Review Article

DIGITAL HEALTH

DIGITAL HEALTH
Volume 10: 1–11

DOI: 10.1177/20552076241230075
journals.sagepub.com/home/dhj

Sage

Beliefs, experiences and concerns of using artificial intelligence in healthcare: A qualitative synthesis

Carol-Ann Fazakarley[1], Maria Breen[2], Ben Thompson[1], Paul Leeson[3] and Victoria Williamson[4]

Abstract

Objective: Artificial intelligence (AI) is a developing field in the context of healthcare. As this technology continues to be implemented in patient care, there is a growing need to understand the thoughts and experiences of stakeholders in this area to ensure that future AI development and implementation is successful. The aim of this study was to conduct a literature search of qualitative studies exploring the opinions of stakeholders such as clinicians, patients, and technology experts in order to establish the most common themes and ideas that have been presented in this research.

Methods: A literature search was conducted of existing qualitative research on stakeholder beliefs about the use of AI use in healthcare. Twenty-one papers were selected and analysed resulting in the development of four key themes relating to patient care, patient–doctor relationships, lack of education and resources, and the need for regulations.

Results: Overall, patients and healthcare workers are open to the use of AI in care and appear positive about potential benefits. However, concerns were raised relating to the lack of empathy in interactions of AI tools, and potential risks that may arise from the data collection needed for AI use and development. Stakeholders in the healthcare, technology, and business sectors all stressed that there was a lack of appropriate education, funding, and guidelines surrounding AI, and these concerns needed to be addressed to ensure future implementation is safe and suitable for patient care.

Conclusion: Ultimately, the results found in this study highlighted that there was a need for communication between stakeholder in order for these concerns to be addressed, mitigate potential risks, and maximise benefits for patients and clinicians alike. The results also identified a need for further qualitative research in this area to further understand stakeholder experiences as AI use continues to develop.

Keywords

artificial intelligence < general, qualitative < studies, systematic reviews < studies, digital health < general, machine learning < general

Submission date: 19 December 2022; Acceptance date: 16 January 2024

Introduction

The use of Artificial intelligence (AI) in healthcare is a growing field across multiple specialities in medicine. Healthcare has become increasingly complex, and organisations across the globe are facing growing workloads, with many struggling to meet patient demand for services.[1] AI is expected to alleviate many of the challenges faced by healthcare professionals[1,2] and has already been applied

[1]Ultromics Ltd, Oxford, UK
[2]Breen Clinical Research, London, UK
[3]RDM Division of Cardiovascular Medicine, University of Oxford, John Radcliffe Hospital, Oxford, UK
[4]King's Centre for Military Health Research, King's College London, London, UK

Corresponding author:
Victoria Williamson, King's Centre for Military Health Research, King's College London, London UK Email: victoria.williamson@kcl.ac.uk

in a multitude of contexts in healthcare, such as diagnostic aids[3] and healthcare management,[4] with studies reporting improved efficiency and the potential for improved patient outcomes.[4]

Due to this increase in research and implementation of AI in healthcare, it has become ever more important to understand the perceptions of those who will be impacted by the technology. Key stakeholders such as clinicians, technology experts, and patients are, and will be, affected by AI use in a variety of ways, and there has already been some exploration into the experiences of these individuals. Quantitative studies conducted using surveys have found that healthcare staff and patients are open to the use of AI tools, with many believing they will improve diagnosis and patient care.[5,6] For example, a survey study of 329 patient experiences of an AI symptom checker found that 84.1% of participants found it to be a useful diagnostic tool, with 91.4% reporting that they would use the tool again. Furthermore, nearly half of the participants discussed the AI diagnosis with their clinician, and most felt that their clinician was more open to discussing the AI results than not (60.2% vs 20.4%).[6] However, patients and professionals also share many concerns, such as data protection, when considering the implementation of AI tools in the care pathway.[7,8] Clinicians have also raised specific issues such as reliance on the new technology[9] which may reduce clinician experience or skill, or the potential of reducing the workforce in specialties such a radiology.[10] Only by thoroughly understanding the thoughts and needs of those who will be involved in the use of AI in healthcare can future acceptability and implementation be improved.

However, it is important to note that the perspectives and experiences of the individuals are likely to be highly subjective, as stakeholders will rarely have the exact same thoughts and opinions on the subject. Therefore, while useful, the findings of quantitative studies in this area are relatively restrictive as closed survey questions do not often allow for participants to provide additional detail surrounding their responses. On the other hand, qualitative methods allow for the exploration of subjective views and experiences, providing in-depth insight into participants thoughts and opinions that may otherwise be missed by quantitative methods,[11] as participants are able to express their views in their own words. Whilst several qualitative studies exploring stakeholders perspectives of using AI in patient care exist, to date, a synthesis and evaluation of the available data remains outstanding. The aim of this study is to review current UK and international qualitative studies that have explored the views of key stakeholders regarding the use of AI in healthcare. A synthesis of the themes and ideas reflected in the selected studies will be conducted in order give broad understanding of the current opinions of those impacted by AI adoption.

Methods

Search strategy

A systematic search was conducted to find eligible studies investigating stakeholders' opinions on the use of AI in healthcare settings that used qualitative methods. The search was conducted between February and March 2022, and included papers published in the last 10 years. The initial searches were conducted on PubMed, PsychInfo, ResearchGate, and Google Scholar using key terms relating to AI, healthcare, various stakeholder groups, and qualitative methods that are presented in Supplementary Material 1. Reference lists of reviewed articles, book chapters, and issues of journals were manually searched to identify any other potentially eligible articles.

Eligibility criteria

A paper was eligible for inclusion if it used qualitative methods, had research questions relating to AI in a healthcare setting, and included a key stakeholder group relating to AI in healthcare (e.g. clinicians, technology experts, or patients). Mixed-method studies were also included if they reported qualitative methods and analysis. Papers were excluded if they did not offer new data (e.g. reviews and editorials), if they were case studies, if the data collection/analysis was purely quantitative in nature, if the full text was unobtainable, or if they were not published in English.

The initial search produced 413 papers, which was reduced to 401 after duplicates were removed. After reviewing the titles and abstracts of the papers, 229 were excluded based on the exclusion criteria. The full text of 75 papers were screened to ensure their suitability for inclusion, with papers not meeting the listed eligibility criteria being excluded at this stage. A total of 54 papers were excluded, with 21 papers meeting inclusion criteria. A preferred diagram for reporting items for systematic reviews and meta-analyses (PRISMA) demonstrating this process is presented in Figure 1. Additional detail is provided in a PRISMA checklist, presented in Supplementary Material 2. Author CAF conducted the initial search, exclusions, and full paper reviews. All reasons for exclusion were recorded at each stage. The final 21 papers were then additionally reviewed by author VW, with no discrepancies occurring between the two authors.

The suitability of the papers was assessed according to the Critical Appraisal Skills Programme (CASP), which measures the quality of the paper based on a number of features such as sample size, methodology, and presentation of findings. Studies could receive a score between 0 and 10, with 10 indicating a paper of optimal quality. Papers that were considered to lack multiple items listed in the CASP received lower scores.

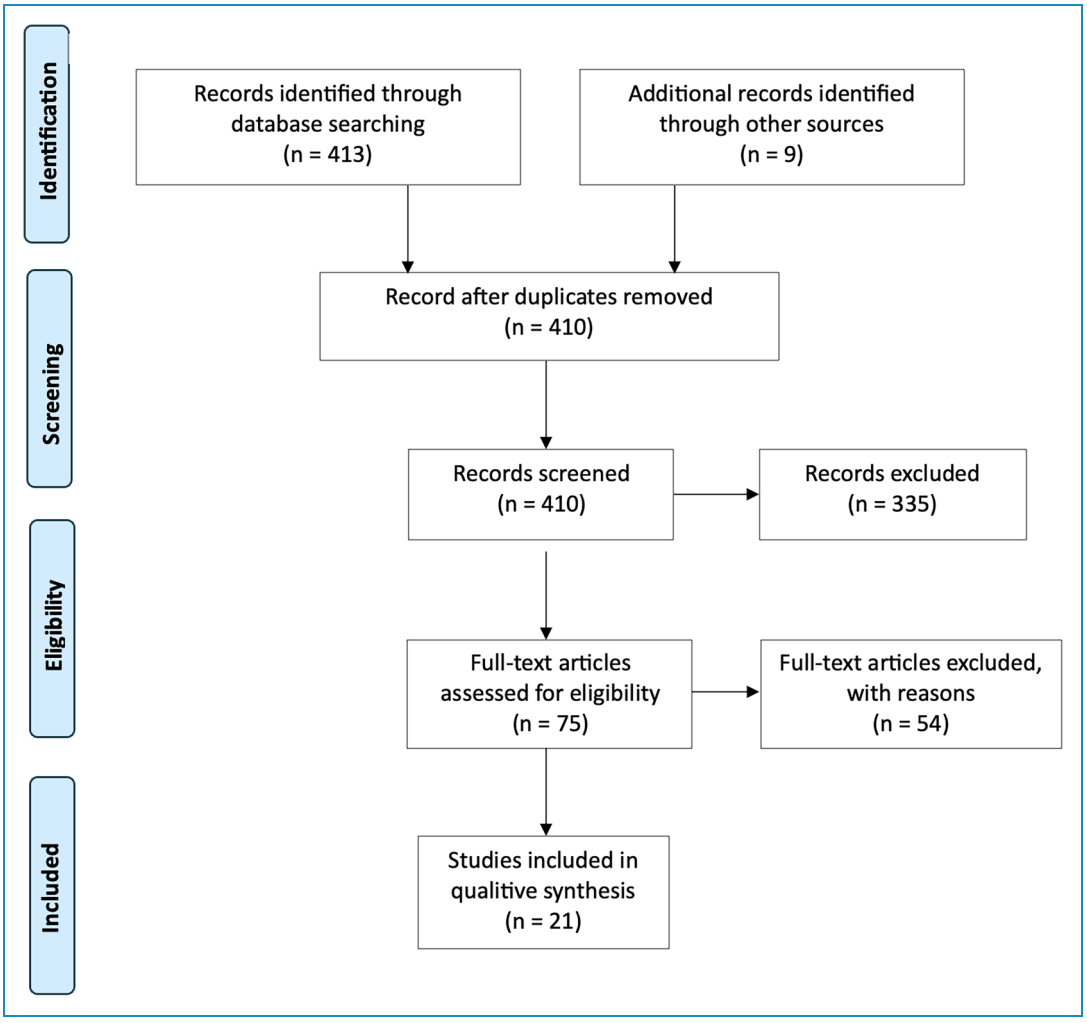

Figure 1. PRISMA diagram.

Data extraction

The characteristics of the 22 included papers can be found in Table 1. The following data were extracted from the full text of each paper: publication year, study design, study location, type of participants included (e.g. healthcare worker, IT expert, patient), data collection method (e.g. interview, focus group), sample size, gender distribution, participant age, all AI in healthcare relevant findings, data analysis method, and sources of bias or ethical issues. In order to extract this data, author CAF systematically reviewed each section of the papers for relevant details. Extracted data were checked by VW. The results were recorded as detailed as possible across all papers to ensure adequate data to include in the synthesis.

Data analysis

After extracting the results of each study, the relevancy of the findings to our review aims were examined. The findings that were relevant were synthesised using thematic analysis.[11] The results were first open coded by the first author (CAF), a process where concepts are allocated into categories based on their properties.[11] These categories were identified by words or short phrases (for example, benefit: reduced workload), that described the concepts within the category. This was achieved by reading the findings several times, examining relationships between the different results and key ideas and overarching concepts were ascertained.

After analysing the data of all included studies, authors (CAF, VW) discussed the initial results and further refined the identified codes/themes.[11] Following the open coding of the extracted data of the included studies, the identified concepts were clustered in relationship to one another.[11] This process was carried out in two ways: (a) on the frequency with which the concept was found in the studies, signifying how effective the concept is[11] and (b) by the subject or topic that the themes related to, which we termed the domains.[11] Each concept that arose from the process of open coding the articles was organised into domains, with each domain pertaining to a central theme.

Table 1. Articles included in qualitative synthesis.

No.	Study	Study location	Year	N	Males (%)	Age range	Stakeholder group	Participant experience of AI (specific tool or general)	Data collection	Analysis method	Quality score
1.	Antwi, Akudjedu, & Botwe[12]	Africa	2021	475	76	N/A	Radiographers	General	Web-based survey (including closed and open-ended questions)	Content Analysis	10
2.	Barnett, Savic, Pienaar, Carter, Warren, Sandral, et al.[13]	Australian	2021	28	54	22–76	Patients, counsellors	Specific, experience of online 'chatbot' prior to interview	Semi-structured interviews, focus groups	Thematic Analysis	8
3.	Blease, Kharko, Annoni, Gaab, & Locher[14]	Switzerland	2021	37	19	N/A	Students (psychology and psychotherapy)	General	Web-based survey (including closed and open-ended questions)	Iterative Analysis	8
4.	Blease, Locher, Leon-Carlyle, & Doraiswamy[15]	Global	2020	791	70	25–65 +	Psychiatrists	General	Web-based survey (including closed and open-ended questions)	Descriptive content analysis	9
5.	Buck, Doctor, Hennrich, Jöhnk, & Eymann[16]	Germany	2022	18	50	34–70	GPs	General	Semi-structured interviews	Grounded Theory	8
6.	Chen, Stavropoulou, Narasinkan, Baker, & Scarbrough[17]	UK	2021	26	N/A	N/A	Radiographers and radiologists	General	Semi-structured interviews	Thematic Analysis	9
7.	Dawoodbhoy, Delaney, Cecula, Yu, Peacock, Tan, & Cox[18]	UK	2021	20	N/A	N/A	Healthcare practitioners, AI experts	General	Semi-structured interviews	Thematic Analysis	9
8.	Goetz, Arnetz, Sudan, & Arnetz[19]	Italy	2020	12	N/A	N/A	Students (medical, engineering and computer science)	General	Focus groups	Inductive Analysis	8

(continued)

Table 1. Continued.

No.	Study	Study location	Year	N	Males (%)	Age range	Stakeholder group	Participant experience of AI (specific tool or general)	Data collection	Analysis method	Quality score
9.	Hui, McKinstry, Fulton, Buchner, & Pinnock[20]	UK	2021	24	33	16–65 +	Patients, clinicians	Specific, presented images of smart devices and data prior to interview	Semi-structured interviews	Framework Analysis	10
10.	Jussupow, Spohrer, & Heinzl[21]	Germany	2022	227	34	N/A	Physcians	Specific, presented with vignette of AI system prior to survey	Web-based survey (including closed and open-ended questions)	Content Analysis	9
11.	Karim, Sandu, & Kayastha[22]	Jordan	2021	35	N/A	N/A	AI and cyber security experts, government and non-government officials, IT educators and academics, students	General	Semi-structured interviews	Thematic Analysis	8
12.	Kocaballi, Ijaz, Laranjo, Quiroz, Rezazadegan, Tong, et al.[23]	Australia	2020	16	63	N/A	GPs	Specific, presented video of AI assistant during focus groups	Focus groups	Thematic Analysis	9
13.	Kueper, Terry, Bahniwal, Meredith, Beleno, Brown, et al.[24]	Canada	2022	35	N/A	N/A	Healthcare providers, patient advisors, decision-makers, digital health stakeholders, researchers	Specific, presented primers introducing core AI concepts during focus groups	Focus groups	Nominal Group Technique	8
14.	Laï, Brian, & Mamzer[25]	France	2020	40	N/A	N/A	Physicians, industry experts, AI researchers	General	Semi-structured interviews	Grounded Theory	8
15.	Morrison[26]	UK	2021	12	100	23–52	Clinicians, researchers, regulatory personnel	General	Semi-structured interviews	Thematic Analysis	10
16.	Musbahi, Syed, Le Feuvre, Cobb, & Jones[27]	India	2021	28	39	23–79	Patients	General	Focus groups	Nominal Group Technique	8

(continued)

Table 1. Continued.

No.	Study	Study location	Year	N	Males (%)	Age range	Stakeholder group	Participant experience of AI (specific tool or general)	Data collection	Analysis method	Quality score
17.	Rainey, O'Regan, Matthew, Skelton, Woznitza, Chu, et al.[28]	UK	2021	411	26	18–65 +	Radiographers	General	Web-based survey (including closed and open-ended questions)	Thematic Analysis	8
18.	Schneider-Kamp[29]	Denmark	2021	27	7	28–57	Nurses, social care assistants	Specific, previous use of AI-enhanced care integration system prior to interview	Focus groups	Thematic Analysis	9
19.	Sujan, White, Habli, & Reynolds[30]	UK	2022	26	N/A	N/A	Patients, hospital staff, technology developers, regulators	Specific, presented example clinical case with different levels of AI support prior to interview	Semi-structured interviews	Thematic Analysis	8
20.	Tam-Seto, Wood, Linden, & Stuart[31]	Canada	2021	44	N/A	N/A	Patients, caregivers, healthcare providers	Specific, presented example of AI-supported mobile app prior to interview/focus group/survey	Semi-structured interviews, focus groups and web-based survey	Content Analysis	10
21.	Thenral, & Annamalai[32]	India	2021	46	67	N/A	Psychiatrists, patients, technology experts, CEOs in health technology	General	Semi-structured interviews	Grounded Theory	8

Note. General = Participants existing experience of AI that was not related to a specific example prior to the study.
AI: artificial intelligence.

Concepts and domains were then defined in detail and expanded.[11] Microsoft Excel was used to organise the data and facilitate analysis. Peer debriefing was carried out with input from co-authors (PL, MB, BT) sought who have expertise in AI tools, healthcare, and qualitative methodologies.

All AI in healthcare findings included in this review were reported by stakeholders in this field, including doctors, patients, counsellors, healthcare and computer science students, and technology and business experts. Participant demographic information (e.g. sample size, age, gender) and type of role were considered when assessing and constructing the themes related to perceptions of AI in healthcare.

Results

Paper characteristics

Twenty-two papers were included in the final analysis for this study. All the papers were published between 2019 and 2022, potentially demonstrating that the use of AI in healthcare has become increasingly important in recent years. Half of the selected studies conducted semi-structured interviews, five organised focus groups, and five utilised web-based surveys that included both closed and open-ended questions. One study combined the use of interviews and focus groups, and one other utilised all three methods in their research. Many of those who conducted interviews or focus groups conducted a proportion online or over the phone. The most common analytic method in the papers was thematic analysis, with nine studies applying this method. Content analysis was utilised by four studies, grounded theory by three, and the remaining studies utilising a number of other analysis methods. The specific method used by each study can be found in Table 1.

In relation to quality, all studies received a CASP score of 8 or more, indicating papers of very high quality. Studies that included multiple stakeholder groups included similar numbers from each group to ensure adequate representation. The stakeholders included in the studies were varied, ranging from clinicians and patients, to AI experts and government officials. Many studies chose to include a combination of stakeholders (such as healthcare practitioners as well as AI experts); however, the most common stakeholder group featured in the studies was clinical staff, with 17 studies including these stakeholders as participants, A full list of stakeholder groups and their respective studies can be found in Table 1. The four largest studies only included physicians and represented 82% of the total participants, of this group nearly half (45%) were radiographers.

Many of those that included healthcare providers, especially those that included GPs, ensured that the participants included had a minimum amount of professional experience (for example, 1 year) to ensure adequate understanding of the profession. With regard to the questions featured in interview guides, focus groups and questionnaires, studies focused on topics relating to the impact of AI on patient experience, clinical practice, and potential concerns. Most studies also examined the potential benefits and challenges that may arise due to the implementation of this technology, with some asking participants to suggest solutions to the issues discussed. Three studies presented specific examples of AI tools that could be implemented in patient care and asked participants to provide their thoughts based on the example given. Several studies also chose to directly ask the participants' understanding of AI prior to completing the study, with many reporting how this may have influenced their findings. Across the included studies, AI was generally understood as a piece of software that processed data in order to provide assistance in some way to the user, for example with decision making or disease management.

Results of qualitative analysis

Although the studies varied in their methodology, participants, and topics, there were several themes relating to AI in healthcare that were repeatedly reported across the selected papers. These themes and the related concepts that were featured in the extracted findings are expanded upon below:

Relieving workload and improving care

Nearly all the featured papers (n = 20) reported themes or ideas relating to relieving the workload of healthcare workers and improving patient care, with a variety of suggestions gathered from participants across different stakeholder groups (including healthcare workers, patients, and technology experts). AI was predominantly identified as a tool that could take on routine and administrative tasks which would allow clinicians to focus on more complex aspects of patient care. Specific ideas included reducing the time taken to transcribe notes, making predictions of treatment paths and potential risks. For example, there were suggestions that AI would be of particular use when managing illnesses such as the flu that lack complexity and often follow routine treatment paths.[19] One paper[29] that interviewed nurses and social care assistants in care homes specifically suggested that AI would be able to identify information that was incorrect or outdated, ultimately saving time when patients are admitted or transferred from one care centre to another. There were also suggestions that such technology could monitor routine care of chronic conditions. This was addressed specifically by Hui et al.[20] who asked patients' and clinicians' views on the use of AI

support for the management of asthma. Patients were particularly receptive to the idea, with the consensus being that being able to log their symptoms into an AI-assisted system could aid self-management and facilitate emergency care as important information would be readily available.

Additionally, it was frequently suggested that AI would act as a diagnostic aid to support clinical decision making, particularly in cases where a diagnosis is difficult to establish.[12–16,18,20–22,24,27,28] By providing this assistance, clinicians are expected to provide accurate diagnoses more efficiently,[19,30] thus reducing wait times for patients. AI tools were also expected to reduce the potential for human error, standardise the diagnostic process, and ultimately improve the patient care experience. Furthermore, studies anticipated this would improve access to diagnosis and care to those who may have been missed by the healthcare system.[14] This was of particular importance to the research surrounding mental health, where the lack of access was identified as a key issue.[31]

Patient relationship and empathy

The patient and doctor relationship was a key theme reported within the included papers. Across many of the studies that mentioned the benefits of automation and reducing workload, this was heavily linked to the idea that patient well-being should not be sacrificed in order to increase efficiency.[13,15,19,20,23,24] Clinicians highlighted that AI tools may interfere with the development of the vital relationship between themselves and their patients, which had the potential to negatively affect patient care. Clinical professionals also highlighted that it is likely that AI would be unable to identify non-verbal communication, leading to possible issues being missed and thus potentially placing patients at risk if they were restricted to solely interacting with AI-tools.

Patients and professionals also repeatedly reported that lack of empathy would be a key issue in the use of AI. Many papers reported that a doctor would need a level of involvement in the care of patients in order to provide the appropriate emotional support for patients. One study[13] discussed the topic of empathy in depth with counsellors and clients in the context of utilising AI chat bots in addiction recovery. In this context, counsellors were concerned clients would be less open with AI and would feel restricted in their responses due to the lack of human interaction. The patients echoed this concern, highlighting that they did not believe chatbots would be able to emulate empathy, and that they would be able to identify when they were speaking to a bot and not to a human, and therefore would struggle to trust the AI with their thoughts.[13]

Lack of education and resource issues

Several studies included themes surrounding the lack of information that was available about AI and the need for transparency in the context of healthcare.[14,16,17,25,26,30,32] One particular study involving patients highlighted that they did not trust AI, and that some of this mistrust had been developed through misinformation in the media, resulting in hesitation when presented with AI technology in their care.[13] Professionals and students often suggested that there was a need for increased education on the development and use of AI in patient care.[12,14,25,28] This was supported further when studies found that while most participants were familiar with the idea of AI, many became unsure when it came to specific terminology, or its potential affordances and limitations. Technology and business experts shared this concern, emphasising that misinformation and general lack of knowledge of AI can cause significant barriers in development and implementation. Similarly, it was mentioned that developers are not appropriately educated in medical care, meaning developed tools are not always suitable for their intended use. When discussing how these barriers can be overcome, developer participants were open to the possibility of more education, either implemented as part of mandatory training, or offered as a supplementary course. Despite this receptiveness to education, lack of sufficient resources was identified as a major obstacle to overcome. At this time, it remains unclear how the training could be sourced, and how it could be executed appropriately.

Funding was also highlighted as a resource that is currently lacking, both to provide education and implement AI tools into healthcare. It was noted that because of limited funds, many countries are unable to adopt AI in order to allow professionals to become more familiar with the technology, as well as providing data for supporting research. As a consequence, studies such as Antwi et al.[12] emphasised that countries without adequate funding will be unable to participate in AI research, and therefore, the technology will not be able to develop in these environments at the same rate as those that have access to high levels of financial support.

Lack of regulations and data concerns

Regulations and responsibility were very commonly reported ideas across the selected studies.[16–18,23,25–27,30,32] Medical and technology experts highlighted that the regulations surrounding AI use are constantly changing and are severely lacking in some areas. As a result, there were many anxieties raised by clinicians about legal responsibility and how medical errors that involved AI would be managed.[19,21] One study[30] specifically mentioned that developers and technology experts should also be involved in any legal proceedings that come as a consequence of AI

use in patient care, and participants emphasised that clinicians should not be considered solely responsible in these instances.

Related to the lack of regulations, the need for data protection and privacy was also stressed throughout the studies. Patients and professionals alike wanted reassurance that data collected and or used by AI tools would be regulated to ensure patients were protected.[15,16,19,20,23,25,31] Additionally, there were fears that the vast data collection and storage needed for AI technology could place patients at risk of exploitation or extortion,[15,32] and these dangers needed to be considered when developing regulations. It was also stressed in multiple papers that any policies needed to be consistent across healthcare services wherever possible, to ensure patient data protection regardless of their location.[26,27,30]

Discussion

This qualitative synthesis aimed to explore the current research involving the topic of AI use in healthcare and provide insight into the common themes and ideas that have been developed in this area. This study developed four key themes from the analysis of the 21 included papers: relieving workload and improving care, patient relationship and empathy, lack of education and resource issues, and lack of regulations and data concerns.

Overall, the included studies consistently demonstrated that various stakeholders are aware of AI and the potential benefits it may have for patient care. Healthcare professionals and students appeared especially receptive to technology that may be able to relieve their growing workload. Clinicians' views of AI particularly focused on their relationship with their patients,[13,23–25,30] demonstrating their patients' experience and well-being are a significant priority when considering the impact of AI technology in healthcare. Additionally, patients often mirrored the opinions of healthcare workers, with there being little to no instances where patients appeared to have opposing views on the use of AI in their care.[13,20] Generally, on the whole, AI was seen as an advancement that could enhance treatment and ease the stress on healthcare professionals by supplementing the current roles performed by clinicians and other workers, rather than replacing them entirely. This concept of maintaining clinician involvement relates heavily to the topic of job security which featured in interview guides in several of the selected studies.[12,15,17,28] Although this was not identified as a specific theme in the present study, it is important to consider. While it appears to be expected that increasing the use of AI will have an impact on most, if not all healthcare roles, it is evident that patient care will still heavily rely on human interaction, in order to maintain aspects of care such as empathy.[13,14,30] However, recent research has suggested that AI may be able to produce empathetic responses[33] and that the expectations of empathy may differ between patients and their clinician.[34] Therefore, it is apparent that this is a significant issue to explore with participants in future research studies, but at this time, it is unlikely that job loss will be a consequence of AI implementation, although how time is spent may change.

The results of this study, taken together, provide evidence that collaboration is vital across stakeholders for the successful and safe implementation of AI in healthcare. For example, clinicians emphasised that healthcare workers must work *with* the AI, rather than against it, in order for it to be the most effective.[23] Similarly, AI tools should provide the opportunity for human intervention, such as overriding the AI's decision, when appropriate.[16,19] Moreover, it is clear that the developers of AI technology must work in close collaboration with the clinicians who will be using their tools throughout the development process, ensuring that they understand what is needed and acceptable in a healthcare context; while clinicians are also able to gain insight into how the AI tool works, consequently improving the transparency in this area.

Collaboration is also needed for the development of regulations and guidelines in order to address many of the legal and data concerns mentioned by the stakeholders in the included studies. Universities and other educational institutions that are responsible for training healthcare workers will need to expand their curriculums in the coming years to increase the availability of education on AI use and development to make healthcare workers more confident when working with AI tools in the future.[12,14,25,28] Additionally, efforts should be made to address misinformation that has created scepticism of AI, such as that reported by Barnett et al.[13] This could help ensure patients have an accurate understanding of AI it be involved in their care. Finally, governments must begin to provide updated guidance regarding the use of data in the context of AI in healthcare and review it regularly in order to keep pace with the rapid development of the technology. Failure to do so will certainly increase apprehension surrounding AI use and could potentially place patients and their data at risk of harm or mismanagement.

Implications and limitations

When examining the results presented in this paper, it is important to consider the impact of these findings. First, our sample includes a variety of stakeholder groups, cultures, and analytic approaches; however, we were able to identify multiple thematic consistencies across the studies. Very few of the included papers presented contrasting ideas, thus it would be fair to conclude that the identified themes may provide a fitting representation of the opinions of stakeholder groups internationally, which could be useful to consider when conducting future research in this area. Second, our findings also present evidence supporting the

need for ongoing use of qualitative methods in AI development and research. From the developed themes in the present study, it is clear that communication between stakeholders is a crucial component that appears to be insufficient at this time. By including qualitative components in primarily quantitative-based AI research (e.g. conducting one-to-one interviews or focus groups), healthcare workers and patients would be able to provide feedback on their experiences of the AI tool, providing valuable additional information to developers as they continue to refine the technology. Finally, the results of this study also highlight several topics for future research to pursue. For example, future studies should continue to explore issues relating to resources and regulations to understand if these concerns persist, change over time, or whether new concerns arise, as AI use expands.

A strength of this review was the use of qualitative methods which allowed for the examination of key stakeholder's subjective views of AI tools in healthcare contexts and this prevented vital concepts being lost or misrepresented. It is also important to highlight that the themes developed from this synthesis are consistent with existing quantitative literature examining both patient[5–8] and medical professional[9,10] perceptions of AI use. This suggests that qualitative methods are suitable to utilise in this context and can provide useful additional insight to the findings of quantitative research.

Nonetheless, this study has some limitations which should be considered when interpreting the results. We were unable to include papers not written in English or unpublished literature due restricted resources. As a result, it is possible that there may be data that has been inadvertently excluded, which may have provided further insight into the use of AI in healthcare. Moreover, another limitation was that in several studies[12,14–19,22,25–28,32] participants' experiences of AI in healthcare contexts were often 'general' – they were not reporting their views and experiences of engaging with a specific tool. More studies are needed which explore participants experiences of engaging with a specific AI tool, potentially including interviews prior to and following tool use to explore changes in views over time.

Conclusion

Overall, this study provides in-depth insight into the perceived utility of AI in healthcare. This study identified that AI is generally welcomed with its potential to improve patient care and reduce clinician workloads. A number of concerns were also identified by this study in the use of AI and it's development – including data protection – our findings suggest that there are many potential solutions to explore. Engaging in collaborative interdisciplinary discussions and including more qualitative components to receive feedback during AI tool development is recommended. Ultimately, it appears that AI is currently seen as an advancement that is desirable in the healthcare sector, and one that could provide many benefits should the barriers and concerns be overcome.

Contributorship: CAF and VW contributed to the search strategy, data extraction, data analysis, and writing of the manuscript. MB, BT, and PL contributed to the review and editing of the manuscript.

Declaration of conflicting interests: PL is a founder and shareholder of Ultromics Ltd. BT and CAF were employees of Ultromics Ltd at the time of submission.

Ethical approval: Ethical approval was not required for this study.

Funding: Provided by Ultromics Ltd.

Guarantor: N/A.

ORCID iD: Carol-Ann Fazakarley https://orcid.org/0000-0002-0354-8915

Patient consent: Patient consent was not required as no patient data was included in this study.

Supplemental material: Supplemental material for this article is available online.

References

1. Reddy S, Fox J and Purohit MP. Artificial intelligence-enabled healthcare delivery. *J R Soc Med* 2019; 112: 22–28.
2. Seibert K, Domhoff D, Bruch D, et al. Application scenarios for artificial intelligence in nursing care: rapid review. *J Med Internet Res* 2021; 23: e26522.
3. Takiddin A, Schneider J, Yang Y, et al. Artificial intelligence for skin cancer detection: scoping review. *J Med Internet Res* 2021; 23: e22934.
4. Seol HY, Shrestha P, Muth JF, et al. Artificial intelligence-assisted clinical decision support for childhood asthma management: a randomized clinical trial. *PLoS One* 2021; 16: e0255261.
5. Antes AL, Burrous S, Sisk BA, et al. Exploring perceptions of healthcare technologies enabled by artificial intelligence: an online, scenario-based survey. *BMC Med Inform Decis Mak* 2021; 21: 1–5.
6. Meyer AN, Giardina TD, Spitzmueller C, et al. Patient perspectives on the usefulness of an artificial intelligence–assisted symptom checker: cross-sectional survey study. *J Med Internet Res* 2020; 22: e14679.
7. Aggarwal R, Farag S, Martin G, et al. Patient perceptions on data sharing and applying artificial intelligence to health care data: cross-sectional survey. *J Med Internet Res* 2021; 23: e26162.

8. Esmaeilzadeh P, Mirzaei T and Dharanikota S. Patients' perceptions toward human–artificial intelligence interaction in health care: experimental study. *J Med Internet Res* 2021; 23: e25856.
9. Scheetz J, Rothschild P, McGuinness M, et al. A survey of clinicians on the use of artificial intelligence in ophthalmology, dermatology, radiology and radiation oncology. *Sci Rep* 2021; 11: 1–10.
10. Sit C, Srinivasan R, Amlani A, et al. Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicentre survey. *Insights Imaging* 2020; 11: 1–6.
11. Braun V and Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006; 3: 77–101.
12. Antwi WK, Akudjedu TN and Botwe BO. Artificial intelligence in medical imaging practice in Africa: a qualitative content analysis study of radiographers' perspectives. *Insights Imaging* 2021; 12: 1–9.
13. Barnett A, Savic M, Pienaar K, et al. Enacting 'more-than-human'care: clients' and counsellors' views on the multiple affordances of chatbots in alcohol and other drug counselling. *Int J Drug Policy* 2021; 94: 102910.
14. Blease C, Kharko A, Annoni M, et al. Machine learning in clinical psychology and psychotherapy education: a mixed methods pilot survey of postgraduate students at a Swiss university. *Front Public Health* 2021; 9: 273–281.
15. Blease C, Locher C, Leon-Carlyle M, et al. Artificial intelligence and the future of psychiatry: qualitative findings from a global physician survey. *Digit Health* 2020; 6: 2055207620968355.
16. Buck C, Doctor E, Hennrich J, et al. General practitioners' attitudes toward artificial intelligence–enabled systems: interview study. *J Med Internet Res* 2022; 24: e28916.
17. Chen Y, Stavropoulou C, Narasinkan R, et al. Professionals' responses to the introduction of AI innovations in radiology and their implications for future adoption: a qualitative study. *BMC Health Serv Res* 2021; 21: 1–9.
18. Dawoodbhoy FM, Delaney J, Cecula P, et al. AI In patient flow: applications of artificial intelligence to improve patient flow in NHS acute mental health inpatient units. *Heliyon* 2021; 7: e06993.
19. Goetz CM, Arnetz JE, Sudan S, et al. Perceptions of virtual primary care physicians: a focus group study of medical and data science graduate students. *PLoS One* 2020; 15: e0243641.
20. Hui CY, McKinstry B, Fulton O, et al. Patients' and clinicians' perceived trust in internet-of-things systems to support asthma self-management: qualitative interview study. *JMIR Mhealth Uhealth* 2021; 9: e24127.
21. Jussupow E, Spohrer K and Heinzl A. Identity threats as a reason for resistance to artificial intelligence: survey study with medical students and professionals. *JMIR Form Res* 2022; 6: e28750.
22. Karim S, Sandu R and Kayastha M. The challenges and opportunities of adopting artificial intelligence (AI) in Jordan's healthcare transformation. *Glob J Inf Technol: Emerg Technol* 2021; 11: 35–46.
23. Kocaballi AB, Ijaz K, Laranjo L, et al. Envisioning an artificial intelligence documentation assistant for future primary care consultations: a co-design study with general practitioners. *J Am Med Inform Assoc* 2020; 27: 1695–1704.
24. Kueper JK, Terry A, Bahniwal R, et al. Connecting artificial intelligence and primary care challenges: findings from a multi stakeholder collaborative consultation. *BMJ Health Care Inf* 2022; 29: e100493.
25. Laï MC, Brian M and Mamzer MF. Perceptions of artificial intelligence in healthcare: findings from a qualitative survey study among actors in France. *J Transl Med* 2020; 18: 1–3.
26. Morrison K. Artificial intelligence and the NHS: a qualitative exploration of the factors influencing adoption. *Future Healthc J* 2021; 8: e648–e654.
27. Musbahi O, Syed L, Le Feuvre P, et al. Public patient views of artificial intelligence in healthcare: a nominal group technique study. *Digit Health* 2021; 7: 1–11.
28. Rainey C, O'Regan T, Matthew J, et al. Beauty is in the AI of the beholder: are we ready for the clinical integration of artificial intelligence in radiography? An exploratory analysis of perceived AI knowledge, skills, confidence, and education perspectives of UK radiographers. *Front Digit Health* 2021; 3: e739327.
29. Schneider-Kamp A. The potential of AI in care optimization: insights from the user-driven co-development of a care integration system. *INQUIRY* 2021; 58: 1–11.
30. Sujan MA, White S, Habli I, et al. Stakeholder perceptions of the safety and assurance of artificial intelligence in healthcare. *Saf Sci* 2022; 155: e105870.
31. Tam-Seto L, Wood VM, Linden B, et al. Perceptions of an AI-supported mobile app for military health in the Canadian armed forces. *Mil Behav Health* 2021; 9: 247–254.
32. Thenral M and Annamalai A. Challenges of building, deploying, and using AI-enabled telepsychiatry platforms for clinical practice among urban Indians: a qualitative study. *Indian J Psychol Med* 2021; 43: 336–342.
33. Ayers JW, Poliak A, Dredze M, et al. Comparing physician and artificial intelligence chatbot responses to patient questions posted to a public social media forum. *JAMA Intern Med* 2023; 183: 589–596.
34. Derksen FAWM, Olde Hartman T, Bensing J, et al. Empathy in general practice-the gap between wishes and reality: comparing the views of patients and physicians. *Fam Pract* 2018; 35: 203–208.