

## Original Research Article

# Artificial intelligence and dichotomy on benefits and challenges: what do healthcare providers say?

Bharat Singh, Surekha Kashyap\*, Ankita Grover

Department of Hospital Administration, Armed Forces Medical College, Pune, Maharashtra, India

**Received:** 08 August 2019

**Accepted:** 19 August 2019

**\*Correspondence:**

Dr. Surekha Kashyap,

E-mail: [surekhakashyapdr@gmail.com](mailto:surekhakashyapdr@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** In a developing country like India, with a vibrant information technology (IT) sector, employing Artificial Intelligence (AI) should be carefully weighed before its introduction in healthcare with relation to perception of healthcare providers (HCP's/Doctors).

**Methods:** This qualitative study was conducted in medical college and affiliated hospital in India. Initially a pilot study was conducted for reliability and internal consistency of questionnaire. Thereafter, pre-tested questionnaire was distributed to 153 healthcare providers and their responses were analyzed on SPSS version 20.0 (IBM) to identify the demographic and job-related differences in their perception regarding the benefits and challenges of using AI in healthcare.

**Results:** Most of respondent were agreed upon the benefits of using AI in healthcare and most cited benefits were speedy decision making, better resource utilization and improvement in staff satisfaction. Similarly most cited challenges were lack of training on AI enabled machines, lack of skilled technical support, high cost of AI and data privacy issue. Further, Age and Job experience were significantly associated with benefits like timely and speedy decision making, improvement in the patient and staff satisfaction respectively. Furthermore, Age, Department, Job experience, Job profile were significantly associated with challenges like high cost of AI, lack of skilled technical support, lack of training in AI enabled machines and lack of trust in AI among patients.

**Conclusions:** Significant challenges of using AI in healthcare with demographic and job related variable based on the results of this research paper need to be resolved first in order to overcome the initial resistance in employing AI in healthcare.

**Keywords:** Artificial Intelligence, Decision making, Healthcare providers (Doctors), Integrated Decision Support System, Perceived AI Benefits, Perceived AI challenges

### INTRODUCTION

The concept of artificial intelligence was first introduced in early 80s. According to the father of Artificial Intelligence (AI), John McCarthy, it is "The science and engineering of making intelligent machines, especially intelligent computer programs". It is a branch of computer science that, tries to make a computer, a computer-controlled robot, or software think tank and

performs tasks akin to human intelligence like visual perception, speech recognition, translation, and decision-making.<sup>1,2</sup> AI integrates the computational network (neural networks) that mimic biological nervous systems.<sup>3</sup> Nowadays, advancements in data storage capacity, speed in processing, and mathematical tools have made it possible for artificial intelligence enabled machines resembling humans, capable to learn from experience and able to perform human like complex task

by machine learning and deep learning based on predefined algorithm.<sup>4</sup> Various artificial intelligence enabled technologies, such as IoT (Internet of Things), IoH (Internet of Human), and AI enabled platform (IBM Watson/Wysa/Artelus) are currently being utilized widely by developed countries and can be integrated on the large scale into the medical field in developing countries as well. Uses of internet based technologies are most important to deliver the effective and quality health services to the patients.<sup>5,6</sup> Integrated Decision Support System (IDSS) is an AI enabled program designed for healthcare professionals to aid in clinical decision making. This system correlates the patient data with the available knowledge in the medical domain. It provides the differential diagnosis based on the strength of association between the symptoms and the laboratory results thereby improving timely decision making and quality care to the patients.<sup>7</sup> A study by Jiang F et al, on the topic stated that, a substantial proportion of AI being utilize in the field of diagnostic imaging, genetic testing and electro-diagnosis.<sup>4</sup> However, A note on “Artificial Intelligence in the Healthcare Industry in India” elaborated on the use of artificial intelligence in the healthcare is very diverse across the sub-field, as follows.<sup>6</sup>

- Descriptive artificial intelligence: It analyses the events that have already been occurred and uses this data to gain further insights, such as detecting trends and minor changes like fracture patterns and skin lesions.
- Predictive artificial intelligence: It is used by healthcare providers in prediction and suggestive actions in the manner to improve efficacy and timely results.
- Prescriptive artificial intelligence: It is used in the Decision Making Support System (DMSS) wherein it aids in clinical decision making by providing the best available treatment option to healthcare providers.

However, over the year various authors have expressed their concern about problems associated with the application of AI in healthcare. Nealon J and Moreno A highlighted the use of intelligent agent in patient scheduling, community care, information access, decision support system while stating that healthcare professional are quite reluctant to use new technology.<sup>8</sup> Schulz PJ and Nakamoto K concluded in their article that it is critical for healthcare professional to educate patients about how to interpret information out of AI.<sup>9</sup> In a study carried out in the public healthcare sector Sun TQ and Medaglia R mapped the challenges of AI as perceived by policy maker, hospital, IT firm manager, doctors and clubbed them in to social, political, ethical, organizational, economic and technological challenges.<sup>10</sup> Jiang F et al, also discussed the benefits of AI in healthcare for early disease prediction, diagnosis, treatment and participation of patients in decision making.<sup>4</sup> Recently an article on “Democratization of Artificial Intelligence” by Kobayasi

Y et al, discussed the challenges with AI in medicine like insufficient AI technician, government policies on protection of personal information and also suggested the medical AI utilization platform to make AI accessible for healthcare providers.<sup>1</sup>

## METHODS

### *Instrument*

A questionnaire was developed for perception of healthcare providers on benefits and challenges of using AI in healthcare. It consisted of four sections, section one gave brief outline of AI in healthcare, section two included five demographic variables of HCP's (Age, Gender, Department, Job experience, Job profile), section three elicited an opinion on five possible benefits of AI in healthcare namely Timely and speedy decision making, Reduction in medical errors, Better resource utilization, Improvement in patient satisfaction and Improvement in staff satisfaction. Lastly, section four obtained an opinion on possible seven challenges of AI in healthcare namely Lack of trust in AI among healthcare providers (respondents itself), Lack of trust in AI among supportive staff, Lack of trust in AI among patients, Data privacy issues, High cost of AI, Lack of skilled technical support in AI and Lack of training on AI enabled machines. Responses for items in section three and four were provided on three point likert scale, in which 1 corresponds to ‘Agree’, 2 corresponds to ‘Disagree’ and 3 corresponds to ‘Can’t comment’.<sup>4,6</sup>

### *Study setting and study design*

This study was conducted in medical college and affiliated tertiary care hospital in India. Initially a pilot study was conducted in which the questionnaire was instituted to 35 healthcare providers (Doctors). Context validity and reliability of the questionnaire was tested via Cronbach's alpha coefficient, it was found to be within acceptable range (0.6-0.7), specifically Cronbach's alpha was 0.632 and 0.603 for items provided in the opinion section of benefits and challenges in questionnaire, respectively.<sup>11</sup> Thereafter, pre-tested questionnaire was distributed to 153 healthcare providers (doctors); between January 2019 to February 2019 those who had given the consent for willingness to participate in the study and were utilizing AI enabled technologies in direct and/or indirect patient care (Purposive sampling was considered).

## RESULTS

### *Results on demographic and job related variables*

The analysis was performed with SPSS version 20.0 (IBM). The sample frequency distribution, according to demographic and job-related variables, is shown in Table 1. Most of the respondents were male (79.08%) as compared to female (20.92%).The age distribution was:

57.52% under 35 years of age, 32.03% between 35 and 45 year and 10.45% over 45 years. Regarding job profile, 75.16% were Post-graduate medical students, 17.65% were Medical teachers, 7.19% were Heads of the department in concerned field of specialty. The departments were grouped into 4 subgroups: Medicine and allied (40.52% respondents), Surgery and allied (30.07% respondents), Hospital administration (18.30% respondents) and Diagnostic services including Laboratory services and Radio-diagnosis (11.11% respondents). Lastly going by job experience, 60.78% respondents had less than 10 years of job experience, 31.38% between 10 to 20 years and 7.84% had more than 20 years of job experience in their respective fields (Table 1).

**Table 1: Overall and sub-sample frequency distribution by demographic and job-related variables.**

Demographic and job-related variables	Subgroup	Overall (N=153)
Age	<35 years	88 (57.52%)
	35- 45 years	49 (32.03%)
	>45 years	16 (10.45%)
Gender	Male	121 (79.08%)
	Female	32 (20.92%)
Department	Medicine and allied	62 (40.52%)
	Surgery and allied	46 (30.07%)
	Hospital administration	28 (18.30%)
	Diagnostic services	17 (11.11%)
Job profile	Post graduate medical student	115 (75.16%)
	Medical teacher (faculty)	27 (17.65%)
	Head of the department	11 (7.19%)
Job experience	<10 years	93 (60.78%)
	10-20 years	48 (31.38%)
	>20 years	12 (7.84%)

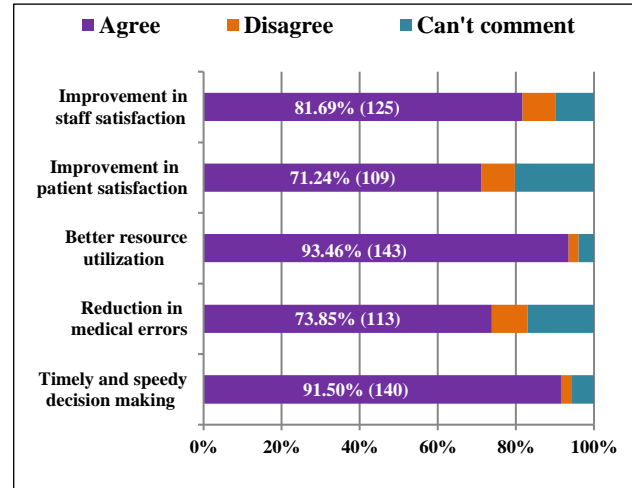
**Result on perceived benefits**

Our results revealed that majority of the healthcare providers agreed upon benefits of using AI in healthcare, i.e. timely and speedy decision making by 140(91.50%), reduction in medical error by 113(73.85%), better resource utilization by 143(93.46%), improvement in patient satisfaction by 109(71.24%), improvement in staff satisfaction by 125(81.69%) respondents (Figure 1).

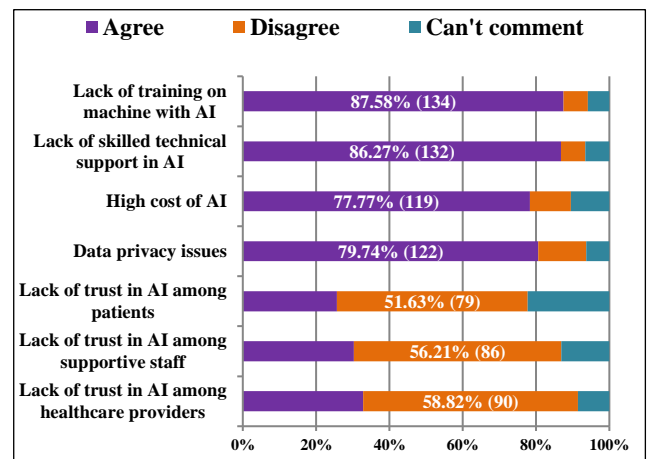
**Result on perceived challenges**

The result of our study showed that most of the participants agreed upon challenges of using AI in healthcare, i.e. lack of training on AI enabled machines by 134(87.58%), lack of skilled technical support in AI by 132(86.27%), high cost of AI by 119(77.77%), data

privacy issue 122 by(79.74%) respondents. Similarly, most of the respondents did not consider following as challenges, i.e. lack of trust in AI among patient by 79(51.63%), lack of trust in AI among supportive staff by 86(56.21%), lack of trust in AI among healthcare provider by 90(58.82%) respondents (Figure 2).



**Figure 1: Overall perceived benefits by HCP in using AI in healthcare.**



**Figure 2: Overall perceived challenges by HCP in using AI in healthcare.**

**Result on significant relation (demographic and job-related variables with perceived benefits and challenges)**

Out of five demographic and job-related variables, age and job experience were significantly associated with benefits like timely and speedy decision making, improvement in the patient and staff satisfaction respectively with P-value <0.05 (95% confidence interval) as shown in Table 2.

Out of seven, four demographic and job-related variables were significantly associated with challenges like high cost of AI, lack of skilled technical support, lack of training in AI enabled machines, lack of trust in AI

among patients with a P-value <0.05 (95% confidence interval) as shown in Table 3.

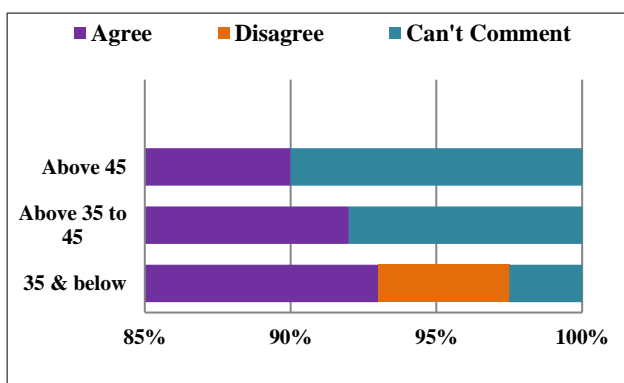
**Table 2: Demographic and job-related variables and their significant relation with benefits.**

Demographic and job-related variable	Significant association with benefits	p-value (Chi-square)
Age	Timely and speedy decision making	0.040
Job experience	Improvement in patient satisfaction	0.005
Job experience	Improvement in staff satisfaction	0.017

**Table 3: Demographic and job-related variables and their significant relation with challenges.**

Demographic and job-related variable	Significant association with challenges	p-value (Chi-square)
Age	High cost of AI	0.019
Department	High cost of AI	0.032
Job experience	High cost of AI	0.010
Job profile	High cost of AI	0.007
Job profile	Lack of skilled technical support	0.014
Department	Lack of training in machine with AI	0.037
Department	Lack of trust in AI among patient	0.023

Several remarkable points of particular interest emerged out of this study (Table 2 and 3). Results on significant relation of demographic and job-related variables with perceived benefits and challenges are as follows.



**Figure 3: Age and Timely and speedy decision making.**

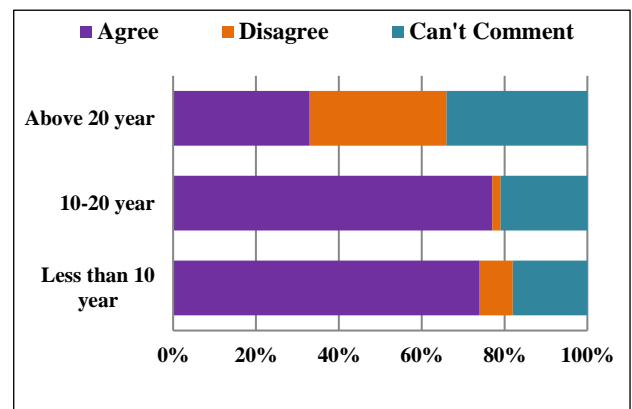
**Age and timely and speedy decision making (Benefits)**

Results of our study reveals that more of the younger respondent perceived the benefit that AI in healthcare enables timely and speedy decision making. 92.04%

respondents below 35 years of age, perceived that AI helps in timely and speedy decision making as compared to 89.79% between 35-45 years of age and 81.25% of above 45 years (Figure 3).

**Job experience and improvement in patient satisfaction (Benefits)**

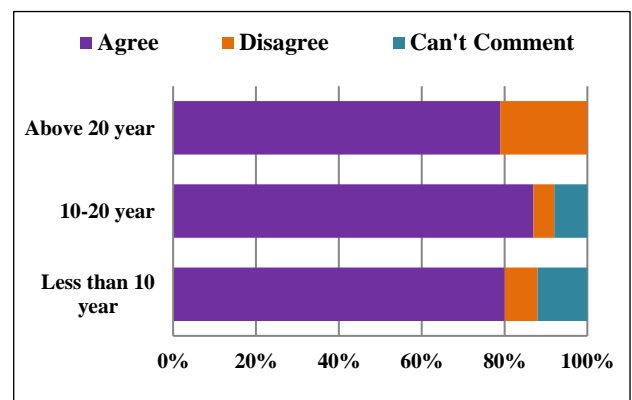
The study reveals that 77.08% respondents with job experience of 10-20 years perceived that using AI in healthcare led to improvement in patient satisfaction as compared to 74.19% respondents with job experience of less than 10 years and 33.33% respondents with job experience of more than 20 years (Figure 4).



**Figure 4: Job experience and improvement in patient satisfaction.**

**Job experience and improvement in staff satisfaction (Benefits)**

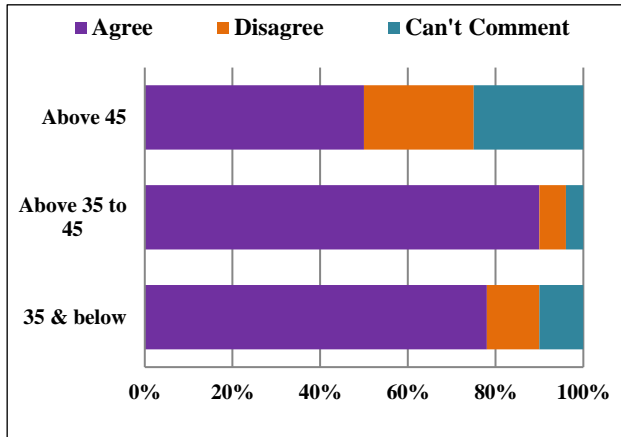
Our study also reveals that most of the respondents with lesser job experience were perceived that staff satisfaction improves with use of AI in healthcare. 87.50% respondents with 10-20 year job experience perceived that using AI in healthcare led to improvement in staff satisfaction as compared 80.64% with less than 10 years and 75% more than 20 years of job experience (Figure 5).



**Figure 5: Job experience and improvement in staff satisfaction.**

**Age and high cost of AI (Challenges)**

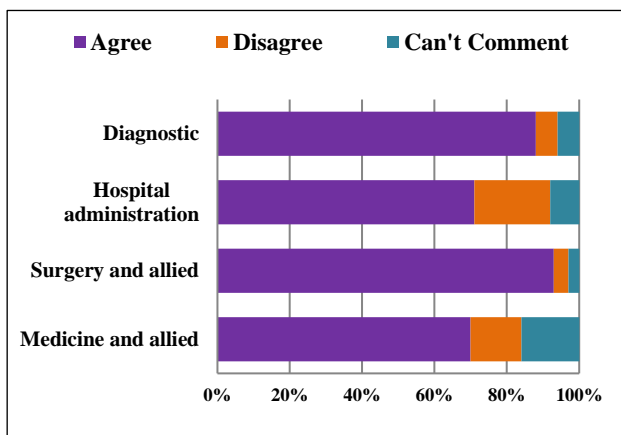
The study results significantly shown that most of the younger respondent agreed on high cost of AI are a challenge in healthcare. 89.79% respondents between 35-45 years of age perceived that the high cost of AI is a challenge as compared to 77.27% below 35 years and 43.75% above 45 years of age (Figure 6).



**Figure 6: Age and high cost of AI.**

**Department and high cost of AI (Challenges)**

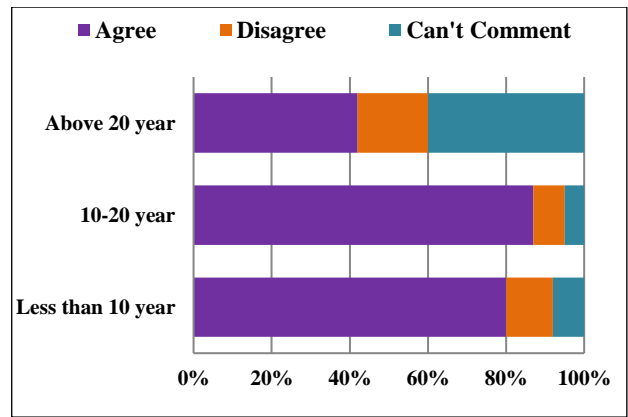
The study reveals that 93.48% respondents from Surgery and allied, 88.23% from Diagnostic services were perceived the high cost of AI is a challenge for implementing AI in healthcare as compared to 71.43% from Hospital administration and 69.35% from Medicine and allied (Figure 7).



**Figure 7: Department and high cost of AI.**

**Job experience and high cost of AI (Challenges)**

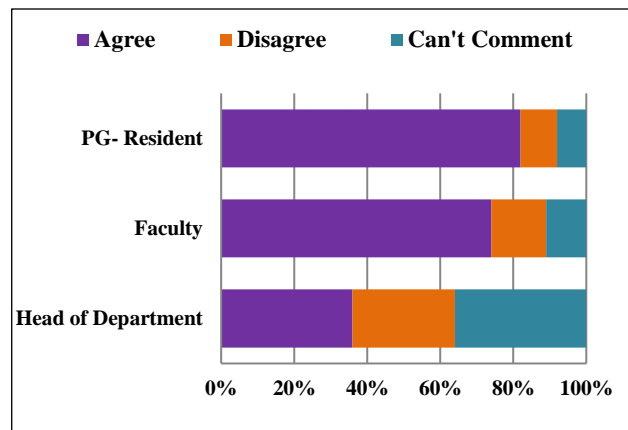
Results reveals that 87.50% respondent with job experience 10-20 years perceived that using AI in healthcare led to improvement in staff satisfaction as compared to 79.57% less than10 years and 41.67% more than 20 years of job experience (Figure 8).



**Figure 8: Job experience and high cost of AI.**

**Job profile and high cost of AI (Challenges)**

More of the Post graduate medical students (81.74%) and Medical teachers (74.07%) were differing in their perceptions as compared to Heads of the department (36.36%) that high cost is a challenge in incorporating AI in healthcare (Figure 9).



**Figure 9: Job profile high cost of AI.**

**Job profile and lack of skilled technical support (Challenges)**

100% Medical teachers and 86.09% Post graduate medical students perceived that lack of skilled technical support is a challenge in using AI enabled technology. Only 63.64% Heads of the department agreed upon the similar perception on lack of skilled technical support (Figure 10).

**Department and lack of training in machine with AI (Challenges)**

In an attempt to relate the department and lack of training in machine with AI, 97.83% respondents from Surgery and allied department perceived lack of training in machine with AI is a challenge as compared to 89.28%

Hospital administration, 88.23% Diagnostic services and 79.03% from Medicine and allied (Figure 11).

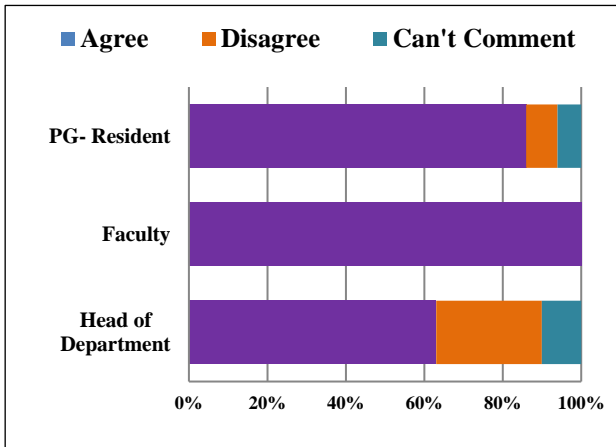


Figure 10: Job profile and lack of skilled technical support.

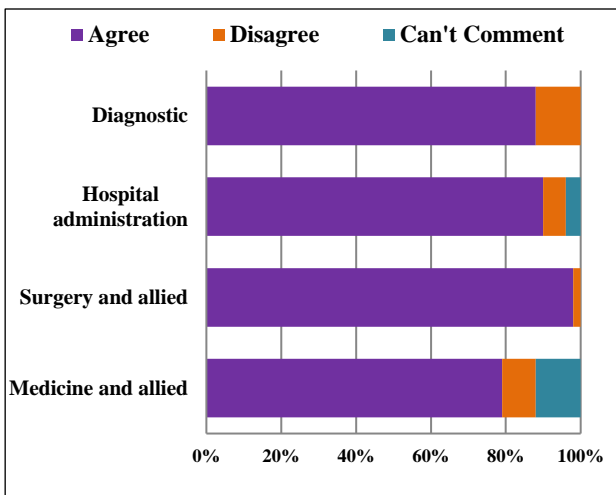


Figure 11: Department and lack of training in machine with AI.

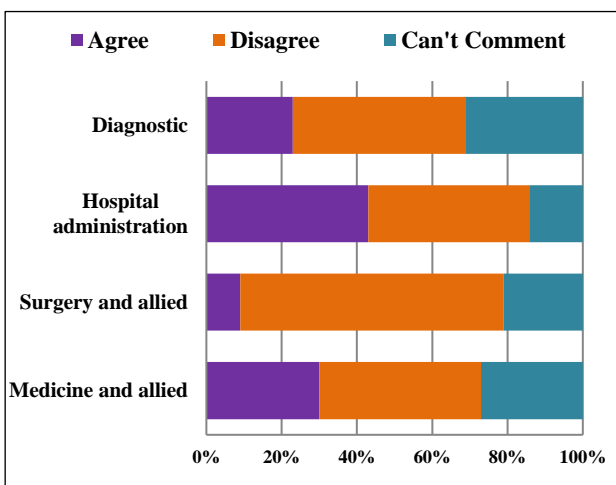


Figure 12: Department and lack of trust in AI among patient.

**Department and lack of trust in AI among patient (Challenges)**

Another significant result was observed on departments and their opinions on lack of trust in AI among patient as a perceived challenge. Only 9% respondents working in the Surgery and allied department were seemingly convinced of lack of trust in AI among patients as a perceived challenge as compared to 30.64% from Medicine and allied, 42.85% Hospital administration and 23.53% of those working in Diagnostic services (Figure 12).

**DISCUSSION**

*Perceived benefits*

The findings of this study (Figure 1) were similar to Maskara R et al, Miotto R et al, and study conducted by HIMSS Analytics where most of participants perceived the benefits in the same way.<sup>12-14</sup> Another document by Walsh P on “Automating Healthcare Can Improve the Patient Experience” reveals that patients are increasingly demanding immediate access, convenient hours, and multiple ways to communicate with their physician. Patients now compare service across healthcare industries and choose among what is convenient to them which are equally important in-patient satisfaction.<sup>15</sup> Moreover, a note on “Using the Power of AI to Improve Staff Retention, Job Satisfaction” by Kanyadi P stated that considering both sides of this equation from employee and clientele, AI incorporation boosts satisfaction on either side.<sup>16</sup>

*Perceived challenges*

Despite the promising results obtained using AI enabled technology, there remain several unsolved challenges facing the application of AI in health care. The findings of this study (Figure 2) were also similar to Sun TQ and Medaglia R, Maskara R et al., Miotto R et al. and study conducted by HIMSS Analytics where most of participant perceived the challenges in the similar way.<sup>10,12-14</sup> Another report on “IT Department can benefit from AI, but at high cost” by Seeley R wrote that despite the challenges of high cost in the initial adoption of AI, it helps in automating routine function in the long run.<sup>17</sup>

Discussion on significant relation (as shown in table 2 and table 3) of demographic and job-related variables with perceived benefits and challenges are as follows.

*Age and timely and speedy decision making (Benefits)*

As depicting in (Figure 3), the differences could be due to more engagement of young doctors with AI enabled machines in teaching institutes and actually reaping more benefits with its use in routine activities. A news document on the subject by McQuater K highlighted a generational gap in use of and perceptions towards AI and wrote that 69% of respondent were worried about AI

making a decision that will impact their lives without their knowledge secondly respondent those aged 55 and over were strongly agreed that they prefer human to AI interaction compared to a third of younger consumers.<sup>18</sup>

#### ***Job experience and improvement in patient satisfaction (Benefits)***

A possible explanation could be direct feedback from the patients due to more engagement with patients in learning process of younger doctors with relatively lesser job experience (Figure 4).

In addition, “World Business Research (WBR) and Conversa Health” conducted a survey, Healthcare-2020: This survey reiterated that how the automated patient experiences transformed the landscape based on direct interviews and survey responses from 134 healthcare executives. The report explored the views of healthcare executives on the usage of automated healthcare technologies and its effective implementation. The survey results concluded that 98% of healthcare executives feel, AI technology will be critical in closing the gaps in engaging the patient and their concerns which could led in patient satisfaction.

However, the above study does not mention about the demographic and job-related variables of the participants.<sup>19</sup> A newsletter by Ben Taylor illustrates that employing AI in healthcare augment participative decision making with patients having a say could also be the reason for patient satisfaction.<sup>20</sup>

#### ***Job experience and improvement in staff satisfaction (Benefits)***

It is important to mention that staff satisfaction depends on various factors like remuneration, workplace environment, rewards, and incentives; similarly, it also depends on working hours and patient load in defined time (Figure 5). Various studies shown that automation benefited workplace safety, reduction in lead time, shorter work week for employee led to protecting and promoting the physical well-being of employee which contributed for staff satisfaction.<sup>21</sup>

#### ***Age and high cost of AI (Challenges)***

A possible explanation on differences in their opinion could be that the neither the youngest age group nor oldest one has been exposed to procurement of recent AI enabled technologies or could be due to the oldest age group were more concerned about the integration of AI in healthcare and its futuristic benefits considering the critical availability of HCP (Figure 6).

#### ***Department and high cost of AI (Challenges)***

As depicting in (Figure 7), these results could be due to initial cost while introducing any technology in the

market always predicted as higher till the time mainstream customers adopt it thereby reducing the costs later and newer AI enabled technologies being utilized by Diagnostic and Surgery and allied departments like Acrobot Precision Surgical System, Computer-Assisted 3D planning, Surgical Navigation, Multi-channel 3D MRI, AI enabled Auto-analyzer.<sup>13,10</sup>

#### ***Job experience and high cost of AI (Challenges)***

The difference in perception could be due to senior doctors believes that the technology in the long run could be a cost effective modality in effective patient care (Figure 8).

#### ***Job profile and high cost of AI (Challenges)***

The difference in perception could be due to as obviously the Medical teachers and Post-graduate medical students are younger in age and lesser in job experience than the Heads of the department, similarly Heads of the department had the ability to analyse the cost effectiveness of AI better than junior subordinate (Figure 9).

#### ***Job profile and lack of skilled technical support (Challenges)***

The difference could be attributed to the medical teacher and Post graduate medical students believing that utilizing AI enabled technology needs skilled technical resources for data analysis and in processing of AI enabled machines (Figure 10).

Author Sun TQ and Medaglia R also supported similar finding in their study on “Mapping the Challenges of Artificial Intelligence”, the author framed that challenges in lack of transparency of AI algorithms and the difficulties of the AI system in processing are prevalent. Similar study on the topic by Kobayasi Y et al, mentioned that Japan is facing the shortage of skilled manpower in AI vis-à-vis a significant increased patient load in radiology which is discouraging young doctors to choose radiology field.

Further study quoted that effective implementation of AI in radiology could make it an ally otherwise would be an enemy, so this could be the reason that remaining Post graduate medical students and Heads of the department either disagreed or remained non-committal on their opinion on lack of skilled technical support as challenge was concerned.<sup>1,10</sup>

#### ***Department and lack of training in machine with AI (Challenges)***

The results attained could be due to the fact that most of AI enabled innovations are being introduced to surgical specialties (Neurosurgery, Cardiac Surgery, Spinal Surgery, GI surgery) which need to be democratized by

medical AI education program on AI enabled medical devices (Figure 11).<sup>1</sup>

### **Department and lack of trust in AI among patient (Challenges)**

The results obtained were contradictory to Pomeroy B who said that nearly 27% people were willing to undergo major surgical procedures and 36% for minor surgical procedures (Figure 12). This contradiction could be either due to the place of study being conducted or survey being directly conducted on people who are more inclined towards using AI in healthcare.<sup>22</sup>

### **CONCLUSION**

Though AI has recently entered the medical field in a limited way in India and there is large scope in the field to benefit from these techniques. In the era of modern technologies, AI enabled healthcare technologies are growing at an accelerated pace. Similarly, patients are becoming increasingly aware of the available technologies and treatment modalities for better scientific results and outcome.

The results of our study could be important in order to provide speedy and quality care to the patients while optimizing resources and relieving health care providers of repetitive and tedious tasks so that they can focus on their domain of healthcare. Also, regarding challenges of using AI in healthcare, most of respondents in this study perceived that lack of training, lack of skilled technical support, high cost of AI enabled technologies and data privacy issues are the challenges for healthcare providers. So, these issues need to be resolved first in order to overcome the initial resistance in employing AI in healthcare domain. There are a lot of opportunities for researchers to identify other significant related factors on benefits and challenges of using AI in healthcare, which could explain the reasons why the various demographic and job-related groups perceive the benefits and challenges differently. Further, views of other stakeholders involved in application in daily practice (supportive medical staff), regulating (policy makers) and the degree to which this can be embedded (IT professionals) may also be considered in future research.

### **ACKNOWLEDGEMENTS**

All the respondents who willingly participated in the study, Hemani Singh (Life science, PhD scholar) and Dr Girish Dadaji Deshmukh (Post graduate medical student) as an active supporter for the study in the benefit of general cause.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

### **REFERENCES**

1. Kobayashi Y, Ishibashi M, Kobayashi H. How will "democratization of artificial intelligence" change the future of radiologists? *Jpn J Radiol.* 2019;37(1):9-14.
2. Aminololama-Shakeri S, Lopez J E. The Doctor-Patient Relationship with Artificial Intelligence. *Am J Roentgenol.* 2019;212:308-10.
3. Sen D, Chakrabarti R, Chatterjee S, Grewal D S, Manrai K. Artificial intelligence and the radiologist: the future in the Armed Forces Medical Services. *J R Army Med Corps.* 2019;1-3.
4. Jiang F, Jiang Y, Zhi H, Dong Y, Li H, Ma S, Wang Y, Dong Q, Shen H, Wang Y. Artificial intelligence in healthcare: past, present and future. *Stroke Vascular Neurol.* 2017 Dec 1;2(4):230-43.
5. Moghadami H, Kharrat M. An Internet of Human (IoH) Framework for Improving Healthcare Business Models. *Iranian J Med Informat.* 2018 Dec 16;8(1):3.
6. Paul Y, Hickok E, Sinha A, Tiwari U. Artificial Intelligence in the Healthcare Industry in India, 2018. Available at: <https://cis-india.org/internet-governance/files/ai-and-healthcare-report>. Accessed 19 January 2018.
7. Hussain W, Ishak W H, Siraj F Artificial intelligence in medical application: An Exploration. *Health Inform Eur J.* 2002;16:1-9.
8. Nealon J, Moreno A. Agent-Based Applications in Health Care. In: Moreno A, Nealon JL, eds. *Applications of Software Agent Technology in the Health Care Domain.* Whitestein Series in Software Agent Technologies and Autonomic Computing, Birkhäuser, Basel; 2003: 3-18.
9. Schulz J P, Nakamoto K. Patient behavior and the benefits of artificial intelligence: The perils of "dangerous" literacy and illusory patient empowerment. *Patient Educ Couns.* 2013;92(2):223-8.
10. Sun T Q, Medaglia R. Mapping the challenges of Artificial Intelligence in the public sector: Evidence from public healthcare. *J Gov Inf.* 2019;36(2):368-83.
11. Ursachi G, Horodnic IA, Zait A. How reliable are measurement scales? External factors with indirect influence on reliability estimators. *Procedia Econom Finance.* 2015 Jan 1;20:679-86.
12. Maskara R, Bhootra V, Thakkar D, Nishkalank N. A Study on the perception of medical professionals towards artificial intelligence. *Int J Multidiscip Res Dev.* 2017;4(4):34-9.
13. Miotto R, Wang F, Wang S, Jiang X, Dudley J T. Deep learning for healthcare: review, opportunities and challenges. *Brief Bioinform.* 2018;19(6):1236-46.
14. AI use in European healthcare@ HIMSS Analytics/e-health trendbarometer, 2018. Available at: [https://www.himss.eu/sites/himss.eu/files/education/whitepapers/eHealth-TRENDBAROMETER-Artificial-Intelligence-May-2018\\_v1b.pdf](https://www.himss.eu/sites/himss.eu/files/education/whitepapers/eHealth-TRENDBAROMETER-Artificial-Intelligence-May-2018_v1b.pdf). Accessed 9 May 2018.



15. Walsh P. Automating Healthcare Can Improve the Patient Experience, 2018. Available at: <https://www.healthcarebusinesstoday.com/automating-healthcare-can-improve-the-patient-experience/>. Accessed 6 July 2018.
16. Kanyadi P. Using the Power of AI to Improve Staff Retention, Job Satisfaction, 2018. Available at: <https://hospitalitytech.com/using-power-ai-improve-staff-retention-job-satisfaction>. Accessed 10 October 2018.
17. Seeley R. IT Department can benefit from AI, but at high cost, 2018. Available at: <https://redmondmag.com/articles/2018/08/31/it-benefit-from-ai-vs-cost.aspx>. Accessed 6 August 2018.
18. Mcquater K. Generational gap in perceptions of AI, 2017. Available at: <https://www.research-live.com/article/news/generational-gap-in-perceptions-of-ai/id/5031632>. Accessed 6 December 2018.
19. Survey: Automated Patient Experiences Will Transform the Delivery of Care, 2018. Available at: <https://hitconsultant.net/2018/03/09/automated-healthcare-patient-experience-survey/#.XHlyE4gzbiU>. Accessed 3 September 2018.
20. Taylor B. Building trust in healthcare, AI and automated decision-making, 2018. Available at: <https://www.healthcareglobal.com/technology/building-trust-healthcare-ai-and-automated-decision-making>. Accessed 29 June 2018.
21. Groover M C. Automation, 2019. Available at: <https://www.britiana.com/technology/automation>. Accessed 6 January 2019.
22. Pomeroy B. Health Perspectives: Are people ready to embrace artificial intelligence and robotics in healthcare? Available at: [https://pwc.blogs.com/health\\_matters/2017/04/are-people-ready-to-embrace-artificial-intelligence-and-robotics-in-healthcare.html](https://pwc.blogs.com/health_matters/2017/04/are-people-ready-to-embrace-artificial-intelligence-and-robotics-in-healthcare.html). Accessed 11 June 2018.

**Cite this article as:** Singh B, Kashyap S, Grover A. Artificial intelligence and dichotomy on benefits and challenges: what do healthcare providers say?. *Int J Res Med Sci* 2019;7:3251-9.