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Research Article

AI in Health Communication

Prof. Dr. Fenella Chadwick*

Harvard University, Department of Public Health, Massachusetts Hall, Cambridge, United States.

ABSTRACT

The rapid integration of Generative Artificial Intelligence (GenAI), such as Large Language Models (LLMs), into health communication presents an urgent need for an adaptable and robust governance framework. GenAI offers unprecedented potential for personalized health information, content generation, and patient engagement, but it simultaneously introduces significant risks, including the proliferation of misinformation, the loss of trust, and ethical challenges related to bias, privacy, and accountability. This paper proposes a model for Adaptive Governance designed to continuously evolve in response to the pace and unpredictable nature of GenAI development and deployment in the healthcare sector. This model shifts from rigid, static regulations to a dynamic, multi-stakeholder system that incorporates iterative policy adjustments, regulatory sandboxes, continuous auditing, and technology-agnostic ethical principles. Key components of this approach include establishing real-time monitoring mechanisms for content accuracy and bias, defining clear liability and accountability across the health communication value chain (from model developers to health providers), and prioritizing human oversight and mandatory disclosure of AI-generated content. Ultimately, developing adaptive governance is essential to harness GenAI's communicative power while safeguarding public health, patient autonomy, and the integrity of medical information.

Keywords

Generative AI (GenAI), Adaptive Governance, Health Communication, Misinformation, Accountability, Regulatory Frameworks, Bias, Ethical AI, Large Language Models (LLMs).

Corresponding Author Information

Prof. Dr. Fenella Chadwick
Harvard University, Department of Public Health, Massachusetts Hall, Cambridge, United States.

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Introduction

The emergence of Generative Artificial Intelligence (GenAI), particularly advanced Large Language Models (LLMs), has initiated a profound transformation across nearly every professional sector, and healthcare is no exception. GenAI tools are rapidly being integrated into health communication workflows, moving beyond simple information retrieval to actively creating, synthesizing, and personalizing patient-facing materials, clinical summaries, and educational content [1-28]. This technological leap offers unparalleled opportunities to enhance efficiency, reduce administrative burdens, and improve patient literacy through tailored, accessible information. However, this integration creates a critical and urgent need for new models of governance, as the dynamic nature, inherent opacity, and potential for misuse within GenAI systems clash with the highly regulated, safety-critical environment of medical practice [29-38].

The Promise and Perils of GenAI in Health Communication

GenAI's promise in health communication stems from its capacity to democratize and personalize information. For example, LLMs can instantly translate complex medical jargon into plain language for diverse populations, generate personalized discharge instructions based on a patient's unique health record, and draft public health campaigns tailored to specific demographic segments. This level of customization has the potential to significantly boost health literacy and adherence to treatment plans. Furthermore, by automating the drafting of routine communication (e.g., patient portals, insurance explanations), clinicians can dedicate more time to direct patient care [39-49].

However, the rapid deployment of these tools is simultaneously unleashing profound risks that current regulatory and legal frameworks are ill-equipped to handle. The primary concern is the potential for misinformation and disinformation. GenAI models are known to "hallucinate" generating factually incorrect, yet highly plausible, information. When applied to health advice, a hallucination can have life-threatening consequences. Furthermore, GenAI systems perpetuate and often amplify algorithmic bias encoded in their training data. If a model generates health advice based primarily on data from a specific demographic (e.g., male, high-income, Western), the advice it provides to marginalized or underserved communities may be irrelevant, ineffective, or even harmful, deepening existing health inequities [50-60].

A third major concern involves accountability and liability. In traditional health communication, responsibility for an error falls clearly on the human communicator (the physician, nurse, or medical writer). With GenAI, the line of liability is blurred. Is the error the fault of the model developer for flawed training data, the hospital for inadequate deployment protocols, or the clinician for failing to sufficiently oversee and correct the AI's output? The "black box" nature of proprietary LLMs, which obscures the decision-making process, makes pinpointing the causal link in a legal negligence claim virtually impossible under current medical malpractice law [61-71].

Why Traditional Governance Fails and Adaptive Governance is Needed

Traditional regulatory structures often built around static, pre-market approvals (like those for medical devices) are proving incapable of governing GenAI. These frameworks fail for three main reasons:

1. Speed of Innovation: GenAI models are updated and retrained at a pace that far exceeds the typical multi-year timeline for regulatory review. By the time a rigid regulation is finalized, the technology it seeks to govern may have fundamentally changed or been superseded by a new model.
2. Generality vs. Specificity: LLMs are General-Purpose AI (GPAI), meaning a single model can be applied to thousands of different tasks (clinical decision support, patient communication, research summaries). Regulating the model itself is insufficient and risks stifling innovation; effective governance must focus on the specific application and its context within health communication.
3. Lack of Transparency: Most commercial GenAI models are proprietary. Regulators cannot examine the core algorithm or training data, making traditional compliance audits that rely on full transparency impossible.

To address these shortcomings, a shift toward Adaptive Governance is imperative. Adaptive Governance is a system designed to be iterative, reflexive, and participatory. It recognizes that the rulebook must be constantly edited in response to real-world experience and technological evolution [72-83].

This approach involves moving from rigid rules to flexible mechanisms, including:

- Continuous Monitoring and Auditing: Establishing independent third-party auditors and regulatory bodies with the capacity for continuous, post-deployment monitoring of GenAI outputs specifically for accuracy, bias, and adherence to safety benchmarks in a clinical setting.
- Regulatory Sandboxes and Pilot Programs: Creating controlled environments where new GenAI applications in health communication can be tested under regulatory supervision. This allows for rapid learning and the co-creation of safe practices before widespread deployment, without sacrificing patient safety.
- Mandatory Human Oversight and Disclosure: Establishing clear, non-negotiable legal and ethical requirements for human review of critical GenAI-generated health communications. Crucially, a mandatory disclosure regime must be implemented, ensuring patients are always clearly informed when they are interacting with AI-generated or AI-assisted content.
- Technology-Agnostic Principles: Focusing regulations less on the technology (e.g., LLMs vs. earlier AI) and more on outcomes ensuring the resulting communication is safe, equitable, transparent, and protects patient privacy (e.g., adherence to HIPAA or GDPR).

Future Works

Future work in the governance and regulation of Generative AI (GenAI) in health communication is centered on developing flexible, human-centric frameworks to manage complex risks like algorithmic bias and ensure continuous safety oversight.

Key areas for future work and policy solutions include:

Developing Adaptive Governance Frameworks

Future efforts will focus on creating regulatory models that can adapt quickly to the fast-paced evolution of GenAI, moving beyond rigid, static rules.

- Adaptive International Legal Frameworks: There is a need for scalable, region-specific regulations and a cohesive public international law framework to reconcile ethical principles with technological innovation in public health. This includes addressing shortcomings in existing models, such as the limited enforceability of World Health Organization (WHO) guidelines and the rigidity of data-sharing rules like the GDPR.
- Human-Centric Design and Accountability: Future governance will emphasize ethical accountability, regulatory adaptability, and transparency as core pillars. This involves developing modular regulation and accountability mechanisms that are inclusive and can work across diverse legal, cultural, and health system contexts.
- AI Governance Maturity Models: Healthcare systems require structured, pragmatic frameworks to assess their current AI governance and establish targets for successful adoption. This involves providing guidance on the necessary resources and personnel to effectively implement AI governance recommendations.

Mitigating Algorithmic Bias in Patient Communication

Future work must develop and enforce policies to prevent and correct algorithmic bias in Large Language Models (LLMs) used for patient-facing communication, ensuring equitable health information.

- **Bias Detection and Mitigation Across the AI Lifecycle:** Solutions must be embedded across the entire AI lifecycle, from data collection to deployment. This includes:
  - Conducting **subpopulation analysis** to ensure model performance is consistent across different demographic groups.
  - Implementing **fairness audits** and mandatory record-keeping of AI decisions for regulators.
  - **Monitoring models over time** for bias drift, especially as training data changes or the model learns new patterns.
- **Diverse Data and Inclusive Design:** A critical focus is on ensuring **diverse and representative training data** that includes "small data" (e.g., social determinants of health like access to transportation and community resources), not just large-scale clinical data. Furthermore, design and development teams must be **interdisciplinary and inclusive** to better understand and account for clinical context and potential disparities.
- **Transparency and Explainability:** Policy will push for **greater transparency** and interpretability of LLM outputs, especially in high-stakes healthcare decisions, to help users understand why an AI delivered a particular piece of communication or recommendation.

Implementing Regulatory Sandboxes for Testing

Regulatory sandboxes are a key mechanism for future work, enabling the safe and controlled testing of innovative GenAI applications in healthcare.

- **Controlled Experimentation:** Regulatory sandboxes create a controlled environment where new GenAI products and services can be tested and experimented with under the supervision of regulators for a limited time.
- **Dual Learning Objective:** These sandboxes serve a dual purpose:
  - **Business Learning:** Allowing innovators to develop and test their solutions in a **real-world environment**.
  - **Regulatory Learning:** Allowing regulators to understand the new technology, define a legally compliant product design, and formulate experimental legal regimes.
- **Support and Legal Certainty:** The sandbox mechanism will provide:
  - **Guidance and Support** to identify and mitigate risks, particularly for **Small and Medium-sized Enterprises (SMEs)**.
  - Legal tools like **no-enforcement letters** or limited **derogations/waivers** from specific regulatory provisions to allow for safe innovation, often with intensified supervision and guardrails.
  - The use of documentation from the sandbox to **demonstrate compliance** with future legislation (e.g., the EU AI Act).

Mechanisms for Continuous Post-Market Surveillance

Given the ability of GenAI models to change after deployment ("continuous learning"), future work is vital for establishing robust, continuous post-market surveillance (PMS) mechanisms.

- **Targeted Surveillance and Risk Scoping:** PMS efforts should be concentrated on AI devices where output unpredictability intersects with a significant risk for patient harm (e.g., generating inaccurate or misaligned medical communication).
- **Aggregated Outcome Data Registries:** A key technical solution is the development of **aggregated outcome data registries** shared among health systems. These registries can use AI agents to:
  - Collect and anonymize real-world evidence on erroneous outputs, safety events, and model degradation.
  - Enable **collaborative monitoring** of AI performance by manufacturers and health systems without violating patient privacy.
- **Periodic Revalidation and Performance Monitoring:** A two-pronged approach for continuous monitoring is needed:
  - **Periodic Revalidation:** Re-testing the latest device outputs using original test data to ensure stability.
  - **Performance Monitoring:** Collecting post-deployment clinical output information to spot trends and outliers that indicate non-technical problems or model degradation over time.
- **Proactive Regulatory Oversight:** Regulatory frameworks (like the FDA's proposed Total Product Lifecycle framework and the EU AI Act) mandate providers to have a **post-market monitoring plan** to collect and review experience gained from using their systems, ensuring continuous compliance and facilitating corrective action.

Conclusion

The conclusion about the necessity of Adaptive Governance for Generative AI (GenAI) in health communication is that traditional, static regulatory models are insufficient to manage the unique risks posed by this rapidly evolving, opaque, and highly impactful technology.

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