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Mari S. Kannelønning

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Contesting futures of Artificial Intelligence (AI) in healthcare: formal expectations meet informal anticipations

Mari S. Kannelønning

Faculty of Social Sciences, Oslo Metropolitan University, Oslo, Norway

ABSTRACT

Artificial Intelligence (AI) technologies are expected to play an essential role in future healthcare systems for saving resources, improving treatment quality and enhancing patient safety. Governments worldwide are preparing for such a future by developing strategies and policies. Drawing on concepts and perspectives from Science and Technology Studies (STS), this article explores how government policies set the agenda for introducing AI in healthcare, using the Norwegian National Health and Hospital Plan 2020–2023 (NHSP) as an example. The article further investigates how the formal expectations included in the NHSP are met with informal anticipations expressed by actors working closer to clinical practices involved in an inquiry process initiated by the policy. Taking a qualitative approach, the article explores what characterises formal expectations of AI in healthcare and how these expectations are contested. The study finds that there are tensions between the different assumptions and that crucial issues concerning the future usage of AI are not yet on the Norwegian Government's agenda. Pairing the forces of the formal expectations with the ambiguous concept of AI, the current chasm between AI development and deployment, and the uncertainties constituted by the contesting elements, the article concludes by introducing a paradox of inevitability.

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Introduction

Artificial Intelligence (AI) is expected to play an essential role in future healthcare systems, providing economic viability and improving treatment quality and patient safety (Aung, Wong, and Ting 2021; Morley et al. 2020). These expectations typically concern AI technologies that can automate repetitive tasks and support healthcare professionals in making decisions during the whole clinical pathway: from diagnostic processes to treatment and follow-up care.[1] However, there is still a chasm between commercially available AI technologies and their deployment in real-world clinical settings (Cabitza, Campagner, and Balsano 2020; Coiera 2019; Seneviratne, Shah, and Chu 2020). Meanwhile, governments worldwide are developing strategies and policies on AI, including visions of a future with AI in healthcare to guide and accelerate implementation processes (see, for example, the European Commission's policy brief Knowledge4Policy 2021; or the UK's National Strategy for AI in Health and Social Care n.d.).

CONTACT Mari S. Kannelønning marika@oslomet.no Faculty of Social Sciences, Oslo Metropolitan University, Oslo, Norway

This article explores how such policies, and the expectations of the future they articulate, set the agenda for introducing AI in healthcare, using the Norwegian National Health and Hospital Plan (NHSP) 2020–2023 as an example. Closely following an inquiry process initiated through the NHSP, involving different stakeholders and producing various outputs, the article also examines how formal expectations are met with informal anticipations expressed by actors situated closer to clinical practices (including hospital managers, procurement officers, and physicians).

Policies like the NHSP are designed to be performative; they initiate activities and actions in the present (Eames et al. 2006, 362). The visions or expectations of the future they bring forth can thus be seen as strategic tools that inform decision-making processes (Beckert 2016, 35–36), mobilise relevant actors (Konrad et al. 2016, 466), and set the political and technological agenda for others to follow (Brown, Rappert, and Webster 2000, 17). Due to this formative strength, they can be seen as both powerful and problematic. For instance, elements disputing them might easily be ignored, potentially leading to costly detours or even severe and irreversible societal consequences.

The field of AI is well-known for its hype, and we are frequently exposed to the rhetoric of AI as technologies of great promise and potential (Bareis and Katzenbach 2022; Verdegem 2021). However, whether or how the expectations of AI will materialise or cause unwanted outcomes is still unknown. This article aims to go beyond the selling points and examines both formal expectations and viewpoints disputing them. The article addresses the following research questions: what characterises formal expectations of AI in healthcare articulated in official strategies and policies? How are these expectations contested by informal anticipations and future assessments of actors operating close to clinical practices? Finally, in the discussion, the article elaborates on a paradox constituted by the formative force of expectations and the uncertainties related to what AI really is and what an introduction of AI might imply. The study refers to a Norwegian case, but the article has relevance outside its Norwegian context, as AI technologies are discussed and policies are developed and implemented worldwide.[2]

The article starts by presenting the conceptual framework, followed by a description of the material and methods, including a presentation of the context, data collection and analysis. It then proceeds by identifying essential aspects of the Norwegian Government's vision, i.e. the formal expectations of AI in healthcare. With this as a backdrop, the article continues by bringing forth the contestations that emerged during the inquiry process studied. Finally, the insights provided by the analysis are discussed in relation to the conceptual framework, followed by concluding remarks.

Forces and dynamics of expectations

This work's theoretical framework builds on concepts and perspectives from the field of Science and Technology Studies (STS), dealing with forces and dynamics of expectations in innovation and technological change (Borup et al. 2006; Brown and Michael 2003; Pollock and Williams 2010).

Scholars within the Sociology of Expectations see expectations as having a performative role in innovation processes (Borup et al. 2006, 289; Konrad et al. 2016). Van Lente (2012) draws attention to such formative strengths by highlighting three essential forces of expectations. The first, 'legitimation', is about how expectations raise awareness and justify investments in early phases of emerging technologies, typically including a solution to a perceived problem. The second, 'heuristic guidance', concerns how expectations provide direction and guide choices and decisions during an innovation process. The third force is a 'coordination effect', as expectations indicate work that has to be done by various actors to fulfil the goals (2012, 773–774). From this point of view, expectations are articulations that 'do things'; as they build agendas and create work in the present, they have performative effects (2012, 772).

Similarly, Geels and Smit (2000) pinpoint that expectations are used to convince relevant stakeholders, foster investments, shape agendas and establish 'protected spaces' (2000, 882). As such, expectations are often exaggerated and optimistic (2000, 881). Brown, Rappert, and Webster

(2000, 3–4) elaborate accordingly that to increase the chances of fulfilling specific envisioned futures, anyone who wants to promote a particular expectation must involve themselves in rhetorical, organisational and material activities aiming to 'colonise' their version of the future. As the expectations become widely shared, they will gain certain protection or enter a 'protected space' created by the collective belief (Konrad 2006, 438). Consequently, the formative force of the expectations is strengthened by being shared by many and, thus, further paired with an element of inevitability (Van Lente and Rip 1998, 222). This sense of inevitability may result in neglecting alternative solutions, potentially contributing to further path dependencies and 'lock-in' effects (Konrad 2006, 430). Such 'lock-in' effects also imply irreversibility, as the allocated resources used to follow a specific direction cannot be reused (e.g. money and people's time). In other words, as Tutton states: 'Each future followed is another future not taken' (2017, 487). However, shifts in widely shared expectations may occur due to real-world events, and consequently, the 'protected space' may dissolve (Konrad 2006, 439). Bareis and Katzenbach stress similarly that despite the power of stakeholders behind certain expectations, their strategies and policies will meet resistance and scepticism as they are implemented into society (2022, 874). The potential shifts in expectations and the opposition they might encounter emphasise further that the outcome of strong formative expectations can be hard to calculate (Beckert 2016, 9).

The fact that even widely shared expectations may not necessarily materialise is why Pollock and Williams (2010) problematise the idea of strong expectations as self-fulfiling prophecies. As unforeseen factors may challenge shared beliefs, they argue for the need to consider what expectations or promises consist of and how they are constructed and distributed (2010, 529). In a similar vein, Brown draws attention to the importance of considering both the temporal and spatial 'situatedness' of expectations to prevent misdirections during innovation (2003, 10). The temporal situatedness is a question of 'when' and what happens as processes driven by certain expectations evolve and different forms of material and social issues appear. Considering what to expect on both shorter and longer terms can function as a caution and enable adjustments of directions before it is too late. The spatial situatedness of expectations concerns the questions of 'where' and 'who'. It emphasises the importance of seeing expectations not as singular representations of the future but as something that needs interpretation and is acted upon differently across actor groups and practices. Uncovering spatial differences can give insights into various agencies of differing power, how expectations are contested, and how some end up setting the agenda (Brown 2003, 13).

Complicating factors in the case of AI

A definitional vagueness characterises the concept of AI (Wang 2019), which, at best, is an overall label covering a large variety of technologies. This ambiguity complicates both the conversations and the outcome of the work related to AI technologies (Krafft et al. 2020; Wang 2019). Whatever definition is used, it will have practical consequences, such as influencing decisions made during various stages of innovation processes (e.g. in policy development and implementation). Without specifying AI, questions like whether AI will be beneficial or not will give several different answers (Wang 2019, 28). Thus, the lack of precise definitions can have quite far-reaching consequences. In the context of national AI strategies, Bareis and Katzenbach (2022) finds that, even though the visions included in policies are based on vague definitions of AI, they are powerful rhetorical devices. Their force lies in how they allocate resources and set rules, turning the visions into certain inevitable technological pathways (2022, 863).

In addition to how the vague and diverging definitions of AI might complicate the process of introducing AI in healthcare, the previously mentioned chasm between available AI technologies and real-world deployments may also affect the process. Apart from limited evidence of actual use and benefits in real clinical settings, the most common explanations for this chasm are issues related to data limitations, regulations, human trust, ethical data use, equity and bias (see, for example, Aung, Wong, and Ting 2021; Freeman et al. 2021; Rajpurkar et al. 2022). Thus, through

the research literature, factors potentially hindering or causing resistance to the many visions of AI technologies in healthcare and their deployment are already known and circulating.

As a final clarification before continuing, reflecting the lack of a widely accepted definition of AI, this article uses the general terms 'AI' and 'AI technologies' interchangeably. These labels cover both AI in a broad sense, for instance, when treating overall conceptions of AI and in connection with the statements of the participants involved in the meetings of the inquiry process. In this context, 'AI technologies' may allude to more specific technologies, for example, AI-based applications to be integrated into existing information systems (e.g. systems for radiology like PACS – Picture Archiving and Communication Systems). In these settings, the term 'algorithm' is additionally used for variation, reflecting how the meeting participants used it.

Material and methods

The context

In 2019 the Norwegian Ministry of Health and Care Services published the NHSP policy plan, through which a coordination project as a national cross-public agency collaboration was established. The project, called *Better use of Artificial Intelligence*, was led by the Directorate of Health and included members from the Directorate of eHealth, the Norwegian Medicines Agency and the four Norwegian regional health authorities. The inquiry process followed in the present study was carried out by the project team and entitled *Good clinical practice and the need for standardisation using Artificial Intelligence in Radiology*[3](my translation). The overall aim of the inquiry process was to identify gaps and suggest national initiatives to ensure safe and proper use of AI in healthcare services. Different digital meetings (insight meetings, workshops and feedback meetings) were carried out in three rounds and involved stakeholders such as hospital managers, project managers, radiologists, patient organisations, AI researchers, AI vendors, and procurement officers. The meetings took place over five months (January–May 2021), and approximately 100 people participated altogether (Helsedirektoratet et al. 2021, 2). After each round of meetings, written summaries were published on the project's website for whoever was interested. Additionally, the summaries were emailed to the stakeholders participating in the upcoming meetings. The final outcome of the process was a report addressed to the Norwegian Ministry of Health and Care Services in the autumn of 2021.

Data collection and analysis

The overall approach of this study is based on a combination of document analysis and meeting ethnography. The document analysed was the NHSP, while the meetings observed were digital, and the observations were centred around the verbal communication unfolding. I attended the meetings as a non-participant observer and kept my camera and microphone off, except for introducing myself if prompted by the chairperson. The primary data from these meetings were fieldnotes written during the observations. I wrote as much as possible, but naturally, I missed some bits and parts of the conversations. However, similar to Thedvall's experience (2013, 112), I gained a fuller understanding of

Table 1. The volume of documents, meetings, and participants.

	Insight meetings	Workshops	Feedback meetings and beyond
Documents (volume)	Project summaries (35 p.) Project analysis (9 p.) Fieldnotes (22 p.)	Project summary (21 p.) Fieldnotes (15 p.)	Project summary (13 p.) Fieldnotes (10 p.) Final report (74 p.)
Number of meetings and duration[a]	2 × 2 h 1 × 1.5 h	3 × 3 h	2 × 2 h
Number of participants (approx.)	45	43 (invited)	40

[a]I did not attend the first three insight meetings, as I was enrolled as an observing researcher after their completion. However, I received and analysed the notes taken by the project team.

the discussions over time as I attended several meetings. As a supplement to the fieldnotes, I used the project team's summaries and reports.

Table 1 below shows the volume of the material and meeting details included in the study.

The NHSP was analysed using a technique similar to 'directed content analysis' (Hsieh and Shannon 2005, 1281). It was a structured process where the document was analysed for content specifically matching Van Lente's three forces of expectations: legitimation, guiding heuristics and coordination (2012). This work was done by thorough readings, while relevant pieces of text were annotated and categorised. The data from the inquiry process, on the other hand, were first subjected to open coding. The fieldnotes, summaries, and reports were read line-by-line, while diverse and disparate themes were identified. These were later coded as the text was closely reread (Emerson, Fretz, and Shaw 2011, 172). As this inductive process became more focused, topics emerged, reflecting what was perceived as important to the participants. Thus, significant observations regarding the future of AI in healthcare, seen from the perspective of actors operating close to clinical practices, could be distinguished and identified from the rest of the material from the inquiry process (2011, 175). This selection of observations was then elaborated on and categorised.

Findings

This section presents the findings in three parts. First, the findings from the analysis of the NHSP are presented, using Van Lente's three dimensions as points of reference. This analysis serves as a backdrop for the second part, which explores the informal anticipations and future assessments of stakeholders involved in the inquiry process, contesting the formal expectations of the NHSP. Lastly, the final report from the inquiry process is shortly outlined.

The NHSP: the formal expectations of AI in healthcare

Legitimation

Like many countries, Norway faces the problem of an aging population with an increasing need for care while the number of taxpayers and the workforce of healthcare professionals is decreasing. After the development of the Norwegian welfare state during the last century, where the so-called Norwegian or Nordic model with equal rights to healthcare was established (Meld. St. 14 (2020–2021), p. 3), public healthcare services have become a significant charge to the national budget. Maintaining the standards of the Norwegian healthcare system is thus seen as a considerable challenge for the future economy (Finansdepartementet 2021). Based on this background, in the NHSP, the Norwegian Government presents AI technologies as a part of the solution for upholding the welfare state and mitigating healthcare struggles (e.g. by reducing the constantly growing workloads in the sector) (Meld. St. 7 (2019–2020)a). Thus, referring to such societal challenges can be seen as attempts to legitimise the government's vision of introducing AI in healthcare.

Heuristic guidance

In addition to legitimisation, the NHSP contains an explicitly formulated vision with clear elements of heuristic guidance. The vision provides direction for the ongoing introduction of AI in healthcare by highlighting specific goals and future roles and activities which may guide the choices and decisions made in the present processes:

> Artificial intelligence makes it possible to utilise national medical databases to provide faster and more accurate diagnostics, better treatment and a more effective use of resources. The regulations make it possible to use medical data to bring maximum benefit to the community, the directorates provide guidance on legal restrictions, and ethical problems associated with the use of artificial intelligence are handled in cooperation with other European countries. The health and care service has established a culture of innovation and knowledge-sharing, and works closely with businesses to develop the tools needed by the service and patients. (Meld. St. 7 (2019–2020)b, 26)

In this quote, the NHSP proclaims that AI will ensure (1) faster and more accurate diagnostics, (2) better treatment, and (3) more effective use of resources. These goals are to be achieved by a set of (guiding) activities such as: (a) providing national access to data, (b) offering support on legal issues (by the directorates), (c) solving ethical issues on a national level in cooperation with the EU, (d) establishing a culture of innovation and knowledge-sharing across the healthcare services, and (e) enabling the development of technologies in a close relationship between public and private sector.

Coordination

Finally, the NHSP describes concrete work to be coordinated and carried out by various stakeholders to reach the future with AI in healthcare. For instance, the plan states that it is crucial to adjust relevant national frameworks, such as the legal framework for sharing and using health data, to secure a safe introduction of AI technologies (Meld. St. 7 (2019–2020)a, 98). It also highlights that improving data quality is important, as, in their words, AI does not become more intelligent than the quality of the data allows (96). Furthermore, working on better access to data and storage capacity is acknowledged as essential for achieving optimal effects of the use of AI. The need to make the public specialist health services responsible for contributing to the realisation of a suitable infrastructure is further emphasised (96–97). Finally, the NHSP concludes that relevant government agencies are to assess the national framework conditions and coordinate further work to enable the use of AI in healthcare, i.e. the national coordination project (98).

The inquiry process: contesting informal anticipations and assessments

The above analysis shows how the NHSP set an overall direction for introducing AI in the Norwegian healthcare sector. However, as the inquiry process unfolded, elements that contested the formal vision emerged especially challenging the goals of using AI for more efficient use of resources, better treatment quality and patient safety. These contestations, presented in five categories below, were mainly based on anticipations and assessments of participants operating in or near clinical practices and concerned issues related to the specific contexts and conditions of future use of AI.

Inaccurate diagnostic outcome

The participants in the inquiry process were concerned about whether inaccurate algorithms might lead to over-diagnosing (finding too much), under-diagnosing (finding too little) or misdiagnosing. Even though the risk of making imprecise diagnoses is not unique to AI technologies, they worried that this would scale to another level of magnitude when complex algorithms were involved. The same concern also applied to algorithms trained on somehow biased datasets or from patient groups different from those belonging to a particular hospital. The meeting participants were concerned that such inaccurate results would produce more rather than less work (e.g. more tests and screenings of patients) and negatively affect the patients' trust.

Deskilling physicians

A second concern was that the use of AI technologies could potentially cause a deskilling of physicians such as radiologists. If AI is used for decision support, for instance, in image diagnostics, and the reasoning behind a diagnosis accordingly becomes 'black boxed', it was anticipated that the radiologists' expertise would decline. This issue especially concerned the expertise of young radiologists and whether they would suffer from no longer learning from the reasoning of and discussions with more experienced colleagues. The potential deskilling was additionally seen as something that could make the hospital system quite fragile and, over time, even more dependent on AI technologies. Some meeting participants also argued that a new kind of expertise was necessary, as physicians will have to know how AI technologies work before trusting them properly. They worried that a lack of knowledge and potential mistrust could lead to either no use or misuse. This issue, in turn,

raised another dilemma related to how physicians would have time to gain a basic understanding of AI in their already busy workdays.

Other competencies

The need for enhancing hospital managers' competencies was also brought up during the discussions: 'One of the greatest needs is to give the managers a more sober insight into what AI will bring in the medium-term future' (participant, feedback-meeting with radiology environments). The need for AI developers with knowledge of the work of physicians in clinical practices was also deemed important. Moreover, the question of whether introducing AI in clinical workflows would make it necessary to include other competencies in the clinics was raised. A meeting participant compared this with the automation of the bank sector, which allegedly led to even larger IT departments. Essential considerations mentioned in this regard were whether, for instance, the radiology resources spared are to be replaced by other types of staff and whether this is desirable for decision-makers aiming to save resources.

Overreliance on algorithms

During the meetings, AI technologies' (alleged) capabilities were criticised for 'presuming' that people are 100% rational. Participants used the phenomenon of decision fatigue as an example of the opposite, asking questions such as: what happens during the day as physicians become tired – will this affect how they use the AI technology? Will they become more capable of trusting it at the end of the day, or after months or years of experiencing certain reliability – would this lead to an overreliance, letting the AI technology make the final decisions? And what if the algorithms become skewed over time as they are exposed to new data – what happens then? These questions, taking as a starting point a view of AI as continuously learning technologies, evoked a perceived need for establishing work tasks to monitor algorithms.

Relevance and applicability of AI technologies

The importance of evaluating AI technologies in relation to local contexts and conditions was emphasised during some of the meetings, and several questions were raised in this regard: are there areas that could benefit from AI – is there a need? How will AI technologies affect existing workflows, and does the work really become more efficient for those using AI? The following statement exemplified a general concern that such aspects were not dealt with: 'It [the capabilities of AI] is exaggerated. We see the big headlines but forget to see what fits into clinical practices' (participant, feedback-meeting with radiology environments). Finally, the participants worried about the potential lack of ability to adjust CE-marked algorithms to local contexts and data due to regulations restricting such modifications of commercial products.

The final report: continued enactment of formal expectations

Despite the informal anticipations contesting and potentially threatening the materialisation of the formal expectations, the final report did not convert these uncertainties into areas for prioritised future investigations. The report suggests, however, several other activities to be carried out by the Directorate of Health and other public agencies, much in line with the activities highlighted in the NHSP. These activities included providing guidelines for procurement of CE-marked AI technologies in the healthcare sector, giving courses to enhance healthcare professionals' competencies within digitalisation and AI, stimulating collaboration across the public sector, ensuring sufficient access to quality data, and supporting hospitals on juridical and ethical issues (Helsedirektoratet et al. 2021, 48–57). Finally, based on the report and its recommendations for future work, the Norwegian Ministry of Health and Care Services stated in the yearly allocation letter for 2022 addressed to the Directorate of Health that they are to 'continue the work of adapting national framework conditions so that the health and care services can safely use Artificial Intelligence for patient treatment.

In 2022, especially interdisciplinary guidance related to legal issues is to be prioritised' (Helse- og omsorgsdepartementet 2022, 36, my translation). Thus, the focus area noted in the allocation letter also aligned with activities highlighted in the NHSP.

Discussion

Overall, the study shows that there are tensions between the formal expectations of AI in healthcare articulated by the Norwegian Government and the informal anticipations of those operating closer to clinical practice. The issues contesting the government's main goals give an example of how formal expectations will meet resistance during policy implementation, as pinpointed by Bareis and Katzenbach (2022). However, where Bareis and Katzenbach, within the scope of their article, purely stress that resistance will occur, this study takes it further, showing what such resistance or scepticism may look like. The present study also exemplifies how powerful visions, despite the resistance, continue to have a strong formative effect with elements of inevitability and path dependency. This conversion of expectations, based on vague definitions of AI into a seemingly inevitable technological pathway, offers an example of expectations provided with a protected space (Konrad 2006, 438).

The NHSP vision of AI in healthcare seems to have a strong influence on the interpretations of the inquiry process's outcome, confirming the vision's strength (Konrad 2006, 438). Thus, the three forces of expectations, as they appear in the NHSP, continue to have performative effects in Norway (Van Lente 2012). AI is still perceived as a solution to challenges in the healthcare sector (legitimation), and both the listed activities (heuristic guidance) and work to be coordinated (coordination) to reach the goals are repeated in slightly different shapes in the reports and plans developed in the wake of the inquiry process. Consequently, the outcome of the inquiry process contributes to 'lock-in' effects, too (Konrad 2006). Alternative paths are not yet considered, including an investigation of the contesting issues put forward by the participants in the inquiry process. Avoiding such explorations of potentially challenging factors in the early phases of policy implementation could lead to less successful outcomes in the long run.

However, implementing the NHSP is a work in progress, and the tensions surfacing in the findings may still be addressed in the future. At the same time, upcoming and unforeseen factors such as regulative changes or disappointing technological performances can still cause a weakening of the formal expectations, leading to a loss of the protected space (Konrad 2006, 441–442). Such a loss of protection, involving a diminishing formative strength, underscores that even the strongest expectations are not necessarily self-fulfilling prophecies (Pollock and Williams 2010). Nevertheless, resources that cannot be reused have already been invested in developing and implementing the NHSP, including organising the inquiry process, writing reports and carrying out other activities based on the report's recommendations. Thus, with the work already done, alternative routes for mitigating present and future challenges in the healthcare sector, with or without AI, may already be passed (Tutton 2017, 487).

This article has focused on an inquiry process carried out in the early phases of introducing AI in healthcare and some immediate consequences of the process' outcome. Therefore, insights into the formal expectations' 'temporal' and 'spatial' situatedness are limited (Brown 2003). However, regarding the temporal situatedness, the issues contesting the formal vision can be seen as cautions of potential future obstacles to consider to avoid taking the wrong course. The tension between the formal expectations and informal anticipations also provides examples of spatial situatedness. Several interpretations of the future with AI in healthcare exist, some more powerful than others. As the study shows, the formal expectations continue to have a performative effect, demonstrating that they have a more substantial power than the informal anticipations. However, as mentioned, despite the sense of inevitability this power indicates, changes may occur as the NHSP implementation proceeds or as new and updated policies for AI in healthcare are developed. Until then, a statement made by a participant in the inquiry process stands strong as an example of the current situation:

> People in the clinical practices know that something is coming; they just don't know, yet, how it will hit them.

The quote pinpoints that people *know* AI will become a part of the clinic, acknowledging AI as something destined for the healthcare sector. As such, it confirms the argument that expectations are 'performative' or even 'constitutive' (Borup et al. 2006; Konrad et al. 2016; Van Lente 2012). However, the second part of the statement underscores that *how* AI will hit the healthcare sector is still unknown. Thus, a paradox seems to emerge: Paired with the sense of inevitability is an element of fundamental uncertainty. To get a better understanding of how the future with AI can turn out to be, it is necessary to go beyond the hype and selling points. It requires more knowledge of what AI for healthcare is or can be and how concrete AI technologies perform in real-world clinical settings. As Bareis and Katzenbach (2022) indicated in their study, the introduction of vast AI programms requires a certain rhetorical force. The technological promise seems vast but is still vague. Thus, Bareis and Katzenbach address the need for powerful actors to 'talk AI into being', narratively constructing AI as both inevitable and disruptive. The rhetorical strategies of grand legacies and international competition that the authors identify in Chinese, US, French and German strategy documents may be less grandiose in the Norwegian documents, such as the NHSP. However, they still push a certain agenda forward.

As the above alludes to and previous studies have shown, the paths of emerging technologies typically start with high expectations without much knowledge of what the future will bring (van Merkerk and van Lente 2005, 1096). This is, without doubt, the case when it comes to AI in healthcare, which in recent years has been subject to extreme hype and, at the same time, advocated for by governments worldwide. Taken together with the ambiguous definitions of AI, affecting how a future with these technologies is perceived and the decisions drawn based on such differing interpretations, the current situation of inevitability may lead to several misguided actions. Combined with the existing chasm between AI development and deployment addressed in several research papers, where limited evidence of actual benefits in real-world settings is a highlighted barrier, it is hard to tell what the future will bring. The same goes for whether or how the formal expectations, such as those included in the NHSP and similar policies, will materialise.

Before anything materialises, the direction of introducing AI in the Norwegian healthcare sector will be guided by what is implied by the three forces of the expectations in the NHSP. This is how the mentioned paradox arises: AI in healthcare is forcing its way forward with tremendous impact, but what is the phenomenon really about beyond the different expectations and definitions? Phrased differently, as long as the introduction process follows the current path, the element of inevitability stays strong based on the present and powerful formal expectations of the Norwegian Government. We may term this an *inevitability paradox*, i.e. that a consensus about the value of AI in healthcare exists parallel to a fundamental uncertainty about what AI technologies for use in real-world settings will look like, when a broader deployment will occur and what will happen in its wake.

Concluding remarks

The Norwegian National Health and Hospital Plan 2020–2023 (NHSP) articulates an overall vision of a future where three main goals are fulfilled: the introduction of AI has ensured faster and more accurate diagnostics, better treatment, and more effective use of resources. To reach this future situation, the NHSP highlights the importance of access to quality data and storage, adapting or developing legal and ethical frameworks, and establishing collaborations across the public and private sectors. The policy plan also initiated a project where relevant government agencies were to assess the national framework conditions regarding the use of AI and coordinate work to enable healthcare services to start using AI technologies. The inquiry process informing the present study was a part of this national coordination work, through which the formal expectations and informal anticipations 'met' and elements contesting the future envisioned emerged. These elements included worries about inaccurate algorithms, a deskilling of physicians, lacking competencies, a potential overreliance on algorithms, and AI technologies not applying to local contexts.

The issues contesting the NHSP vision exemplify how current expectations of AI in healthcare can meet resistance as the implementation of AI strategies and policies proceeds. As of now, despite the varying perceptions of the future with AI, only one of them seems to set the agenda in the present Norwegian context. The inquiry process' final report and the allocation letter from the Norwegian Ministry of Health and Care Services did not address the issues potentially limiting the efficacy of the formal vision, showing that the initial expectations keep having formative effects. Thus, the formal expectations have the momentum and power to continue the process towards the desired and articulated future. This continuation exemplifies the presence of a sense of inevitability and path dependency, where alternative directions are easier to neglect. Finally, from the analysis of the NHSP vision, AI technologies are expected to solve several large-scale problems. But the vague definitions, the current chasm between the development and implementation of AI in healthcare, and the contesting elements highlighted in this study indicate that the road is paved with uncertainties. Will the contesting issues, or other obstacles emerging, eventually cause the formal expectations to collapse? Will negotiations be the case, or will the formal expectations and the elements of resistance gradually intertwine?

These and similar questions call for additional investigations of implementations of policies like the NHSP and other initiatives aiming to deploy AI in healthcare. Such examinations can illuminate further whether or how the expectations of AI will materialise and whether or how the contesting elements will assert themselves (and thus challenge the early impression of something inevitable).

Notes

1. For examples see: https://www.ibm.com/resources/watson-health/artificial-intelligence-impacting-healthcare/; https://www.siemens-healthineers.com/digital-health-solutions/digital-solutions-overview/clinical-decision-support/ai-rad-companion
2. For examples of other enactments of AI in healthcare visions see: https://www.ai.se/en/node/81535/information-driven-healthcare, https://fcai.fi/ai-for-health, https://www.nhsx.nhs.uk/ai-lab/
3. Radiology was prioritised as focus area as it was perceived as one of the most mature areas for AI adoption. Despite this focus, the project team argued that many of the issues uncovered during the inquiry process was relevant for other disciplines as well (Helsedirektoratet et al. 2021).

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Notes on contributor

Mari S. Kannelønning is a PhD student in Social Sciences within the area of Information Studies at Oslo Metropolitan University, Norway. Her research interests revolve around emerging information technologies and the introduction of artificial intelligence (AI) in healthcare in particular. In her doctoral project, she specifically explores the expectations of AI in healthcare, the promissory work of AI suppliers, and the formation of networks of professionals working to enable AI in healthcare.

References

Aung, Y. Y. M., D. C. S. Wong, and D. S. W. Ting. 2021. "The Promise of Artificial Intelligence: A Review of the Opportunities and Challenges of Artificial Intelligence in Healthcare." *British Medical Bulletin* 139 (1): 4–15. https://doi.org/10.1093/bmb/ldab016.

Bareis, J., and C. Katzenbach. 2022. "Talking AI Into Being: The Narratives and Imaginaries of National AI Strategies and Their Performative Politics." *Science, Technology, & Human Values* 47 (5): 855–881. https://doi.org/10.1177/01622439211030007.

Beckert, J. 2016. *Imagined Futures: Fictional Expectations and Capitalist Dynamics*. Cambridge: Harvard University Press.

Borup, M., N. Brown, K. Konrad, and H. Van Lente. 2006. "The Sociology of Expectations in Science and Technology." *Technology Analysis & Strategic Management* 18 (3–4): 285–298. https://doi.org/10.1080/09537320600777002.

Brown, N. 2003. "Hope Against Hype - Accountability in Biopasts, Presents and Futures." *Science & Technology Studies* 16 (2): 3–21. https://doi.org/10.23987/sts.55152.

Brown, N., and M. Michael. 2003. "A Sociology of Expectations: Retrospecting Prospects and Prospecting Retrospects." *Technology Analysis & Strategic Management* 15 (1): 3–18. https://doi.org/10.1080/0953732032000046024.

Brown, N., B. Rappert, and A. Webster. 2000. "Introducing Contested Futures: From Looking Into the Future to Looking at the Future." In *Contested Futures: A Sociology of Prospective Techno-Science*, edited by N. Brown, B. Rappert, and A. Webster, 3–20. Aldershot: Ashgate.

Cabitza, F., A. Campagner, and C. Balsano. 2020. "Bridging the "Last Mile" Gap Between AI Implementation and Operation: "Data Awareness" That Matters." *Annals of Translational Medicine* 8 (7): 501. https://doi.org/10.21037/atm.2020.03.63.

Coiera, E. 2019. "The Last Mile: Where Artificial Intelligence Meets Reality." *Journal of Medical Internet Research* 21 (11): e16323. https://doi.org/10.2196/16323.

Eames, M., W. Mcdowall, M. Hodson, and S. Marvin. 2006. "Negotiating Contested Visions and Place-Specific Expectations of the Hydrogen Economy." *Technology Analysis & Strategic Management* 18 (3–4): 361–374. https://doi.org/10.1080/09537320600777127.

Emerson, R. M., R. I. Fretz, and L. L. Shaw. 2011. *Writing Ethnographic Fieldnotes*. 2nd ed. Chicago: University of Chicago Press.

Finansdepartementet. 2021. "Hovedpunkter i Perspektivmeldingen 2021." https://www.regjeringen.no/no/tema/okonomi-og-budsjett/norsk_okonomi/perspektivmeldingen-2021/hovedpunkter-i-perspektivmeldingen-2021/id2834526/.

Freeman, K., J. Geppert, C. Stinton, D. Todkill, S. Johnson, A. Clarke, and S. Taylor-Phillips. 2021. "Use of Artificial Intelligence for Image Analysis in Breast Cancer Screening Programmes: Systematic Review of Test Accuracy." *BMJ* 374:n1872. https://doi.org/10.1136/bmj.n1872.

Geels, F. W., and W. A. Smit. 2000. "Failed Technology Futures: Pitfalls and Lessons from a Historical Survey." *Futures* 32 (9-10): 867–885. https://doi.org/10.1016/S0016-3287(00)00036-7.

Helsedirektoratet, Direktoratet for e-helse, Statens legemiddelverk, Helse Nord RHF, Helse Vest RHF, Helse Midt-Norge RHF, & Helse Sør-Øst RHF. 2021. "Tilrettelegging for bruk av kunstig intelligens i helsetjenesten." https://www.helsedirektoratet.no/rapporter/tilrettelegging-for-bruk-av-kunstig-intelligens-i-helsesektoren-ny-01.10.2021.

Helse- og omsorgsdepartementet. 2022. "Tildelingsbrev til Helsedirektoratet for 2022." Oslo, Norge https://www.regjeringen.no/globalassets/departementene/hod/tildeling-oppdrag-og-arsrapporter/2022/tildelingsbrev-til-helsedirektoratet-for-2022.pdf.

Hsieh, H.-F., and S. E. Shannon. 2005. "Three Approaches to Qualitative Content Analysis." *Qualitative Health Research* 15 (9): 1277–1288. https://doi.org/10.1177/1049732305276687.

Knowledge4Policy. 2021. "How Can Europe Become a Global Leader in AI in Health? Knowledge for Policy." https://knowledge4policy.ec.europa.eu/file/how-can-europe-become-global-leader-ai-health_en.

Konrad, K. 2006. "The Social Dynamics of Expectations: The Interaction of Collective and Actor-Specific Expectations on Electronic Commerce and Interactive Television." *Technology Analysis & Strategic Management* 18 (3-4): 429–444. https://doi.org/10.1080/09537320600777192.

Konrad, K., H. Van Lente, C. Groves, and C. Selin. 2016. "16 Performing and Governing the Future in Science and Technology." In *The Handbook of Science and Technology Studies*, edited by U. Felt, R. Fouché, C. A. Miller, and L. Smith-Doerr, 465–493. Cambridge: MIT Press.

Krafft, P., M. Young, M. Katell, K. Huang, and G. Bugingo. 2020. "Defining AI in Policy Versus Practice." Paper Presented at the Proceedings of the AAAI/ACM Conference on AI, Ethics, and Society.

Meld. St. 14. 2020–2021. "Long-term Perspectives on the Norwegian Economy 2021." https://www.regjeringen.no/contentassets/91bdfca9231d45408e8107a703fee790/en-gb/pdfs/stm202020210014000engpdfs.pdf.

Meld. St. 7. (2019–2020)a. "Nasjonal Helse- og Sykehusplan 2020–2023." https://www.regjeringen.no/contentassets/95eec808f0434acf942fca449ca35386/no/pdfs/stm201920200007000dddpdfs.pdf.

Meld. St. 7. (2019–2020)b. "National Health and Hospital Plan 2020–2023." Summary. https://www.regjeringen.no/contentassets/95eec808f0434acf942fca449ca35386/en-gb/pdfs/stm201920200007000engpdfs.pdf.

Morley, J., C. C. Machado, C. Burr, J. Cowls, I. Joshi, M. Taddeo, and L. Floridi. 2020. "The Ethics of AI in Health Care: A Mapping Review." *Social Science & Medicine* 260: 113172. https://doi.org/10.1016/j.socscimed.2020.113172.

The National Strategy for AI in Health and Social Care. n.d. https://transform.england.nhs.uk/ai-lab/ai-lab-programmes/the-national-strategy-for-ai-in-health-and-social-care/.

Pollock, N., and R. Williams. 2010. "The Business of Expectations: How Promissory Organizations Shape Technology and Innovation." *Social Studies of Science* 40 (4): 525–548. https://doi.org/10.1177/0306312710362275.

Rajpurkar, P., E. Chen, O. Banerjee, and E. J. Topol. 2022. "AI in Health and Medicine." *Nature Medicine* 28 (1): 31–38. https://doi.org/10.1038/s41591-021-01614-0.

Seneviratne, M. G., N. H. Shah, and L. Chu. 2020. "Bridging the Implementation Gap of Machine Learning in Healthcare." *BMJ Innovations* 6 (2): 45–47. https://doi.org/10.1136/bmjinnov-2019-000359.

Thedvall, R. 2013. "Punctuated Entries. Doing Fieldwork in Policy Meetings in the European Union." In *Organisational Anthropology: Doing Ethnography in and among Complex Organisations*, edited by A. Nyqvist and C. Garsten, 106–119. London: Pluto Press.

Tutton, R. 2017. "Wicked Futures: Meaning, Matter and the Sociology of the Future." *The Sociological Review* 65 (3): 478–492. https://doi.org/10.1111/1467-954X.12443.

Van Lente, H. 2012. "Navigating Foresight in a sea of Expectations: Lessons from the Sociology of Expectations." *Technology Analysis & Strategic Management* 24 (8): 769–782. https://doi.org/10.1080/09537325.2012.715478.

Van Lente, H., and A. Rip. 1998. "Expectations in Technological Developments: An Example of Prospective Structures to be Filled in by Agency." In *Getting New Technologies Together: Studies in Making Sociotechnical Order*, edited by C. Disco and B. van der Meulen, 203–230. Berlin/Boston: De Gruyter, Inc.

van Merkerk, R. O., and H. van Lente. 2005. "Tracing Emerging Irreversibilities in Emerging Technologies: The Case of Nanotubes." *Technological Forecasting and Social Change* 72 (9): 1094–1111. https://doi.org/10.1016/j.techfore.2004.10.003.

Verdegem, P., ed. 2021. *AI for Everyone? Critical Perspectives*. London: University of Westminster Press.

Wang, P. 2019. "On Defining Artificial Intelligence." *Journal of Artificial General Intelligence* 10 (2): 1–37. https://doi.org/10.2478/jagi-2019-0002.