

ARTIFICIAL INTELLIGENCE

National study on use of artificial intelligence in breast disease and cancer

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ABSTRACT

BACKGROUND: The aim of this study was to examine the thoughts, reservations, approaches and perspectives on the future of artificial intelligence (AI) held by physicians specializing in breast healthcare in our country.

METHODS: Our survey was sent to the members of the Federation of Turkish Breast Disease Associations (MHDF) by e-mail. The survey investigates the attitudes towards the use of AI in breast disease and cancer, including demographic characteristics of the participants, their daily practice and approaches, and their stance on the future.

RESULTS: The questionnaire was sent to a total of 1,890 people via e-mail. 108 (40.1 %) participants believed that the use of AI in breast disease would improve their field of expertise moderately, 103 (38.3 %) expected this improvement to be considerable. 169 (70.3 %) respondents identified 'rapid diagnosis' as the most important advantage of AI. 123 (45.7 %) participants considered concerns about potential medical errors and liability issues to be the most worrying aspects of AI.

CONCLUSION: According to our study, the use of AI technology in the diagnosis and treatment of breast disease and cancer seems to be beneficial for both physicians and patients. However, physicians have some concerns about possible medical errors and liability issues that AI might cause (Tab. 1, Ref. 25). Text in PDF www.elis.sk

KEY WORDS: breast diseases, artificial intelligence, cancer, surveys and questionnaires.

Introduction

The current scientific era is undergoing a digital revolution, where Artificial intelligence (AI) technologies play a crucial role and have become the touchstone of our digital age (1, 2). The deep learning of computers, machine learning, etc. used in the field of healthcare can all be collected under the heading of 'AI technologies'.

This rapid digitalization and increased opportunity to use AI is helping to innovate the approach to breast disease and cancer in medical sciences (3). Breast cancer is the most common malignancy in women and the leading cause of cancer death. Now, with the help of AI, there is more optimism for a universal resolution to this important public health problem (4, 5).

Efforts to develop AI technologies for an early diagnosis and best treatment of breast disease and cancer are increasing, particularly in areas where image processing is possible, such as radiology and pathology (6, 7). The recently published study highlighted the great potential of AI technologies to change the routine practice of radiological breast cancer screening, so important in the early diagnosis of breast cancer (8). An early diagnosis of breast cancer and appropriate risk analysis are crucial for the treatment of this disease and there are new studies reporting the use of big data and AI to achieve an earlier diagnosis of breast cancer (9). In the multidisciplinary treatment of breast cancer, in addition to experience-based medicine, AI technologies are now being developed in the fields of surgery, oncology and radiation oncology, to offer the patients the opportunities for personalized treatment (4, 10, 11).

All these technological advances in AI have historically changed the diagnosis, treatment, and management of breast disease. The aim of this study was to evaluate the impact of AI on approaches to breast disease and cancer among the physicians specializing in breast health in our country, with a national survey. Our survey examined the opinions held by such physicians on AI; their reservations, approaches and outlook for the future. As a novel study on this specific subject matter, we believe that it could fill an important research gap in national and international arenas.

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Tab. 1. The survey questions and answers.

THE QUESTIONNAIRE	n	%
What is your age?		
30–40	63	(23.4%)
40–50	105	(39%)
50–60	78	(29%)
60–70	23	(8.6%)
What is your profession?		
Surgeon	92	(34.2%)
Radiologist	47	(17.5%)
Pathologist	51	(19%)
Medical Oncologist	34	(12.6%)
Radiation Oncologist	45	(16.7%)
If you use AI in your specialist practice, how often do you use it?		
I never use it.	218	(81%)
I use it on a daily basis.	20	(7.4%)
I use it on a weekly basis.	14	(5.2%)
I use it on a monthly basis	11	(4.1%)
I use it on a yearly basis	6	(2.2%)
Which specialization related to care of breast disease and cancer do you think will be impacted by AI the soonest and the strongest?		
Surgeon	29	(10.8%)
Radiologist	149	(55.4%)
Pathologist	26	(9.7%)
Medical Oncologist	45	(16.7%)
Radiation Oncologist	20	(7.4%)
What is your greatest concern for the future related to the use of AI in breast disease and cancer? (There may be more than one option.)		
Losing my job	47	(17.5%)
Increased medical error and liability issues	123	(45.7%)
Possible AI dependency	106	(39.4%)
Concerns about big data sharing	95	(35.3%)
Unethical decision-making or violations of ethical values	107	(39.8%)
I am not concerned	47	(17.5%)
Misdirection of artificial intelligence	1	(0.4%)
Who will have medicolegal responsibility?	1	(0.4%)
Legal approaches on legal liability	1	(0.4%)
What is the most important advantage gained by using AI in your approach to breast disease and cancer? (There may be more than one option.)		
Rapid diagnosis	169	(70.3%)
Economical and inexpensive response	69	(25.7%)
Evaluation of the patient in more detail	145	(53.9%)
Examination of higher number of patients	135	(50.2%)
Ease of accessibility	85	(31.6%)
What is your knowledge about AI in breast disease and cancer?		
I have no information	73	(27.1%)
I have only a little knowledge	133	(49.4%)
I am moderately knowledgeable.	55	(20.4%)
I am very knowledgeable	8	(3%)
Have you ever used AI in your practice for breast disease and cancer?		
I have never used it	217	(80.7%)
I use it occasionally	33	(12.3%)
I use it moderately	13	(4.8%)
I use it frequently	6	(2.2%)
Do you believe it is necessary to use AI in breast disease and cancer?		
It is not necessary at all	3	(1.1%)
It is somewhat necessary.	75	(27.9%)
It is moderately necessary.	88	(32.7%)
It is very necessary.	73	(27.1%)
I have no idea.	30	(11.2%)

Materials and methods

The questionnaire used for this survey study was designed by a team of four people specializing in the treatment of breast disease and cancer in our hospital and using Google Drive. A test version was launched with a group of 20 specialist physicians from different branches and necessary improvements were made based on their feedback.

The approval for this survey was obtained from the local ethics committee of the Health Sciences University, Izmir Tepecik Training and Research Hospital.

The final questionnaire was sent to the members of the Turkish Federation of Breast Disease Associations (MHDF) by e-mail, with a brief information, between 26 May and 27 June 2021. Members of the Federation (MHDF) comprised general surgeons (breast surgeons), radiologists, pathologists, medical oncologists, radiation oncologists (registrars, associate professors, professors) working in different parts of the country. Respondents were denied access to the survey for the second time. Our survey was conducted online only and no gifts and/or payments were made to the respondents.

Instead of referring to individual terms such as: algorithm, deep learning or machine learning, the umbrella phrase ‘AI’ was used throughout. The questionnaire consisted of 20 questions in total, 19 of which were closed-ended and one of which was open-ended. The demographic characteristics of the participants and their attitudes to using AI technologies in the care of breast disease and cancer were investigated, including their approaches, daily practice, and outlook for the future. Respondents, who did not fill out the questionnaire completely and those, who returned it after the deadline were excluded from the study. As respondents were free to decide whether to complete the questionnaire, its completion was considered as tacit consent for the use of the questionnaire data.

Statistics

In our study, the results are presented as a descriptive statistical analysis.

Tab. 1.

Do you believe that AI in breast disease will improve the fields of application within your area of expertise?		
It will bring no improvement	3	(1.1%)
It will bring a small improvement.	37	(13.8%)
It will bring a moderate improvement.	108	(40.1%)
It will bring great improvement.	103	(38.3%)
I have no idea.	18	(6.7%)
Will AI have a noticeable impact in ≤5 years in terms of diagnosis and treatment of breast disease and cancer?		
It will have no impact.	11	(4.1%)
It will have some impact.	98	(36.4%)
It will have a moderate impact.	93	(34.6%)
It will have a great impact.	49	(18.2%)
I have no idea.	18	(6.7%)
Do you believe that AI will have a noticeable impact on the diagnosis and treatment of breast disease and cancer in ≤ 10 years?		
It will have no impact.	1	(0.4%)
It will have some impact.	34	(12.6%)
It will have a moderate impact.	76	(28.3%)
It will have a great impact.	144	(53.5%)
I have no idea.	14	(5.2%)
How would you evaluate the effectiveness of AI in the clinical diagnosis of breast disease and cancer?		
It is not effective at all.	14	(5.2%)
It is somewhat effective.	59	(21.9%)
It is moderately effective.	97	(36.1%)
It is very effective.	53	(19.7%)
I have no idea.	46	(17.1%)
In terms of breast disease and cancer, does AI provide advantages in the early diagnosis and risk analysis of breast cancer with the use of big data?		
It gives no advantages.	3	(1.1%)
It gives some advantages.	39	(14.5%)
It gives moderate advantages.	87	(32.3%)
It gives many advantages.	122	(45.4%)
I have no idea.	18	(6.7%)
How would you evaluate the effectiveness of AI in breast cancer screening?		
It is not effective at all.	3	(1.1%)
It is somewhat effective.	48	(17.8%)
It is moderately effective.	91	(33.8%)
It is very effective.	85	(31.6%)
I have no idea.	42	(15.6%)
How would you evaluate the effectiveness of AI in the pathological evaluation of breast disease?		
It is not effective at all.	12	(4.5%)
It is somewhat effective.	56	(20.8%)
It is moderately effective.	88	(32.7%)
It is very effective.	56	(20.8%)
I have no idea.	57	(21.2%)
How would you evaluate the effectiveness of AI in the radiological evaluation of breast disease?		
It is not effective at all.	7	(2.6%)
It is somewhat effective.	35	(13%)
It is moderately effective.	93	(34.6%)
It is very effective.	99	(36.8%)
I have no idea.	35	(13%)
How reliable do you find AI in guiding treatment for breast disease and cancer?		
It is not reliable at all.	13	(4.8%)
It is somewhat reliable.	89	(33.1%)
It is moderately reliable.	150	(55.8%)
It is very reliable.	17	(6.3%)

Results

The survey was sent to a total of 1,890 physicians via e-mail, and 269 (14.2 %) participants completed all the questions. The highest rate of reply came from the general surgeons: 92 (34.2 %). 149 (55.4 %) of the participants defined radiology as the specialty related to breast disease and cancer most affected by AI. 123 (45.7 %) participants considered concerns about potential medical errors and liability issues to be the most worrying aspects of AI.

In the answer to the same open-ended question on where the medicolegal responsibility would lie, one participant mentioned his worries about legal responsibility, while the second participant expressed concerns about being misled by AI.

169 (70.3 %) of the respondents believed the most important advantage of AI to be a rapid diagnosis. When participants were questioned about their knowledge of AI use in breast disease and cancer, 133 (49.4 %) reported having a little knowledge while 73 (27.1 %) had no knowledge at all. 217 (80.7 %) participants claimed never to have actually used AI for breast care in daily practice. When asked about the necessity of using AI in this area, 88 (32.7 %) of the participants thought that it was moderately necessary. 108 (40.1 %) participants thought that AI would improve their specializations in breast diseases to a moderate degree while 103 (38.3 %) thought it could bring great improvement.

49 physicians (18.2 %) predicted that the impact of AI on the diagnosis and treatment of breast disease would be very high within ≤ 5 years, and 144 (53.5 %) expected this to happen within ≤ 10 years.

93 of the participants (34.6 %) defined the effectiveness of AI in clinical diagnosis as moderately effective. 122 (45.4 %) of the participants thought that the use of AI and big data could provide many advantages for an early diagnosis and risk analysis of breast cancer. 87 (32.3 %) participants defined the effectiveness of AI in screening programs to be moderate, while 98 (36.7 %) believed AI to be very effective in breast radiology. AI was found to be moderately reliable as a treatment guide by 150 (55.8 %) participants.

Tab. 1.

How do you think AI should be used in the future for the treatment of breast disease and cancer?		
I find the potential use of AI disturbing.	4	(1.5%)
I believe it should be used partially.	60	(22.3%)
I believe there should be an approx.50/50 collaboration between the physician and AI.	195	(72.5%)
I believe all the treatment should be handled by AI.	5	(1.9%)
I have no idea.	5	(1.9%)
Does the future of AI use in the treatment of breast disease and cancer alarm you?		
I am not at all alarmed.	150	(55.8%)
I am a little alarmed.	70	(26%)
I am moderately alarmed.	30	(11.2%)
I am extremely alarmed.	3	(1.1%)
I have no idea.	16	(5.9%)

In our survey, 195 (72.5 %) respondents identified the need for a 50/50 collaboration between physician and AI in the future. When asked whether the future AI use in treating breast disease and cancer was alarming, 150 (55.8 %) participants stated that they were not afraid at all. The survey questions and answers are shown in Table 1.

Discussion

Our results showed that doctors specializing in the treatment of breast disease believed that using AI for the breast disease and cancer is of benefit to both physicians and patients. Currently, most physicians in our survey do not use AI; however, they expect the use of AI for breast disease to increase over time. It was also suggested that a 50/50 collaboration between physicians and AI seemed appropriate for the future. While physicians were not alarmed by the idea of using AI in the future, they did have important reservations regarding ethics, medical errors and legal responsibility.

To our knowledge, this survey on the use of AI by physicians working in the field of breast disease and cancer is the first such survey to be carried out either nationally or internationally.

According to our survey, it seems that AI technologies will improve breast disease and cancer care for both physicians and patients. The global population is growing rapidly, and the incidence of breast cancer is on the rise; therefore, the requirements (labor and financial needs) for breast disease screening, diagnosis and treatment are constantly increasing.

In fact, breast cancer currently accounts for approximately 30% of malignancies in women (12). According to one study, physicians spend 27 % of their clinic time on face-to-face communication with their patients, but 49 % of their time on the computer reviewing patient records and carrying out office work (13). Besides this paperwork, physicians must constantly strive to keep up to date with a constantly renewing bank of medical knowledge.

These stark realities highlight the difficulties inherent in managing important health problems, namely, the optimal diagnosis and treatment of breast disease and cancer. Fortunately, it seems that AI-driven healthcare technologies can be used to address many

of these and other system-related challenges (14). Indeed, thanks to these technologies, a better and quicker service can be offered to a larger number of patients. Schwalbe N. et al. suggest that simultaneous advances in the infrastructure of information technology and mobile computing power are a cause for optimism that AI can be used to address health challenges in many societies. They emphasize the increasing importance of AI technologies in early diagnosis and rapid treatment, as well as for detailed analysis and determining the prognosis of a disease (15).

There is certainly a paradigm shift in the management and direction of general

health affairs and AI is thought capable of reducing the errors of human clinical practice (16). When asked about the urge to use AI in breast disease and cancer, the participants in our study defined it as either moderately necessary (32.7 %) or very necessary (27.1 %).

In addition, the use of AI was thought to bring advantages for patients such as a rapid diagnosis (70 %), a more detailed evaluation (54.3 %), and examination of a larger number of patients (49.8 %). Our survey concluded that the use of AI in breast disease would lead to improvements in medical specialization fields at either a high (38.3 %) or moderate (40.1 %) level. These results showed that physicians could manage a larger number of patients with the help of AI technologies. In the future, if more appropriate patient care can be provided, as physicians work together with AI to treat breast cancer and disease, the increasing needs of breast cancer patients in society could be met. Early and detailed diagnosis of breast cancer will be possible; better treatment of more patients can be planned. We believe that such technological developments can help breaking the tyrannical hold breast cancer has over women.

Our study showed that while AI is not currently used to a large extent in the treatment of breast diseases and cancer, its use in this field is expected to increase over the next decade. Breast disease is reported as one of the most common types of disease seen in surgical outpatient clinics (17). Meanwhile, information technology and digitalization are developing in the field of healthcare, and there are efforts to use it more extensively, especially in breast disease (6, 7, 18). As far as we can observe, AI is not widely practiced in all specialties that manage breast disease and cancer care. However, it is under an intensive research and there are high expectations that physicians will be able to use AI to assist them in their daily practices soon (14, 15, 19). Despite these high expectations, the study conducted in Germany reported that there are still few practical applications of artificial intelligence in the clinical use. In the same paper, physicians argued the need for robust studies on the practical application of AI (20). In our study, 81.3 % of the participants reported not using AI technology in their daily work with breast disease. This situation is similar according to one in literature. However, our participants also reported their expecta-

tion that the visible effect of AI on breast disease and cancer care would continue to increase over the next 5–10 years. Based on these results, it seems that our participants expect the impact of AI to be very strong in 10 years' time, although not in the near future or within 5 years.

Furthermore, our study participants reported being unafraid of using AI technologies in the care of breast diseases and cancer in future and felt that it would be appropriate to work in cooperation with AI. However, despite this willingness, they did have some concerns. Each new technological innovation leads to a change in societal attitudes, especially when this technology may replace an individual's job, so an increase in the anxiety felt by physicians is understandable. There were similar concerns when computers were first used in medicine (21). However, AI differs from computers as AI technology that can directly replace the physician's job is actually being developed (1, 2). Previously, it was thought that AI would replace doctors (21), although this has not yet happened. Recent developments on this issue have been rapid but have still not come to fruition. In the recent survey, health workers reported their concerns that AI technologies would take over their jobs (22). In another study, the majority of doctors refuted the idea that artificial intelligence would replace them, and the same study reported that physicians believed AI could be of benefit to them in the future for both diagnosis and treatment (23). In another published study, physicians identified a high cost and a lack of human touch as disadvantages of AI, despite being aware of other advantages in medical practice (24).

In our study, approximately 55.8 % of the participants stated that they were not alarmed by AI at all and emphasized that it would be appropriate to work in full cooperation (50/50) with AI in future. Clearly, the huge amount of data produced on breast disease and breast cancer can be more easily processed and applied with the help of AI, thus providing great convenience for both patients and physicians. However, some potential ethical issues of AI use in healthcare are still unresolved. In addition to ethics, our questionnaire describes physicians' concerns about medical errors and the allocation of responsibility. It seems likely that the focus will be on resolving these important issues as the use of AI technologies in the approach to breast disease is further developed.

Our survey judged that the field of specialization within breast healthcare affected the soonest and most profoundly by AI would be radiology. Studies on image processing have been carried out for many years within this discipline, with radiology image processing technologies described in literature as the most commonly studied use of AI in medicine (6, 19, 25). Recent studies have reported successful screening programs using AI for the early diagnosis of breast cancer (8) and these results have the potential to fundamentally change screening procedures. These are exciting developments in the early diagnosis of breast cancer. In our study, radiology was selected by a wide margin as the branch of specialization that would benefit the most by AI compared to other specialties. Therefore, we conclude that in this digital age, physicians should closely follow literature for developments in radiology.

Limitations: This original study has some limitations. Firstly, subgroup analysis could not be performed due to low numbers in the groups. Secondly, the survey questions and their resulting answers are somewhat subjective. Last of all, doctors from other specialty roles involved in the treatment of breast cancer were not included in the survey.

Conclusion

Our survey concludes that the use of AI technology in the care of breast disease and cancer is beneficial for both physicians and patients. Most physicians in this field do not use AI in their daily practice but consider it appropriate to work in collaboration with AI in the future. Physicians should not be reluctant to adopt AI technologies in their professional lives. Physicians have identified concerns about the use of AI in relation to ethics, medical errors, and the question of responsibility. They also expect AI to impact the branch of radiology the soonest and most deeply. There is a need for further well-planned, more comprehensive, and detailed survey studies on this popular topic.

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