.4%; $P<0.001$); similarly, the PP analysis shows 39.7% improvement to 33.5% ($P=0.001$), respectively. 2) In the ITT analysis, both expert (42.3% vs 32.8%; $P<0.001$) and non-expert (37.5% vs 32.1%; $P=0.023$) endoscopists demonstrated a statistically significant increase in ADR. In the PP analysis, the improved ADR was not statistically significant for non-expert endoscopists (39.9% vs 36.5%; $P=0.201$). 3) ADR of advanced and nonadvanced adenomas were significantly enhanced by AI-assisted colonoscopy, regardless of lesion location in the proximal or distal colon. While associated with a slight increase in intubation (~0.3 minutes) and withdrawal (~0.5 minutes) times, this drawback is argued to be clinically acceptable given the greater adenoma resections which could allow for long-term cancer prevention.				