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AI Diagnostic Technologies and the Gap in Colorectal Cancer Screening Participation

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Abstract. AI augmented clinical diagnostic tools are the latest research focus in colorectal cancer (CRC) detection. While the opportunity presented by AI-enhanced CRC diagnosis is sound, this paper highlights how its effectiveness with respect to reducing CRC-related mortality and enhancing patient outcomes may be limited by the fact that patient participation remains extremely low globally. This paper builds a foundation to consider how human factors tend to contribute to low participation rates and suggests that a more nuanced socio-technical approach to the development, implementation and evaluation of AI systems that is sensitive to the psycho-social and cultural dimension of CRC may lead to tools that increase screening uptake.

Keywords. colorectal cancer screening, socio-technical design, patient outcomes

1. Introduction

Colorectal cancer (CRC) is the second leading cause of cancer related death in the world [1]. To reduce CRC-related mortality, high-risk citizens are invited to undertake a tiered two-stage screening process of (1) Immunochemical Faecal Occult Blood Test (FOBT) screening with (2) follow-up colonoscopy, that aims to detect early traces of the disease. While this Gold Standard approach has been shown to reduce CRC-related mortality, its effectiveness is dependent on reaching a screening coverage greater than 65-80%, and several high-income nations have failed to reach these targets [2]. For example, in Australia, participation rates have plateaued at ~40% over the last 5 years, and participation in follow-up colonoscopy by positive FOBT patients is also low (50 – 70%) [3]. Concerningly, marginalised groups at highest risk of CRC participate the least in screening. This is despite efforts to raise awareness through (a) mass media public health campaigns, (b) targeted support programs, and (c) primary care engagement and health systems improvement [4]. Several qualitative studies have suggested that CRC screening adoption and adherence is more often driven by complex psycho-social and cultural interactions. Most significantly, fear, anxiety, stigma, shame, or uneasiness associated with a positive cancer diagnosis, or the invasiveness of a colonoscopy, are reported as major barriers preventing screening participation [4,5]. When multi-factorial barriers present, such as time scarcity or inaccessibility to healthcare centres, the participation problem is exacerbated.

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2. AI and the Need for a Socio-Technical Approach in the Design of New Tools

There has been considerable research on AI systems in the screening and diagnosis of CRC [6]. AI polyp detection systems have emerged, for instance, to respond to the fact that 25% of polyps are missed during routine colonoscopies, which increases the risk of interval cancer and can negate the benefits of screening [7]. However, for such systems to be advantageous, patients must participate in screening. There is a gap in existing knowledge on how AI tools can be developed in ways that are sensitive to the psycho-social and cultural dimensions that prevent uptake in existing screening programmes to begin with. Utilising a socio-technical approach to the development of future AI technologies may lead to a more significant impact on patient outcomes. For example, a socio-technical approach would identify that patient motivations for non-participation perpetuate around themes of cancer anxiety, colonoscopy invasiveness, and accessibility of healthcare interventions. These issues could be mitigated with the right technology, such as utilising AI-augmented capsule endoscopy devices to target the detection of *precancerous* lesions through an at-home consumer-based health delivery model. Notably, there are many candidates for an intervention (blood, urine, stools, mobile images, smart toilets, ubiquitous health data, among others) and identifying the interventional context for AI development that maximises participation is important.

However, AI model efficacy is sensitive to the type of data used and there is an inevitable interplay between user interaction and data. A model that is accurate, but that requires data the average citizen cannot or is unwilling to provide, may lack utility. Furthermore, implicit contextual, cultural, and temporal biases permeate most ML data distributions [8]. Evaluation methodologies that ensure representation of marginalised patients that are most at risk of CRC, are lacking. Our research aims to develop a robust and nuanced socio-technical framework to the design, development, implementation, and evaluation of AI systems in clinical practice.

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