The Future of Artificial Intelligence in the Healthcare Industry

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Honors in the Department of Political Science

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Research Objectives

- Identify patterns in how the history of technology is portrayed
- Use those patterns to assess the current narrative surrounding artificial intelligence
- Highlight discrepancies in AI literature
- Determine if a clear definition of artificial intelligence exists that could serve as a baseline for healthcare innovations
- Identify potential benefits of AI in the healthcare industry and compare with difficulties in practice
- Address any withstanding barriers to implementing artificial intelligence tools in health services
- Consider both provider and patient perspectives on artificial intelligence
- Conclude whether artificial intelligence should have a significant role in the future of the healthcare industry

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Overview of Technology in History

Historians of technological advancement have struggled for decades with accurately relaying events of the past in a manner that is free from personal bias. In fact, their work repeatedly aims to "capture the spirit of the people and of the institutions they portray, and they have an eye for the telling anecdote. But their immediacy comes at the price of perspective." According to Michael Mahoney in "The History of Computing in the History of Technology," that perspective is negatively influenced by time in the sense that they are "guided by the current state of knowledge and bound by the professional culture. That is, its authors take as givens (often technical givens) what a more critical, outside viewer might see as choices. Reading their accounts makes it difficult to see alternatives, as the authors themselves lose touch with a time when they did not know what they now know." Consequently, articles on the fascination and excitement surrounding technological advancements may not always showcase reality.

Mahoney, Michael S. "The History of Computing in the History of Technology." *Princeton University*, The Trustees of Princeton University, www.princeton.edu/~hos/Mahoney/articles/hcht/hchtfr.html.

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Current Narrative for AI Technologies

Utilizing machine intelligence as opposed to human intelligence for the purposes of planning, offering solutions, and providing insights, artificial intelligence's medical promise is dominating the narrative - despite uncertainty regarding its capacity in current health systems. What *is* certain is that AI has the ability to alter traditional dynamics between doctors, patients, administrators, and other relevant parties in the healthcare industry; whether AI will bolster or hurt these dynamics is up for interpretation.

Eagerness to deploy healthcare AI predominantly stems from its potential in clinical operations. In this setting, artificial intelligence may help to "effectively streamline diagnostic and treatment processes by using large amounts of structured and unstructured medical data across institutions." Radiology and pathology are particularly expected to benefit from AI tools made for this purpose.

Chebrolu, Kumar, et al. "Smart Use of Artificial Intelligence in Health Care." *Deloitte Insights*, www2.deloitte.com/us/en/insights/industry/health-care/artificial-intelligence-in-health-care.html/.

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Addressing the Narrative

Although many publications do intend to merely capture the "spirit of the people" in response to the prospect of AI, the discussion has evolved in a way that falsely depicts the extent of artificial intelligence in the United States and beyond.

In actuality, how we define AI remains unclear on an international scale. The race to establish AI thereby cannot have a true finish line until its meaning is more transparent and consistent across literature with classifications that are widely agreed upon.

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Discrepancies in AI Literature

Complicating matters is the reality that AI has become an umbrella term for numerous technological capabilities, rather than a specific type of machine demonstration, throughout various forms of literature. This has given marketers leverage to promote companies falsely claiming to use AI which, in turn, blurs public perception of artificial intelligence even more so.

A stunning report from a London-based venture capital firm, MMC, found that "out of 2,830 startups in Europe that were classified as being AI companies, only 1,580 accurately fit that description." The numbers equated to a shocking 40% of European firms identified as AI startups failing to even "exploit the field of study in any material way for their business."

Olson, Parmy. "Nearly Half Of All 'AI Startups' Are Cashing In On Hype." *Forbes*, Forbes Magazine, 5 Mar. 2019, www.forbes.com/sites/parmyolson/2019/03/04/nearly-half-of-all-ai-startups-are-cashing-in-on-hype/?sh=309e8183d022.

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Clarifying the AI Literature

Distinguishing artificial intelligence from other technological capabilities requires outlining the qualities of knowledge, machine learning, and AI that are different from one another - rendering each tool unique.

The meaning behind "intelligence" further reveals how the popular press' references to artificial intelligence are primarily deep learning applications, with additional confusion added if referencing machine learning or computer knowledge techniques as AI. For these misinterpretations to be resolved, AI must represent the state at which a machine can prove its critical thinking skills, common sense, wisdom, or real understanding of the world - so as to avoid the other technological applications discussed in this paper being grouped into "artificial intelligence." This state does not yet exist.

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Potential Benefits of Healthcare AI

Use Case or User Group	Category	Examples of Applications	Technology
Patients and families	Health monitoring Benefit/risk assessment	• Devices and wearables • Smartphone and tablet apps, websites	Machine learning, natural language processing (NLP), speech recognition, chatbots
	Disease prevention and management	• Obesity reduction • Diabetes prevention and management • Emotional and mental health support	Conversational AI, NLP, speech recognition, chatbots
	Medication management	• Medication adherence	Robotic home telehealth
	Rehabilitation	• Stroke rehabilitation using apps and robots	Robotics
Clinician care teams	Early detection, prediction, and diagnostics tools	• Imaging for cardiac arrhythmia detection, retinopathy • Early cancer detection (e.g., melanoma)	Machine Learning
	Surgical procedures	• Remote-controlled robotic surgery • AI-supported surgical roadmaps	Robotics, machine learning
	Precision medicine	• Personalized chemotherapy treatment	Supervised machine learning, reinforcement learning
	Patient safety	• Early detection of sepsis	Machine learning

"Artificial Intelligence Special Publication: The Hope, the Hype, the Promise, the Peril." *National Academy of Medicine*, 4 May 2020, nam.edu/artificial-intelligence-special-publication/.

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AI Barriers: An Empirical Analysis of EHRs

The U.S. lacks an advanced national health system for accessing large amounts of health data, inhibiting much of the VC funding from contributing to meaningful AI experimentation. By this logic, AI cannot integrate into the U.S. healthcare industry without first improving its understructure: the electronic health record.

The American Hospital Association Annual Survey publicizes information regarding health technology trends across hospital facilities. In collaboration with state healthcare agencies, Medicare and Medicaid centers, national organizations, and governmental bodies, over 6,200 hospitals are identified for the AHA survey each year - with an impressive response rate upwards of 75%. By selecting information from the survey relating to electronic health records, this research completes a cross-state comparison using 2015 data to examine which states or regions are the most prepared for AI in healthcare.

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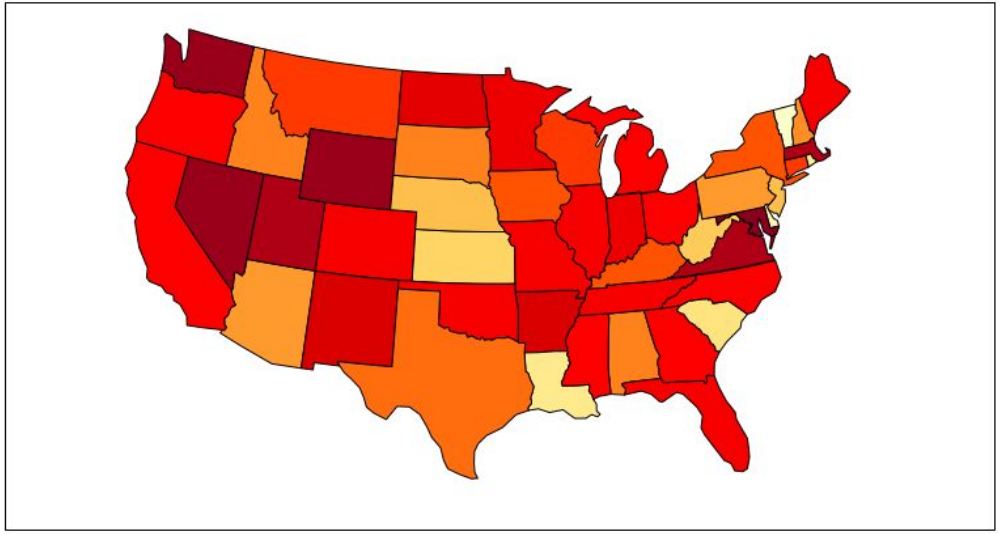
Empirical Analysis Findings

Percent of All Hospitals that have Adopted at least a Basic EHR with Clinician Notes



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Empirical Analysis Findings

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```

	region	region_code	period	pct_hospitals_basic_ehr_notes
99	Vermont	VT	2015	0.65
61	Delaware	DE	2015	0.67
71	Louisiana	LA	2015	0.70
92	Rhode Island	RI	2015	0.70
64	Hawaii	HI	2015	0.71

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Empirical Analysis Findings

```
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```

	region	region_code	period	pct_hospitals_basic_ehr_notes
73	Maryland	MD	2015	0.95
86	Nevada	NV	2015	0.94
100	Washington	WA	2015	0.94
103	Wyoming	WY	2015	0.94
72	Massachusetts	MA	2015	0.93
97	Utah	UT	2015	0.93
98	Virginia	VA	2015	0.93
55	Arkansas	AR	2015	0.90

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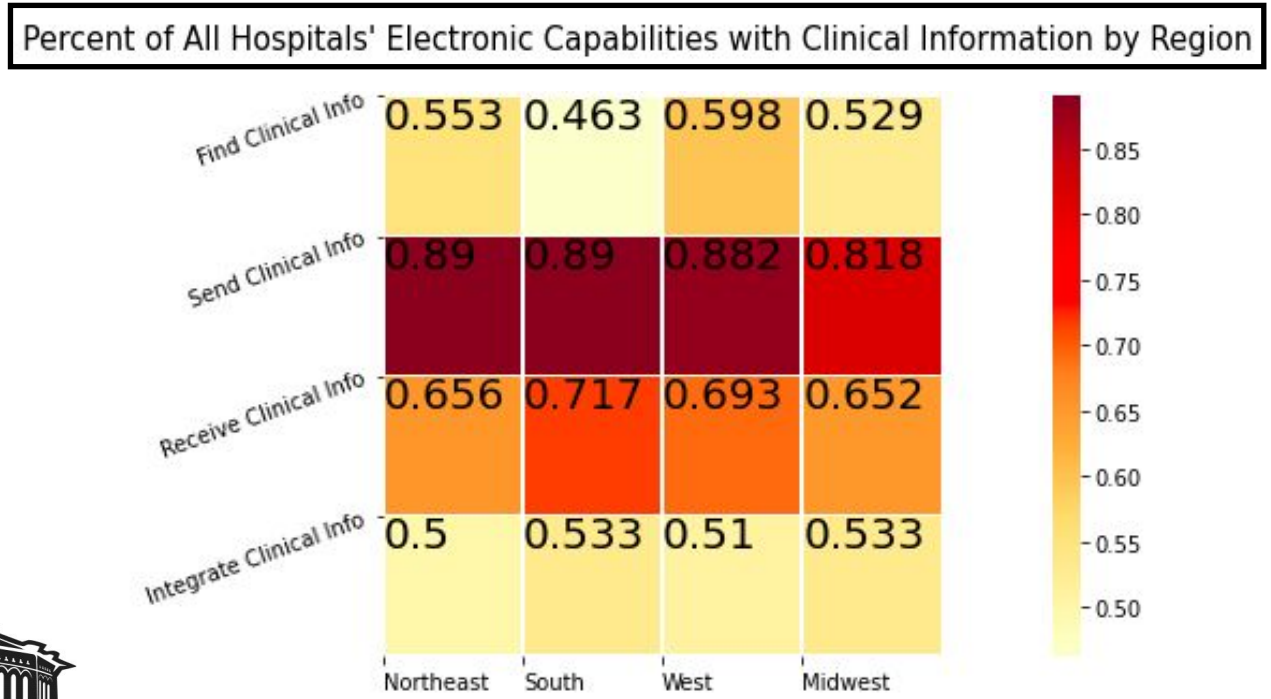
Empirical Analysis Findings



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Insights into the State of EHRs

Future development of EHRs must appreciably focus on the regions with larger distributions to revamp hospitals within lower quartiles. More specifically, attention to integrating patient information from outside sources without needing to manually enter data should be a top initiative. So long as states have numerous hospitals without proper EHRs in place for exchanging summary care records or finding, sending, receiving, and integrating clinical information from outside providers, the U.S. healthcare system will not achieve the level of connected care necessary for AI to ever thrive in a medical setting.

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Conclusion

Although historians and journalists alike may continue to promote the "spirit of the people" above the drawbacks of artificial intelligence and the choices we still have for how, where, or whether to even use it, this research finds that the United States cannot assert AI as its future for the healthcare industry. Rather, current discussions surrounding AI must center on how technological innovations can support providers and their teams in daily practices - not replace them. Failing to engage in these types of conversations will dismiss other viable options to revitalize the healthcare industry and overlook the necessity to address major issues in foundational technologies - especially the electronic health record. This ultimately illustrates that devoting time and resources to healthcare AI while the industry's foundation is left fragmented would be a disservice to all involved parties and inhibit improvements to the system as a whole.

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