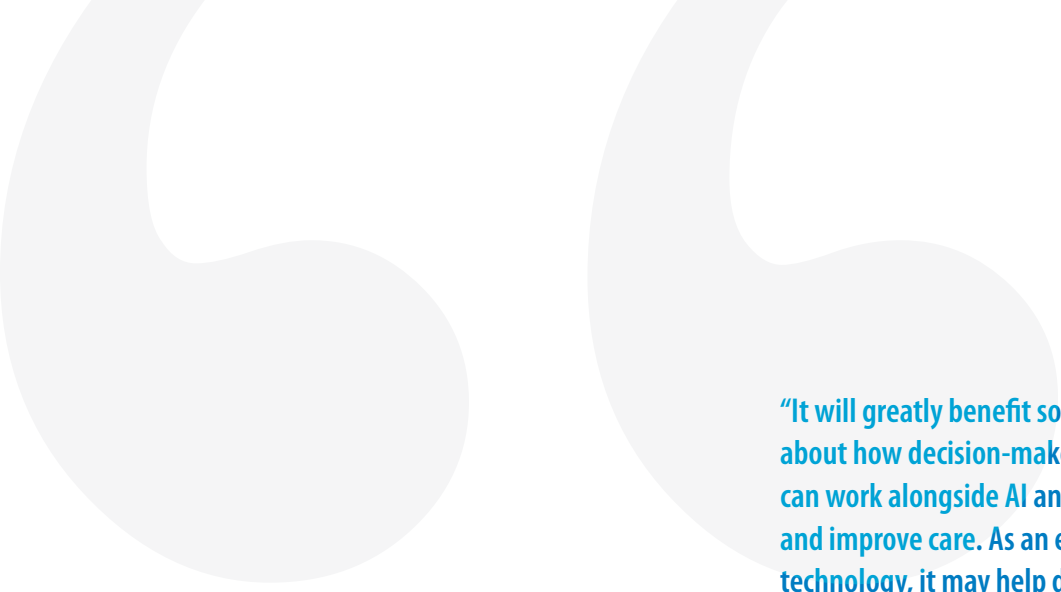


AI FOR HEALTHCARE: BALANCING EFFICIENCY AND ETHICS





“It will greatly benefit society to maintain an open mind about how decision-makers in healthcare organizations can work alongside AI and selectively rely on it to inform and improve care. As an early leader in adopting the technology, it may help dispel the prejudices and myths surrounding AI, and build basic awareness and education among working professionals in the medical field and beyond. The industry also needs to establish ethical standards and obligations for the organization as well as metrics to assess the performance of AI systems. As people displaced from their current roles by automation are being retrained and reskilled to perform new ones, redirecting a significant section of that talent to operate and manage the ethics charge will prove beneficial. Finally, practitioners must allow an adequate period of time for any issues in the system to surface. This period of time is based upon many factors including the maturity of the organization and the complexity of the technologies being deployed. These measures will go a long way in ensuring that AI fulfils its promise to transform healthcare delivery not just efficiently, but purposefully.”

– An Infosys viewpoint

INTRODUCTION



A report from the World Health Organization said that the global shortage of healthcare workers was 7.2 million in 2013 and would climb to 12.9 million by 2035. It also issued a grim warning that if not attended to immediately the shortage would have serious implications for the health of billions of people around the world.

Luckily, digital technologies, such as Artificial Intelligence (AI), are coming to the sector's rescue, improving the reach and availability of healthcare delivery, especially in underserved areas, while also lowering the cost of access. The healthcare industry has responded warmly, and there is widespread agreement that it is at the forefront of AI adoption. Healthcare organizations spent about US\$600 million on AI in 2014 and will multiply that tenfold by 2021.

What drives these investments? Which of the several technologies are attracting the most attention in healthcare? How prepared are healthcare organizations for AI-led transformation?

As part of its study *Amplifying Human Potential: Towards Purposeful Artificial Intelligence*, Infosys commissioned independent research to investigate the approach and attitudes that senior decision-makers in large organizations have towards AI technology and how they see the future application and development of AI in their industries. As part of the research, 10 industries were surveyed, including Retail, Fast Moving Consumer Goods (FMCG), Utilities, Financial Services, Healthcare, Pharmaceuticals and Life Sciences, Manufacturing, Telecoms, Automotive and Aerospace, and the Public Sector.

What follows is a glimpse into the findings specific to the healthcare sector.

HOW HEALTHCARE APPROACHES AI



AI and healthcare share a well-established past. Healthcare was one of the first practical applications for early AI systems like Dendral. Today, healthcare-based AI systems are some of the most well-funded initiatives in the technology sector. According to the Infosys survey, 94 percent of the responding organizations say they invested between US\$1 million and US\$10 million in AI technologies last year. However, the average investment, at US\$4.7 million, was lower than the overall average across all industries.

Three primary forces drove investment interest, namely executive decisions (cited by 28 percent of the healthcare respondents) followed by “particular business, operational or technical problems” (24 percent) and a desire to harness competitive

advantage (21 percent). While the healthcare organizations in the survey appear to be satisfied with the working of current AI deployments, they are also preparing for future implementations by investing in IT infrastructure (62 percent), developing the right knowledge and skills (57 percent), using external support to assist with planning (47 percent) and building AI into the company ethos (46 percent). Specifically, organizations were most interested in deploying AI in IT systems and security (54 percent), data analytics (40 percent), and customer relationship management business areas (40 percent).

How is your organization preparing for AI deployment and use?

Investing in supporting IT infrastructure	62%	Using external support for knowledge gathering	39%
Developing knowledge/skills	57%	Gathering feedback from customers	33%
Using external support to assist with planning	47%	Assessing competitor/industry approach	20%
Building AI into company ethos	46%	We are not preparing for AI	5%

What was the driving force behind this deployment?

Executive-led decision	28%	Unexpected solution to problem	7%
Particular business, operational or technical problem	24%	Customer demands	5%
Competitor advantage	21%	Offshoot of another project	1%
Internal experiment	16%		

AI FOR EFFICIENCY AND EFFECTIVENESS



The healthcare industry made it to the middle ranks of AI maturity, taking seventh place out of 10. Most healthcare organizations report using AI systems for at least one year, and 24 percent say they have been using them for three to five years. There are plans to deploy a wide array of AI systems, in the areas of big data processing (66 percent), predictive/prescriptive analytics (57 percent), machine learning (57 percent), and expert systems (43 percent). New AI systems based on deep learning neural networks and interactive voice response technologies (34 and 26 percent) are also of interest.

Improving operational efficiency and care delivery is an important priority. AI has a range of applications that do a number of things from managing the supply chain to lending diagnostic support. AI is adding great value to the clinical process by taking over a big chunk of clinical and outpatient services, leaving physicians free to focus on more critical activities. For instance, machine learning algorithms are processing and analyzing enormous quantities of information in the form of clinical notes, diagnostic images and health records to quickly detect patterns and insights that would have taken decades before.

AI FOR DISCOVERY AND DIAGNOSIS



Timely, accurate detection has a huge bearing on treatment outcomes in the case of rare or difficult-to-diagnose illnesses. Unfortunately, medical practitioners can only analyze a limited number of images and samples, and their diagnoses are subject to human error. AI, on the other hand, can process millions of samples in quick time, consistently and reliably, every time.

An example of machine learning in diagnosis is Morpheo, an AI platform that studies sleep disorders. Analyzing sleep patterns is a time consuming, complicated exercise that is hugely benefiting from AI-led automation. Besides making it easier for

physicians to treat patients, the platform is expected to yield predictive/preventive treatments in the future.

AI is also holding out the hope of detecting diseases even before the symptoms manifest. A startup in California has come up with an Adaptive Genomics Engine that spots disease signatures in the blood dynamically. It does this based on freely floating and dynamically changing genetic material, which offers a genomic picture of an individual at any given time.

AI FOR DRUG DEVELOPMENT



Machine learning and AI can make a huge difference to the cost and lead time of drug discovery, which currently stands at an average of US\$2.5 billion and 10-15 years, respectively. The drug discovery process involves testing chemical compounds on permutations and combinations of a variety of conditions associated with a particular disease. Given the complexity and time involved, scientists are forced to restrict the number of test combinations. Machine learning algorithms, however, have no such limitations and are capable of learning to make

predictions based on previously learned data and even prioritize experimentation. This is very useful in bringing down the time and cost of drug discovery. For example, a San Francisco based startup has used its machine learning and neural networks solution to discover drugs that may potentially reduce the spread of Ebola. The analysis took all of one day to complete.

ETHICS AND AI



As AI penetrates deeper into work and personal life, it raises questions about the ethics of replacing humans with machines. These questions are of greater consequence in healthcare where decisions are literally a matter of life and death. While AI has already proved more capable than clinicians in making certain diagnoses, do we want it advising patients? Patient privacy is an equally important issue. To use machine learning in diagnosis, it is necessary to train it using patient health records, healthcare statistics and a host of personal information. Who will ensure that the data is used responsibly, ethically, and securely? Then there is the universal question of what large-scale automation will do to job security. Linked to that are some concerns regarding getting AI and human employees to work alongside in harmony and safety.

Healthcare organizations are cognizant of all these issues, and believe that these will hinder adoption to some extent. 57 percent of the respondents agree

that fear of change among employees is the biggest barrier to adopting AI technology. They also cite other barriers, such as cultural acceptance (50 percent), ethical concerns (48 percent), lack of in-house skills (48 percent), and the cost of AI solutions (63 percent).

Employees' fear of change is another name for job insecurity. This is justified to some extent because 34 percent of the healthcare respondents in the survey confirmed their intention to replace workforce resources and roles with new technologies within the next 12 months. But that does not mean all those jobs will be lost. 76 percent of the healthcare organizations say they would either redeploy employees within the same area of the organization (42 percent) or retrain them into a new role or area (34 percent). Only 24 percent of the respondents say they plan to make the affected employees redundant within their own organizations.



What does your organization primarily plan to do in terms of employees that have been replaced with technology?

Redeploy within the same area of the organization **42%**

Make them redundant **24%**

Retrain them into a new role/area of the organization **34%**

Organizations aren't wasting time getting started. Roughly 44 percent of all the healthcare respondents say they are already training employees about the benefits and use of AI, or are planning to do so in the next 12 months (31 percent).

This "redeploy or retrain" theme will become common as AI systems grow in use and functionality. In fact, we can already see a great deal of discussion over what will happen to a skilled workforce when we examine specialized fields like radiology. Segments of the radiology field are undergoing a sort of identity crisis

in response to the introduction of AI as capable of detecting tumors with high accuracy. A popular but misguided concern suggests AI systems may render radiologists redundant in the near future, when in fact AI systems will likely amplify the abilities of today's radiologists, giving them more opportunities to focus on patient care and to have a larger influence on the course of a treatment.

REAPING THE BENEFITS



Of the organizations that have deployed AI, many are reaping benefits by way of informed decision-making (46 percent), cost savings (42 percent), automated processes and tasks (41 percent), revenue (41 percent), faster resolution of business problems (41 percent), and more. In fact, 21 percent of the respondents say they believe AI could help

contribute a 20 percent to 30 percent increase in revenue by the year 2020, and another 25 percent were optimistic that could happen in the same year itself.

CONCLUSION



The use of AI in the healthcare sector presents an exciting opportunity for organizations to drastically improve care in a short period of time, while saving cost. However, they would need to carefully consider how AI deployment could affect their workforce and ensure that the proper ethical checks for autonomous systems are in place. While AI systems will become increasingly common in healthcare organizations, they will exist to support people in their jobs. For instance, AI will optimize clinical processes, such as recording patients' vital signs or analyzing scans and samples, but the doctor will decide the final line of treatment. When developing drugs, scientists choose target molecules from a set of possible candidates using instinct or guesswork. AI can do that much more efficiently and effectively, but it would still be an "experimentalist's helper". AI will enable healthcare professionals to understand diseases faster and make better clinical decisions, and it will help researchers innovate quickly by failing fast en route. The purpose of AI will be to augment natural intelligence, and its role will always be subordinate to the human's.

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