Comparative Case Study on Implementing Generative AI in Medical Practices to Ease Documentative Overburden: A Sociotechnical Systems Perspective

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***Abstract*—This paper presents a comparative case study of a live implementation of a Generative AI solution in 5 medical practices. Our findings shed new light on the impact of Generative AI on various aspects, such as social structures, roles, organizational processes, and technical systems of medical practices. It is well known now that the increasing documentation burden on physicians has led to medical errors, patient safety concerns, and physician burnout. This study investigates the adoption and implementation of a Generative AI-based clinical documentation technology in medical practices over 5 months. Our data included interviews, participant observations, process documentation and mapping, tracking social interactions, and analyzing textual user feedback data. The results enabled us to develop an implementation process framework that can be generalized across medical practices, categorizing changes into social, technical, organizational, and goals & outcomes. The implementation of Generative AI has led to both tangible and intangible benefits, including the creation of a new role of Scribe to provide human oversight of AI-generated clinical documentation. Resistance and apprehensions from practice staff have impacted implementation speed and decision-making. The study emphasizes the importance of considering social and organizational process changes in adopting new technologies and identifies role re-reforming and triadic co-creation as key concepts. Our process framework also includes an entrepreneur's and emerging technology product implementation team's co-creation experiences with the medical practices. Overall, this research provides a processual framework to capture the nuances of adopting and co-evolving an emergent and uncertain technology.**

Keywords-Physician Burnout; Documentation Overburden; Generative AI; Medical Practices; Clinical Documentation.

I. INTRODUCTION

Physicians are a crucial part of the healthcare delivery system, and their primary responsibility is to provide clinical treatment, medical advice, clinical documentation, and the best possible care to the patients. Although a physician's role can vary based on the peculiarities of the healthcare setting, in general, physicians provide services including preventive care measures, diagnosis of the ailment, referring other specialists, ordering medical tests, reviewing results, defining care plans, and explaining to the patients. There is an increased interest in making patients part of the decision-making process in a clinical setting, which is Shared Decision Making (SDM). SDM is a process where healthcare professionals and patients collaboratively make decisions based on reliable information, available options, and personal circumstances [3]. SDM requires physicians to spend very focused quality time assessing and discussing the clinical options and care plans. Physicians must also extensively document the clinical encounter details and the agreed-upon care plan with the patient.

Physicians are to document the patient encounter with detailed notes for dual purposes, record keeping of patient clinical notes, and for billing/insurance claim processing perspective. Clinical notes are crucial for government-regulated insurance plans such as Medicare and Medicaid. They can be audited by government agencies at any time, up to 7 years from the service date. For private commercial insurance plans, the payer can ask for detailed patient chart notes either as part of the claim adjudication process or to conduct periodic audits. Therefore, clinical documentation must be maintained in a timely and robust manner by the physicians to ensure effective delivery of patient care by other physicians coordinating the care and to avoid any auditing failures and regulatory penalties. The burden of clinical documentation responsibilities, however, limits the physicians' time to spend with the patients and provide high-quality clinical care. According to a survey conducted by Christino et al. [2] - A Nationwide Survey of Residents' Perceptions of Clinical Documentation Requirements and Patient Care, most physicians (92%) feel the documentation and regulatory obligations are excessive with 40% of the time for the documentation, and 12% with the patient at the bed side for clinical care.

The demand for extensive clinical documentation is increasing as regulations and insurance companies put a greater onus on physicians to document all aspects of patient care, treatment plans, procedural justifications, and any potential risks for clinical outcomes. The continual shift from clinical service and administrative tasks, such as clinical documentation, adds pressure to the physicians and contributes to their burnout. Extended office hours, continuous medical appointments, clinical tasks, administrative tasks, coordination between staff members, patient encounters, and other tasks lead to growing discontentment and dissatisfaction with current clinical

documentation methods. This documentation overburden has contributed to medical errors, patient safety threats, lower quality of documentation and learning, and, ultimately, physician burnout [5]. Generative AI-based clinical documentation solutions can aid in ameliorating the current situation, thereby improving the productivity and performance of medical practices. That said, Generative-AI-based clinical documentation is still incipient, thereby requiring a deeper exploration of factors that impact the implementation of a novel yet proven technology.

The remainder of the paper is organized as follows: Section II provides the research methods we have used for this research study of cross-site comparison of medical practices adopting the emerging technology – Generative AI technology. In Section III, we explain the research study's results and describe the output from our analysis of the data we collected. Section IV further discusses the findings and the overarching process model we built and compares the change dimensions across the sites. In Section V, we provide the conclusion and opportunities for future research.

II. METHODS

Our study utilizes a qualitative research design with a hybrid approach that combines a sociotechnical systems approach with a comparative case study across five medical practices. We investigated the adoption and implementation of a Generative AI-based clinical documentation technology solution in 5 medical practices. We gained insights into how these practices differ when adopting uncertain and emergent technology. We used the cross-case comparative analysis method, first developed by Miles & Huberman [4]. It provides a structured approach to trace implementation processes within one practice site and then compare it with other sites (See Table 1). By employing this approach, we were able to develop a comprehensive understanding of the implementation processes, considering both the specific contextual realities of medical practices and the broader sociotechnical aspects at play.

A healthcare technology startup, Orci Care Inc., has been implementing its AI-based clinical documentation solution, built on Open AI's GPT 4.0 Large Language Model (LLM) version 2024-05-13 with human oversight service, at five medical practice sites. Four of the five medical practices are in upstate New York, and the fifth medical practice is in Atlanta, GA. These medical practices are physician-owned private practices, including Primary Care and Pediatrician specialties. We conducted 30 interviews with physicians, staff members, and members of the implementation teams from Orci Care Inc. across five medical practices where the product teams implemented the Generative AI technology solution. Through the implementation, we have collected the data over 5 months. In addition to the interviews, we also analyzed the data collected from field observations, pre-and post-implementation process documentation, and textual data collected through a product feedback form that the physicians in the medical practices filled out to track their views on using the Generative AI solution.

Implementing emerging technology such as Generative AI involves many unknown factors that might directly or indirectly influence the outcome of the implementation. Examples include whether to continue using the technology once the practice has made a commitment to it or when and how to decide that it is having an unfavorable impact on the practice and terminating its use. We explored various factors in adopting emerging technology in various medical practices to compare multiple dimensions. We also investigated the changes that occur during and post-implementation from the perspectives of the technology itself, the process of introducing it, social factors, the goals of the practice and the outcomes of the technology's use.

In addition to the interviews, we also analyzed the data collected from the notes on the field study, documentation about the pre-and post-implementation process, social interactions, and responses to a feedback survey. The diverse data sources will make the qualitative analysis more solid and incorporate various viewpoints. Grounded theory methods provide guidelines for collecting and analyzing the data systematically and making sense of the data while building the

TABLE I. DIMENSIONS OF CHANGE WITH GENERATIVE AI ADOPTION

	Site-1	Site-2	Site-3	Site-4	Site-5
Social Change					
Substitutive Apprehending	Low	Low	X	High	Med
Adoption Priming	++	+	N/A	(-)	++
Pre-AI Interactional Dissonance	Med	Low	Low	Low	Med
Post-AI Interactional Enrichment	++	+	++	X	+
Competence Scaffolding	Med	Med	Low	High	Med
Technical Change					
Technology Deficiency	Med	High	Low	Low	Med
Implementative Co-maturing	High	Med	Med	High	High
Continual Technology Tinkering	Med	Med	Low	High	Med
Triadic Co-creating	High	Med	Low	High	Med
Oversight Enforcing	High	Med	Low	High	High
Organizational Change					
Administrative Burdening	High	Low	Med	Med	High
Solution Exploring	High	Low	Med	High	High
Role Reforming	2	1	2	1	2
Perceived Change Load	Low	High	Low	Med	Med
Process Simplifying	++	+	++	+	++
Calibrated Onboarding	High	Med	Low	Med	High
Goals & Outcome					
Prospecting Trailblazers	High	Low	Med	Med	High
Affirmative Verifying	High	Low	High	Med	High
Comparative Verifying	Low	Low	Med	High	Low
Performative Verifying	High	Low	Med	Med	High
Realized Beneficence	++	+	++	X	++
Potential Beneficence	+	+	X	X	+
User Trust Accreting	++	+	++	+	++
Ultimate Outcome					
Continued AI Use	Positive	Negative	Positive	**Neutral**	Positive

Numbers (0 – 2) = Number of new job roles
++ = Significant positive change
+ = Noticeable positive change
N/A = Not Applicable/Available
(-) = Noticeable negative change
X = No noticeable change
Low = Low change/level
Med = Medium change/level
High = High change/level

theoretical frameworks [1]. Grounded theory allows the researcher to identify the patterns in the data and build the theoretical concepts from the data rather than beginning with a set of hypotheses to prove [1]. While my research is not entirely based on grounded theory, we leveraged the concepts of data collection and the grouping of the data to construct my framework.

III. RESULTS

The analysis of data collected over 5 months on Generative AI implementation across five medical practices led to the discernment of a process framework (see Figure 1). The goal was to conceptualize the findings across a broader range of Generative AI-based technologies for adoption in medical practices. We created initial codes of the information from the 30 interviews using the online program Delve. Next, following the grounded theory, we created focused codes that identified the overarching concepts from the initial codes and first-order categories. The focused codes represent the generic concepts that can be applied beyond the specific scope of this study to the adoption of any emerging technology in medical practices. We used the techniques of Miles and Huberman [4] to visualize various process elements and concepts and document the resulting displays. These visuals helped develop a processual map of implementing the emerging technology. It should be useful for further research and helpful for those seeking to introduce future emerging technology into medical practices. We have developed the overarching process model for Site-1 and enhanced it to incorporate the process model from the other four sites, resulting in a generalized process model that cuts across all five medical practice sites. Our analysis revealed that implementing the Generative AI technology created different adoption experiences across the practices. The changes observed across the sites are categorized as social changes, technical changes, organizational changes, and goals & outcomes. This approach is apt and suitable for this research study as the emerging technology adoption across multiple sites.

The comparative case study across the five medical practice sites provided insights into the adoption experiences of the physicians and the elements of their ability to adopt the change, co-creative savviness, and patience levels to sustain initial disruptions. Adoption priming is preparing and supporting the end users through the initial adoption stages, sustaining the disruption with minimal impact, and assisting in achieving long-term benefits of the emerging technology implementation. The sites have experienced different levels of adoption priming based on physicians' technical savviness, staff reluctance levels to support the change, and job security concerns. Etc.

In a typical matured and stable technology implementation and adoption process, the main factors of the adoption include the technical systems, implementation complexity, and end-user readiness. However, in emerging technology implementations, additional consideration is given to the ambiguity of the end user in trusting the technology and acceptance levels of the disruptions during the implementation and stabilization phases. As Generative AI technology can potentially challenge and substitute traditional human roles in creating such content, the technology is inciting job security fears. We found that job security concerns with the emerging technology were present in some sites significantly more than the others. We also found that some practices created a new job role for Scribe as a human oversight of the AI-based emerging technology.

The overarching process model, as shown in Figure 1, describes the end-to-end view of emerging technology adoption at medical practices from a sociotechnical systems perspective. The horizontal view shows the progression of emerging technology adoption phases. The pre-AI phase describes process elements experienced at the sites before the AI adoption. It shows the existence of interactional dissonance between physicians and patients as physicians experience administrative overburden and are distracted from taking notes while treating the patients. The pre-AI Product Discovery Phase includes the processual elements of exploring and evaluating solution options by the medical practices to solve the administrative burden, engaging the Generative AI-based product team, and learning more about the product. In this phase, it is observed in a few sites that substitutive apprehensions from the practice staff with the fear of job security exist. The AI Implementation phase includes the process elements involving how the product team and medical practice collaborate with the technology implementation and initial adoption disruptions. The collaboration between the product team, the physician, and the medical practice staff generates co-creation, adoption priming, competence scaffolding, and continual technology tinkering. The product team continues to enhance the product with the physician and medical practice staff's feedback, calibrating the onboarding process and co-maturing the product implementation. Physicians enforcing the human oversight of the AI output for clinical documentation resulted in role re-forming and generating new roles at the medical practice as "Scribe". Oversight enforcement and process simplification with the technology adoption promoted user trust accretion on the product & the emerging technology as physicians continue to verify the technology and realize the tangible and intangible benefits of the AI technology and the adoption outcome of the perpetuating AI use. It is observed across the sites that adopting AI technology for clinical documentation resulted in patient interactional enrichment.

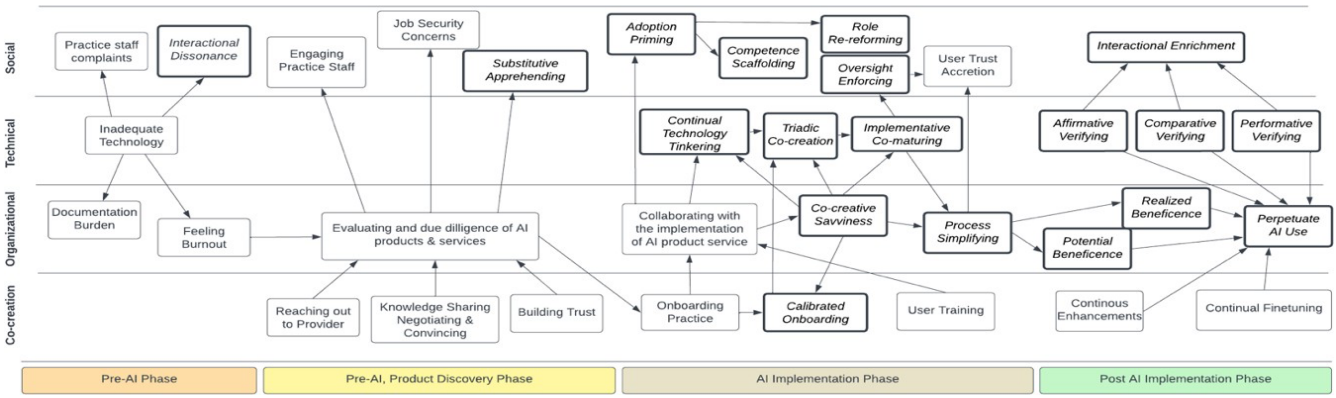

Figure 1. Overarching Process Model (Across All Sites)

IV. Discussion

Our study finds that implementing a Generative-AI-based technological solution for clinical documentation has led to several potential intangible and tangible benefits for physicians and medical practices. For instance, the implementation has seen the emergence of a new role in medical practices, that of a *Scribe* as human oversight. The scribe's role is to maintain critical oversight and conduct careful quality control of the clinical documentation generated by AI by verifying and curating it for the physician's consumption. We also find evidence of role-reforming in the medical practice in coordinating the clinical documentation activities between physicians, scribes, clinicians, and other practice staff. Some sites encountered varying levels of resistance from the practice staff with substitutive threats and apprehensions that significantly impacted implementation speed and subsequent AI use decisions. Furthermore, we found that professionals in charge of implementing emerging technologies need to consider the physicians' adoption ambivalence and substitutive apprehensions of the practice staff and can handle it effectively through implementative co-maturing.

Technology startup teams of emerging technology such as Generative AI have a very tricky situation to handle, as the product team needs to continue to monitor and adopt the underlying unmatured technology such as Artificial Intelligence (AI) while evolving the product and services to implement and provide tangible benefits to the customers. Notably, our study shows the critical importance of triadic co-creation as an element of the implementation process. This research is significantly different from the implementation of traditional technologies in the sense that in the context of Generative-AI, the co-creation process involves mutual adaptation between the technology implementation team, the user (personnel in the medical practices), and the AI-based technology that can autonomously learn and modify itself. We found that triadic co-creation occurs when product teams work closely with early customers who are equally motivated to achieve tangible and intangible benefits with the emerging technology.

V. Conclusion and Future Work

This research offers a novel multi-dimensional perspective on adopting Generative AI in medical practices, focusing on a sociotechnical system approach. The research included the comparative qualitative study of Generative AI adoption at 5 medical practices. It emphasizes the role and the importance of considering social, organizational process changes, and technical systems when adopting new technologies. The study provided an implementation process of emerging technical adoption at medical practices from the perspectives of social, organizational, and technical, and goals & outcomes categories. The research found that Generative AI adoption at medical practices resulted in tangible and intangible benefits to the practice and in most of the cases a new role of Scribe has evolved. It also found that resistance and apprehensions from the practice staff has resulted in adoption speed and the overall outcome. The study identifies role re-reforming and triadic co-creation as the key elements in implementing an emerging technology at medical practices.

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