Continuing Education in HTA for Digital Health Integration

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Abstract. This paper explores how continuing education can support more context-sensitive and ethically grounded enactments of digital health technologies in the Danish healthcare system. Based on 20 semi-structured interviews with health actors across clinical, educational, managerial, innovation and policy domains, we analyse how different professionals perceive current enactments of health technologies and the role of continuing education. Our analysis reveals widespread concern over time scarcity, fragmented responsibilities, and lack of shared vocabularies across professional domains. Interviewees call not only for technical training, but for educational spaces that support critical reflection, ethical awareness, and cross-professional dialogue. In response, we present Health Technology Assessment 2.0 (HTA 2.0), a framework developed for continuing education. Drawing on both inductive and deductive coding, we examine how its six dimensions (Technology, Economy, Environment, Organisation, Patient/Citizen, and Ethics) resonate with everyday practice and healthcare actors' concerns. We suggest the potential of HTA 2.0 to act as a boundary object: structuring shared reflections while accommodating different professional viewpoints. We conclude that continuing education should not aim for consensus but provide structured arenas where health actors can explore challenges, reflect on dilemmas, and co-develop meaningful approaches to digital transformation.

1 Introduction

1.1 Demographic Changes and the Growing Healthcare Demand

The Danish healthcare system is increasingly shaped by demographic and structural changes. An aging population, the rising prevalence of chronic diseases, and growing citizen expectations are converging to place considerable demands on both healthcare services and the healthcare professionals delivering them (Højgaard & Kjellberg, 2017).

These pressures are not merely numerical; they challenge the core organization and sustainability of care.

By 2036, the number of citizens over the age of 80 is expected to have nearly doubled compared to 2016, while the working-age population continues to decline (Højgaard & Kjellberg, 2017; Hansen et al., 2022). This demographic 'double pressure' implies that more people will require complex care, but fewer will be available to deliver it. Compounding this, the demand for healthcare professionals is rising significantly, with projections estimating a need for 44,000 additional employees in the public sector by 2030 just to maintain current service levels (KL, 2022). Yet recruitment and retention remain major challenges: the number of vacant nursing positions has increased, and resignation rates among healthcare staff have surged by 50% from 2020 to 2024 (Sundhedsmonitor, 2024).

These developments are mirrored in the increasing complexity of care. Patients with more than one chronic condition require longer, cross-sectoral treatment trajectories, demanding strong coordination, new types of competencies, and flexible systems. For instance, patients with three or more chronic conditions generate healthcare costs up to eleven times higher than those without any (Højgaard & Kjellberg, 2017).

1.2 Technology as a Proposed Solution?

In response to mounting structural challenges, Danish healthcare policy has increasingly turned to digital health technologies as a potential solution (Indenrigs- og Sundhedsministeriet, 2023). Strategies such as the National Strategy for Digital Health (Sundheds- og Ældreministeriet, KL & Danske Regioner, 2018), promote an integrated, citizen-centered healthcare system supported by scalable, interoperable digital solutions. *Local Government Denmark* (KL, 2022) and *Danish Regions* (Danske Regioner, 2022) highlight technologies, such as medication robots and video consultations, as pragmatic tools to ease workloads, enhance patient autonomy, and improve efficiency.

The Danish Resilience Commission (Robusthedskommissionen, 2023) emphasizes technology's role in addressing staff shortages by automating tasks, enhancing patient self-care, and supporting differentiated service models. The Commission recommends structural reforms to accelerate adoption, including modernized regulation and funding mechanisms. Yet stakeholders also caution against simplistic 'technological quick fixes' (Langstrup & Gjødsbøl, 2023) and point to major implementation challenges: insufficient governance, inconsistent evidence assessment, lack of guidance on how to implement and use health technologies in practice, as well as limited continuing education.

These strategies stress shared infrastructure and digital standards, encouraging locally driven innovation to be scaled nationally. However, the success of such innovation relies heavily on implementation capacity, professional engagement, and systematic knowledge sharing. Digital technologies may offer great potential, but successful

integration is contingent on meaningful implementation, local anchoring, and proper workforce training (Ugeskriftet, 2018a, Ugeskriftet 2018b). Health professionals often experience frustration and encounter challenges when new tools are introduced without time, support, or adaptation of workflows (Jensen & Børsen, 2024).

At the EU level, *Regulation 2021/2282* reflects a growing recognition that the assessment and implementation of health technologies is a complex process. This regulation aims at harmonising the approach to *Health Technology Assessment* (HTA) across member states and reducing fragmentation and duplication in assessment procedures. It was introduced to meet the challenges developers face when navigating multiple, parallel national requirements that is said to delay innovation and increase costs. By establishing joint clinical assessment procedures to support national decision-making, the EU seeks to streamline evidence processes while respecting local healthcare contexts (European Parliament and Council, 2021).

The *WHO Regional Digital Health Action Plan for the European Region 2023–2030* (World Health Organization, 2022), also identifies digital transformation as a key accelerator of resilient and people-centered healthcare systems. It outlines strategic priorities including governance, literacy, evidence-building, and equity in digital health adoption. It is emphasized that digital innovation must be driven by real-world health needs, respect professional expertise, and empower citizens.

1.3 A gap Between Technological Potential and Real-World Use

While digital health technologies hold immense promise for improving healthcare efficiency, quality, and access, real-world use often falls short of this potential. The implementation of new digital technologies tends to be far more complex than anticipated, especially when introduced into already strained healthcare systems. Technologies that appear beneficial on paper frequently lead to unintended consequences such as increased workload, fragmented workflows, and staff frustration. An example is the implementation of the Epic based electronic health record implemented in two Danish regions in 2016. The rollout was followed by major workflow disruptions, data integration failures, and sharp increases in time spent on clinical documentation. Reports describe patient injuries linked to system errors, and five years after go-live, one third of users still express dissatisfaction. The case illustrates how large-scale digitalization can compromise care quality and staff wellbeing when technological ambition outpaces organizational readiness (Hertzum, Ellingsen & Cajander, 2022).

A large-scale analysis has revealed that many digital interventions fail to reduce staff time or improve productivity. Among 467 reviewed studies, over 30% showed no or even negative impact on healthcare staff time (Shemesh et al., 2025). The reasons were primarily linked to poor usability, lack of training, additional administrative burdens, and

failure to adapt existing workflows. The findings challenge the widespread assumption that procurement of digital tools alone is enough to generate meaningful benefits.

Frontline experiences often illustrate a stark mismatch between policy ambitions and everyday realities. A study of public sector digitalization describes how healthcare professionals must continuously adapt to shifting digital systems while juggling core responsibilities. The result is a workday marked by system fragmentation, constant change, and limited time for actual patient-centered tasks. As Oskarsen and Bratteteig (2024) underline, the additional time and resources required for technology implementation often constitute invisible work that remains poorly recognized.

These experiences also reflect a broader structural challenge: the organizational context is rarely ready to absorb the full impact of digital change. Agile development practices may enable rapid software iteration, but they often fail to align with the slower, highly interdependent nature of clinical work. As a result, system updates and new functionalities can outpace organizational capacity for adaptation, creating continuous disruption and frustration among staff (Oskarsen & Bratteteig, 2024).

In parallel, HTA rarely documents clinician time as a key metric. This is documented in a recent scoping review of telemedicine trials. Among the 78 included studies, only four measured clinician time directly, and most found no significant difference between telemedicine and standard care (Kidholm et al., 2024). Despite this, time use is rarely included as a key evaluation parameter in formal HTAs. As a result, current assessment practices risk overlooking one of the most pressing challenges facing healthcare systems today i.e., the shortage of time and personnel.

The result is a situation where digital technologies are introduced with high expectations, but limited awareness of the conditions necessary for successful integration. Without robust implementation strategies, local adaptation, and investment in staff training and engagement, the benefits of digitalization risk remaining theoretical.

1.4 Bridging the Gap through Continuing Education

Frameworks increasingly recognize that digital transformation requires not only smarter technologies, but smarter learning systems. *The Danish Ministry of Higher Education and Science* (Uddannelses- og Forskningsministeriet, 2023) identifies continuing education as a strategic lever for supporting innovation in the life sciences and healthcare sectors. Particular emphasis is placed on interdisciplinary, practice-oriented formats that support professionals in dealing with both technological and societal challenges. Yet, the existing continuing education landscape remains fragmented. A national analysis by the *Danish Center for Social Science Research* (VIVE, 2023) shows that while non-formal digital and clinical training opportunities exist, they are often scattered, short-term, and poorly coordinated making them difficult to navigate for time-constrained healthcare professionals. In response, the *Danish Ministry of Higher Education and Science*

launched a targeted funding scheme under the national Life Science Strategy to support the development of continuing education initiatives that address digitalisation, automation, and technological change in healthcare (Uddannelses- og Forskningsministeriet, 2023). This project is funded by that programme and reflects a broader political recognition of digital transformation not only requires new tools, but also new professional competencies.

To conceptualize the potential of continuing education in bridging 'the implementation gap' in digital healthcare, we draw on perspectives from *Responsible Research and Innovation* (RRI) and *Science and Technology Studies* (STS). RRI calls for embedding anticipation, inclusion, reflexivity and responsiveness into the development and governance of technologies (Stilgoe et al., 2013). In healthcare, this entails recognizing that technologies do not only solve problems they also reconfigure professional identities, ethical obligations, and the distribution of work. Rather than prescribing fixed solutions, contemporary RRI approaches emphasise contextual translation and value negotiation in local settings (Boenink & Kudina, 2020). This is the type of work that continuing education could potentially support, by creating structured spaces where professionals can explore emerging dilemmas, voice concerns, and develop anticipatory competences before innovations become entrenched.

STS complements this view by offering conceptual tools to understand how reflection and collaboration happen in practice. One such concept is critical proximity (Amanatidis & Børsen, 2024) that refers to the ability to stay close enough to practice grasping its constraints, while maintaining enough distance to critically engage with routines and institutional logics. Continuing education may offer a site for cultivating this stance allowing professionals to examine real-world dilemmas without the pressure of immediate decision-making, fostering a mode of inquiry that is both grounded in practice and reflexive.

STS can also open for an understanding of how cross-professional collaboration around HTA can unfold despite different views, through the concept of boundary objects (Star & Griesemer, 1989). Boundary objects are concepts, frameworks, or artefacts that are flexible enough to adapt to local needs while retaining a stable identity across domains. In the context of this project, HTA continuing education can be seen as a possible boundary object (Levina & Vaast, 2005). We will use this concept to explore if continuing education in HTA can create a common ground where health actors, with different roles and perceptions, can engage in constructive dialogue about assessment and implementation of digital health technologies.

Thus, in this paper, we approach continuing education not as a vehicle for teaching professionals how to use technologies, but as an arena for collective reflection and dialogue about how technologies shape care, professional judgement, and organizational practice. Rather than focusing on operational proficiency, we conceptualize continuing

education as a space for enactment, where professionals actively examine, discuss, and negotiate the meanings, risks, and opportunities of digital health tools in their own contexts. This shift from *use* to *enactment* highlights education as a reflective and anticipatory practice rather than a purely technical one.

Taken together, these frameworks point to continuing education as a promising but underutilized arena for fostering more reflexive and context-sensitive digital innovation. It is not a silver bullet, but it may offer an important entry point for engaging with ethical, organizational, and practical tensions that often complicate implementation of health technologies. Thus, our research question addressed in this paper is:

> *How do healthcare actors perceive continuing education in Health Technology Assessment as a means to bridge the gap between the potential of digital health technologies and their everyday enactment in clinical practice?*

2. Method

To answer this research question, this study employs a qualitative and interview-based research design that explores how healthcare actors understand and assess digital health technologies in practice, as well as how they see and desire continuing education. Semi-structured interviews were chosen as they allow for both consistency and flexibility across conversations, enabling participants to reflect on concrete experiences while also articulating broader concerns and priorities. This approach can capture nuanced, context-dependent insights needed to inform the development of continuing education frameworks.

In line with the exploratory aim of the study, the analysis followed a two-step design combining inductive and deductive coding. In the first, inductive phase, emergent themes were identified from the interview material to capture how health actors describe everyday experiences, tensions, and needs related to digital technologies. In the second, deductive phase, these insights were revisited through the analytical lens of the *Health Technology Assessment* 2.0 (HTA 2.0) framework (further explained in Section 3.2) to explore how informants' reflections related to its six dimensions: Technology, Economy, Organisation, Patient/Citizen, Ethics, and Environment. HTA 2.0 was selected because it provided a structured yet flexible framework for identifying which aspects of technological change participants emphasized, neglected, or contested. Rather than evaluating technologies themselves, the framework was used to map how different aspects and implications surfaced in the informants' reflections.

2.1 Semi-Structured Interviews

The data collection consisted of 20 semi-structured interviews with actors across the Danish healthcare sector. Participants were selected via purposive sampling to ensure diversity in professional backgrounds, institutional affiliations, and hands-on experience with digital health technologies. Interviewees included clinical staff, educators, policy advisors, innovation consultants, and representatives from hospitals, municipal services, and professional organizations. To provide a structured overview of participant diversity, the 20 informants were grouped into four main categories based on their professional affiliation and role: (●) Innovation and digitalization units, (●) Healthcare professionals, (●) Academics and educators of Healthcare Professionals, and (●) Professional and regulatory organizations in healthcare in the healthcare sector. *Figure 1* illustrates the distribution of interviewees across these categories.
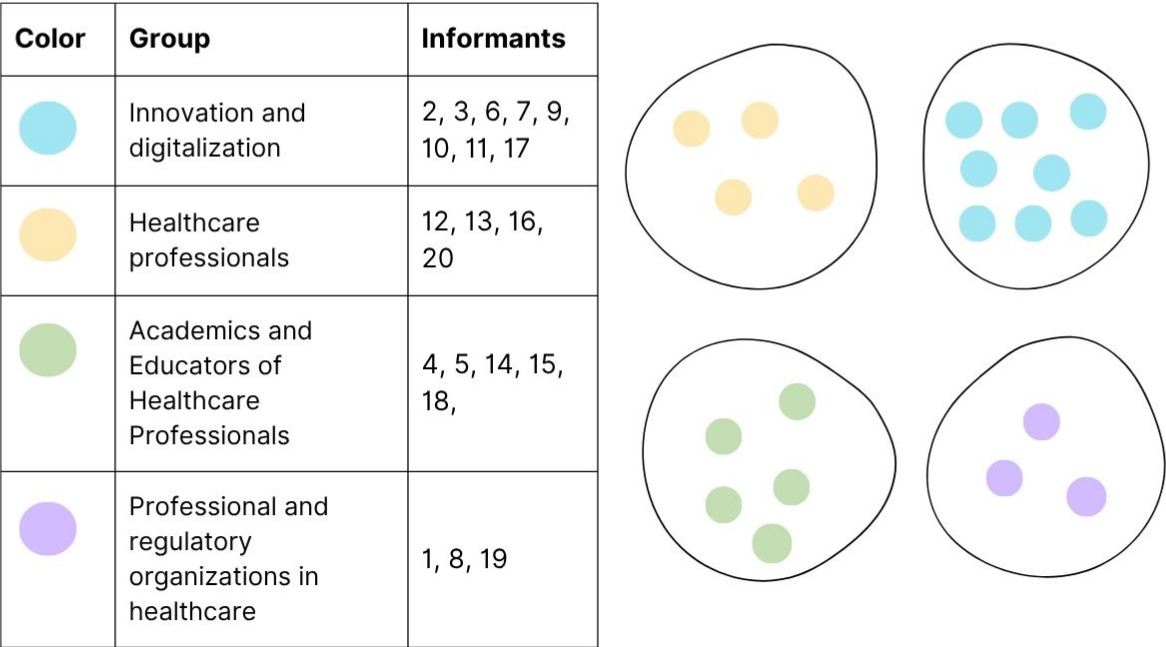
Color	Group	Informants
●	Innovation and digitalization	2, 3, 6, 7, 9, 10, 11, 17
●	Healthcare professionals	12, 13, 16, 20
●	Academics and Educators of Healthcare Professionals	4, 5, 14, 15, 18,
●	Professional and regulatory organizations in healthcare	1, 8, 19

Figure 1: Overview and grouping of interviewees

To guide the interviews, a semi-structured interview guide was developed and used. The guide covered a range of themes: from procurement and assessment of digital technologies to implementation strategies, organizational involvement, sustainability considerations, and the perceived need for continuing education to bridge the implementation gap. Questions were tailored to elicit both evaluative and experiential insights for instance, how needs for new technologies are identified, how success is defined during implementation, and what competencies are seen as lacking or essential for engaging with digital health tools.

The interviews were conducted online, lasted approximately 60 minutes, and were audio-recorded with the participants' informed consent. Transcriptions and minutes of the

interviews were prepared and anonymized. Anonymization was carefully negotiated to protect individual identities while still retaining relevant information about participants' institutional and professional contexts. Each participant was consulted on how they are presented in the final output.

The interviews were analysed using the hermeneutic circle, an iterative method that moves between parts and wholes to refine understanding continuously. This approach allowed us to identify and relate individual perspectives to broader institutional and sectoral patterns, resulting in a rich understanding of how digital health technologies are assessed, negotiated, and made to work in practice.

Through the analysis we identify illustrative excerpts to be used in this paper. To validate the interpretations and ensure accurate representation, the selected quotes and their contextual framings were shared with the interviewees, who were given the opportunity to revise, clarify, nuance, or retract their contributions. This feedback loop strengthened the trustworthiness of the material and ensured that the analysis accurately reflected the intentions and insights of the participants.

3 Findings and Analysis

The following section presents the empirical findings based on 20 semi-structured interviews with healthcare actors. The section is structured in three parts: first, we outline shared and divergent perspectives among healthcare actors (3.1); second, we present five inductive themes that illustrate practical tensions and knowledge needs (3.2); and finally, we apply the HTA 2.0 framework deductively to examine how these issues align with its six analytical dimensions (3.3).

3.1 Shared and Divergent Health Actors Perspectives on Continuing Education

The interview material reveals both shared concerns and meaningful divergences in how different healthcare actors perceive digital transformation and the role of continuing education. Across the four main groups (innovation and digitalization consultants, healthcare professionals, educators and academics, and representatives of professional and regulatory organizations) there is strong agreement that digitalization cannot succeed through technical training alone. Informants across roles and professions emphasize the need for competencies that include critical reflection, contextual understanding, and ethical awareness.

More informants stress that continuing education is essential not only to enable safe and effective use of digital tools, but also to support professional judgement and maintain critical and contextual reflection. As one interviewee put it:

> *'We still need to keep our critical gaze, and that makes it even more important to develop some kind of competence, so we don't end up causing too many unintended incidents'* (I5, Academics and Educators).

Another reflected on the strain continuing education might place on healthcare professionals, noting that:

> *'It has become part of our work life that we must continue educating ourselves in technology while we work. And I think that's a cruelly underappreciated part of being a healthcare professional. The job of a healthcare worker is to deal with illness and human life. When we are asked to learn something new, we risk making mistakes, both for ourselves and others.'* (I11, Innovation and digitalization).

Significant challenges were raised regarding the feasibility of current and potential future educational offerings. Time scarcity, organizational pressure, and insufficient managerial support were cited as significant barriers. In this context, continuing education is not merely a technical fix but a site of negotiation about institutional priorities, the conditions under which professionals can learn, and the values that guide digital transformation. These insights align with recent national policy frameworks, including those from the *Danish Ministry of Higher Education and Science* (Uddannelses- og Forskningsministeriet, 2023) and the *Danish Centre for Social Science Research* (VIVE, 2023) analysis, which call for more coherent, practice-oriented educational strategies.

Despite this consensus, significant differences exist regarding how continuing education should be structured and what it could and should achieve. Health professionals emphasize safeguarding care quality, relational work, and patient safety. They call for educational formats that respect resource constraints and support decision-making under pressure. In contrast, innovation and digitalization consultants often frame continuing education as a lever for accelerating implementation, aligning practices with strategic goals, and improving efficiency. Educators stress the importance of flexible, practice-based learning grounded in pedagogical principles, while representatives of professional organizations highlight structural issues such as fragmented training opportunities, lack of coordination, and the need for clearer governance.

These differences reflect not just distinct roles, but different institutional logics: managerial, clinical, pedagogical, and policy driven. Each logic informs specific ideas about what counts as valuable knowledge, acceptable risk, and legitimate implementation. The result is not only misalignment of expectations but also practical tensions in how educational initiatives are understood and prioritized. These converging and diverging perspectives highlight the need for continuing education that is both flexible and dialogical, enabling professionals to navigate multiple logics and reflect across roles.

In the following section, we turn to inductive themes that further illuminate how these tensions and needs play out in everyday clinical and organizational settings.

3.2 Inductive Themes Emerging from the Interviews

Our inductive analysis generated five cross-cutting themes that illuminate the practical tensions and point to perceived knowledge needs faced by healthcare professionals engaging with digital technologies.

3.2.1 Impact of Technology in Practice

Interviewees highlight the dual role of technology as both enabler and obstacle. While acknowledging its potential, they frequently cite frustrations with poor usability, system fragmentation, and mismatch with clinical workflows.

> *'The dream is to have technology either optimize/streamline specific types of work, so you can avoid doing manual tasks, for example, and instead shift time toward performing the core task.'* (I11, Innovation and digitalization)

This statement captures the desire for technology to free up time and resources for healthcare professionals, enabling them to focus more on their primary responsibilities. However, it also hints at the practical challenges in achieving this ideal. The theme also reveals a pragmatic knowledge boundary, where management's drive for efficiency contrasts with clinicians' emphasis on professional judgement and relational care. This divergence illustrates how the same technology can be valued differently depending on institutional priorities, requiring spaces of negotiation to align its intended and experienced effects.

3.2.2 Structural Barriers

Informants identify systemic issues such as insufficient training, lack of time, and siloed decision-making. These obstacles make it difficult to translate strategic goals into practice.

> *'There is a lack of someone with the ongoing responsibility to maintain and possess the necessary competencies when it comes to technology implementation in healthcare.'* (I9, Innovation and digitalization)

This highlights how the absence of continuous responsibility for competency development contributes to the challenges in sustaining effective technology implementation. More of the interviewees mention structural fragmentation amplifies syntactic boundaries: the absence of a shared vocabulary between technology developers and clinical staff complicates decisions about what constitutes 'solid evidence'. For example, expectations rooted in evidence-based medicine often clash with the more situated, practical impacts of digital tools in practice.

3.2.3 Critical Tech Literacy of Healthcare Professionals

More informants underline that the problem is that healthcare professionals are underprepared to engage with technology beyond operational use. They emphasize the need for tools and training that support critical thinking and ethical reflection regarding technology in healthcare. As one informant explained:

> *'There is a difference between knowing how to navigate social media at home and having a professional technological literacy, because you have to communicate differently with patients, for example when chatting with them.'* (I5, Academics and Educators)

This distinction underscores the importance of developing profession-specific digital competencies that go beyond everyday technology use, enabling healthcare professionals to communicate effectively and ethically in clinical contexts. These findings point to semantic boundaries concerning the concept of 'good technology'. While decision-makers may equate it with cost-efficiency or scalability, practitioners emphasise alignment with professional values, user needs, and patient safety. This divergence illustrates tensions between different institutional logics (Riiskjær, 2014). Healthcare is a pluralistic field, where professional, managerial, and market-oriented logics coexist and often clash. These frictions shape how new technologies are interpreted, resisted, or adapted in practice.

3.2.4 Leadership and Organisational Change

Stronger leadership engagement and clearer implementation strategies are consistently identified as crucial for successful technology adoption. One informant highlights the importance of making technology-related tasks a core responsibility within performance assesments:

> *'If it is a core task you are measured on, then it also becomes a managerial focus. Because we act in accordance with how we are measured, that's how we are structured.'* (I10, Innovation and Digitalisation)

This statement emphasizes the necessity for leadership to prioritize and systematically support change management, as accountability drives organizational focus and action. The theme also reinforces the importance of addressing pragmatic boundaries at an organisational level. Leadership structures often overlook the continuous competence development required to absorb technological change, thereby rendering this work 'invisible' in formal systems of recognition and assessment.

3.2.5 Contextualization and Integration of Technology

Healthcare actors hold diverse interpretations and attitudes toward how technological solutions should be implemented. This diversity is illustrated by an informant who notes the importance of bridging different professional perspectives: *'They are two different worlds, and it is really important that they meet in the same room.'* (I2, Innovation and digitalization)

This quote highlights the challenges caused by a lack of shared language and differing realities between IT professionals and clinicians, which can hinder collaboration. The informant further emphasizes the need for open dialogue about needs and challenges to ensure solutions truly address user requirements and to tailor technologies to local contexts to balance scalability with practical usability.

Across all five themes, the interviews reflect a landscape marked by overlapping knowledge boundaries. These boundaries reflect divergent institutional aims, competing definitions of value, and incompatible evidence standards, and do not only hinder collaboration but also shape what kinds of technologies are adopted, resisted, or adapted. Continuing education has the potential to act as a boundary infrastructure that makes these frictions visible and negotiable through shared inquiry and reflective dialogue.

3.3 From Emergent Needs to Structured Assessment: Rethinking HTA

The five inductive themes outlined above reveal complex tensions, unmet needs, and interpretive boundaries in the everyday use of digital technologies in healthcare. To further examine how these challenges map onto existing assessment frameworks, we applied a deductive coding strategy based on an expanded version of the classical HTA framework. In the initial deductive phase, interview responses were coded according to the traditional HTA domains: Technology, Economy, Organisation, and Patient/Citizen (Børsen, 2025). However, it quickly became clear that additional critical aspects, especially ethical dilemmas, and environmental impacts, are consistently emphasised by participants but absent in the formal framework.

This observation aligns with trends in international health policy developments. The *EU Regulation 2021/2282* calls for a harmonised and evidence-based approach to HTA across Europe, while simultaneously underlining the need to implement technologies in ways that are efficient and sustainable for both patients and society (European Parliament and Council, 2021). Similarly, the Organisation for Economic Co-operation and Development(OECD) has introduced the concept of anticipatory governance, which advocates for early reflection on ethical and environmental concerns in the development and assessment of new technologies (Robinson et al., 2023). These broader developments directly support interviewees' calls for more practical and reflective

models: *'If we had an assessment approach that included ethics and sustainability locally at hospitals, I truly believe it would have an impact.'* (I1, Professional and regulatory organizations)

Thus, we introduce the HTA 2.0 framework (Jensen & Børsen, 2025) that is visualized in Figure 2. This updated model retains the four classical domains but adds two essential dimensions: Ethics and Environment. These are not included to increase complexity, but to surface issues that are already part of practitioners' everyday experience yet often remain invisible in formal assessments.

Figure 2: The HTA 2.0 framework (Jensen and Børsen, 2025). The model expands traditional HTA with ethical and environmental dimensions to support reflective decision-making in clinical settings. The star-shaped layout visually illustrates how the six dimensions are interlinked, indicating that they do not operate in isolation but continuously influence and shape one another in practice.

HTA 2.0 should not be understood as a complete model, but as a starting point for developing a more practice-oriented approach to health technology assessment. The six dimensions form an initial analytical structure that can be further specified through concrete methods and reflective questions in educational settings. For instance, ethical aspects may be explored through deliberative and ethical inquiry methods, technological aspects through user testing, and organisational aspects through mapping exercises of decision and responsibility chains as well as through observations of workflow integration. In the context of continuing education, these methodological elements will be developed iteratively together with participants, allowing the model to evolve as both an analytical and pedagogical tool. The intention is to further develop the model throughout

the project, as we consider it a dynamic rather than a static framework. In this sense, HTA 2.0 functions as a boundary object flexible enough to invite interdisciplinary dialogue, yet stable enough to provide a shared language for exploring how digital technologies transform healthcare practices.

The HTA 2.0 framework thus serves a dual purpose: it functions both as an analytical and a pedagogical tool to support reflection, learning, and informed decision-making. In the following section, we apply its six dimensions deductively to the interview data to explore how healthcare actors articulate challenges and priorities related to each domain.

3.3.1 Technology: Assessment, Integration, and Professional Agency

The interviews reveal that digital technologies hold significant promise, but their actual value is difficult to document systematically. Several respondents express concern over the lack of usable evidence demonstrating real-world effects, particularly in terms of workflow improvements and labour savings. One regulatory informant questioned the asymmetry between pharmaceutical and technological approval practices: *'No one today would take a pill if it hasn't been tested, so why would we implant or monitor with technology if we don't know it works?'* (I1, Professional and regulatory organization).

This highlights a widespread concern that technologies are often introduced before robust clinical documentation is available. Technological fatigue emerges as a barrier, especially when early implementation is poorly anchored, or communication is lacking. As one healthcare professional explained, even those tasked with promoting new systems can lose motivation when scepticism dominates:

> *'It is incredibly difficult to act as a super-user when so many people have already formed a negative opinion about the technology. I found it very hard to be the front person for something like that'* (I12, Healthcare professionals).

Technologies that are not aligned with existing work routines are experienced as burdensome rather than supportive. This underlines a shared call across groups for critical engagement and professional ownership in assessing whether technologies truly meet clinical and organizational needs.

Innovation and digitalization actors specifically describe technology as a strategic enabler of system-wide transformation, focused on scalability, interoperability, and structural efficiency. Yet many also point to a gap between ambition and execution. As one consultant noted: *'You can't implement change by dropping a new system in people's inbox. There needs to be dialogue and planning'* (I2, Innovation and digitalization). Another added: *'There is a lack of people with a clear mandate to secure implementation and follow-up'* (I9, Innovation and digitalization).

These reflections show an awareness that success depends not only on technical solutions, but on leadership, and institutional support.

Healthcare professionals approach technology from a pragmatic standpoint, grounded in clinical workflow and patient care. Several describe frustration with tools that increase documentation without improving efficiency: *'It doesn't help me finish my shift faster, it just adds more clicks'* (I16, Healthcare professional). Their experiences point to a recurrent usability gap and to the risk of alienation when new tools are introduced without sufficient adaptation or consultation.

Educators and academics view technology through a pedagogical and epistemic lens. Their emphasis lies not only on operational skills, but also on fostering critical reflection on how digital tools shape professional judgment, relations, and responsibilities. As one educator explained, *'It's about developing a professional understanding of technology, not just using it, but reflecting on what it does to the practice'* (I14, Academics and educators). Another highlighted the importance of making this reflection an integral part of learning: *'We don't teach technology as a separate thing, it's integrated across subjects because it's part of the profession'* (I15, Academics and educators).

Professional and regulatory actors emphasize safety, accountability, and system-level coherence. They express concern over the lack of systematic, transparent assessment processes at the local level and warn against premature adoption (I1, Professional and regulatory organization). Concerns were also raised about data ownership and the risks of dependency on commercial platforms.

Taken together, these perspectives reveal that 'technology' is not a neutral artefact, but multifaceted. While innovation actors focus on systemic impact, clinicians stress usability, educators promote reflective learning, and regulators demand robust assessment. HTA 2.0 offers a structured vocabulary that can surface these diverging rationales and facilitate dialogue across professional boundaries.

3.3.2 Economy: Cost-Benefit Uncertainty and Coordination Gaps

Across all groups, economic concerns are central, but interpreted through different logics and institutional priorities. Several informants question whether digital health technologies deliver actual savings or merely displace costs. A common concern is that while national policies emphasise innovation and efficiency, implementation costs are often borne by frontline professionals without additional resources. As one regulatory informant noted:

> *'It sounds good that patients don't have to come to the hospital, but if a nurse has to spend two hours every Friday going through vital parameters on a screen, maybe we haven't actually saved anything on labor.'* (I1, Professional and regulatory organization)

Innovation and digitalisation actors often frame economy in terms of long-term return on investment, scalability, and cost-effectiveness at a system level. However, several also highlight the lack of coordination between institutions, which results in inefficiencies and lost opportunities for collective procurement:

> *'Each department or region often purchases its own equipment, like full-body scanners. If we coordinated better, regionally or nationally, we could probably save money by buying in bulk.'* (I2, Innovation and digitalization)

Healthcare professionals take a more pragmatic stance. Their focus lies on hidden costs: time spent on documentation, managing new tasks/invisible work, and disruptions to clinical routines, costs that are rarely acknowledged in budget models. One healthcare professional (I16) expressed, that time spent navigating new systems is rarely compensated or offset by workload reduction.

Educators and academics draw attention to challenges of continuing education. They note that integrating digital health into already packed curricula requires trade-offs: *'There are already so many mandatory themes, it's not easy to create space for new things, even when they're important'* (I5, Academics and educators)

Finally, regulatory and policy-oriented informants highlight the lack of frameworks to evaluate economic impact across institutional boundaries. Several stress the need for cross-sector models that consider not only direct financial savings, but also implications for staffing, service quality, and equity.

Taken together, these perspectives suggest that while 'economic value' is widely invoked, its definition is contested. For some, it implies future efficiency; for others, it highlights immediate strain. HTA 2.0 offers an opportunity to make these tensions visible by encouraging assessment practices that include both local workload and system-level return, fostering more realistic and accountable decision-making.

3.3.3 Environment: Sustainability and Technology Lifecycles

Despite increasing political attention to green transitions, environmental sustainability remains a notably marginal theme in most formal assessments of digital health technologies. Across the interviews, informants generally agree that environmental impacts are rarely prioritized in procurement, implementation, or professional training.

Innovation and digitalisation actors describe a lack of lifecycle thinking, where technologies are introduced without consideration of durability, upgradeability, or waste. One consultant expressed frustration with premature obsolescence: *'We replace entire systems after just a few years, that can't be sustainable'* (I9, Innovation and digitalisation)

Regulatory and professional actors echo this concern, pointing to the need for more structured integration of environmental criteria. One informant highlighted international models as more advanced in this regard:

> *'The Canadian HTA model is more flexible as sustainability and ethics are included. I think that could have real impact if applied at a hospital level… But if [sustainability and ethics] became more of a general mindset, that's where the potential lies and where it could make a real impact.'* (I1, Professional and regulatory organization)

Educators and academics suggest that sustainability could be embedded in training, not just as a technical theme but as a component of ethical and professional awareness. They propose linking environmental considerations to broader discussions about responsible innovation and resource use. By contrast, healthcare professionals rarely mention environmental issues unprompted, reflecting the acute time pressures and prioritization of patient care. As such, sustainability often becomes an invisible dimension in day-to-day healthcare practices. Taken together, the interviews suggest that while sustainability is recognized as important, it is rarely operationalized. HTA 2.0 could help surface environmental concerns by treating them as a legitimate dimension of assessment, particularly when linked to cost, durability, and responsible use of public resources. In this way, the framework may help move sustainability from rhetorical commitment to practical consideration.

3.3.4 Patient and Citizen: Digital Divide and Relational Concerns

Interviewees note that patients' digital competencies vary widely, and that healthcare professionals are increasingly expected to support, guide, and assess patients in their use of digital services. Several respondents raise concerns that digital tools, while designed to optimize processes, risk undermining relational aspects of care if not implemented thoughtfully. One regulatory informant expressed frustration that the patient perspective is often instrumentalized:

> *'The patient perspective is often poorly addressed by health tech companies. If it is considered, it's usually for marketing purposes. But we're more interested in whether the technology truly benefits the patient or helps the healthcare system save resources. Often, someone has come up with a clever idea they want to profit from, and the patient view gets lost in the process.'* (I1, Professional and regulatory organization)

Care work is repeatedly described as relational and ethically grounded. One innovation consultant emphasizes that new technologies inevitably reshape this dynamic:

'When you work in healthcare, you carry a deep relational responsibility toward the patient in front of you. Whether you are making clinical decisions or supporting basic care needs, the interaction is grounded in respect and integrity. Introducing new technologies into this space is never neutral. If professionals are equipped to reflect on how digital tools shape these encounters, the quality of care can be preserved.' (I11, Innovation and digitalization)

These reflections point to a need for more systematic attention to the patient experience, not merely in terms of usability but as part of the ethical and relational fabric of care. Educators emphasize the importance of preparing students to adapt technology use to individual patients and maintain empathy in digital encounters. One educator (I5) noted that digital competence includes understanding how patients engage differently with tools and how those shapes clinical relationships.

Innovation actors often refer to patient feedback in terms of usability studies, interface design, or quantitative evaluations. One consultant, however, noted that such insights rarely address deeper experiences of care: *'Users may say the system works well, but that doesn't tell us how it affects trust or conversation in a patient consultation setting.'* (I3, Innovation and digitalization)

Regulatory informants call for more structured involvement of patients in assessment and policy development, warning against technologies that unintentionally widen the digital divide. As digitalization increases, the inclusion of diverse patient perspectives is seen as essential to ensuring equity and responsiveness. Taken together, the data show that while the value of the patient perspective is widely acknowledged, its interpretation varies across groups. HTA 2.0 can serve to make these differences explicit, supporting dialogue about how technology affects not just outcomes but also care relationships, trust, and inclusion.

3.3.5 Organization: Structural Constraints and the Role of Leadership

Organizational conditions strongly shape whether technologies succeed or fail in practice. Across interviews, informants consistently highlight that digitalization efforts are undermined when time, training, and communication are insufficient. Importantly, the success of implementation is not only dependent on the technology itself, but on leadership engagement, staff involvement, and the ability to articulate the rationality behind change. Healthcare professionals describe fragmented leadership and a lack of clear communication. One nurse emphasized the consequences of top-down rollouts: *'You don't implement by dropping a new system in our inbox. We need to know why and how'* (I12, Healthcare professional).

Many clinicians note that organizational support is often inconsistent, particularly when new technologies are introduced without sufficient planning, time, or follow-up. This results in resistance and frustration.

Innovation and digitalization actors view organisations as key levers for transformation. They speak of change management strategies, leadership metrics, and implementation roadmaps. Yet several acknowledge that this perspective is often misaligned with clinical realities. One consultant notes:

> *'If we don't explain why we are implementing this technology, people just see it as an annoying system disrupting their everyday work.'* (I6, Innovation and digitalization)

Another pointed out the absence of clearly defined roles for sustaining implementation (I9, Innovation and digitalisation). Educators and academics highlight that organizational support is crucial for enabling digital competence development. They argue that time for learning must be built into the system and that digital upskilling should not rely on individual initiative alone. Instead, structural enablers and recognition are necessary to ensure that digitalization becomes a supported part of professional development. Representatives of regulatory and professional organizations focus on governance, coherence, and accountability. Several informants express concern that without formal structures to assign responsibility for digital change, implementation efforts become fragmented or unsustainable. They stress the importance of aligning initiatives across levels to avoid duplication and inefficiencies. Taken together, these perspectives reveal that digital transformation depends not only on tools and strategies, but also on organisational readiness and distributed responsibility. HTA 2.0 may help clarify these dynamics by making visible the conditions that shape implementation, not just what technologies do, but what it takes to make them work.

3.3.6 Ethics: Dilemmas and Decision Blind Spots

Ethical aspects are frequently described as present but insufficiently addressed in formal assessments. Across the interviews, informants agree that ethical dilemmas, ranging from surveillance and data ownership to opaque decision-making in AI, are highly relevant in everyday practice but often remain underexamined. Healthcare professionals tend to frame ethics as something embedded in daily practice, often under time pressure and operational stress. One nurse captures this tension succinctly: *'Sometimes I'm not sure if I'm doing the right thing, registering or caring.'* (I13, Healthcare professional). This reflection illustrates how ethical judgment is exercised not only in grand decisions but in small, routine choices that balance professional duty and human presence. Innovation and digitalisation actors are increasingly attentive to ethical issues like algorithmic bias, transparency, and unintended consequences. However, ethics is often addressed too late in the process: *'We talk about ethics when the system is live, but maybe we should do it earlier.'* (I7, Innovation and digitalisation)

Another informant mentions that it is important to inform and prepare healthcare professionals when AI systems are implemented, otherwise it can affect their trust to a new system:

> *'You need to prepare the staff if a technology like AI is coming to their department. You can't just say: here's an artefact, a closed black box, and no one knows what it does.'* (I2, Innovation and digitalisation)

Educators and academics emphasise ethics as a transversal competence and an integral part of professional identity. They advocate for embedding ethical reflections into all stages of training, not as an isolated topic but as part of critical thinking and decision-making in practice. Professional and regulatory actors stress the need for clearer frameworks and procedures to evaluate ethical implications during procurement and approval. They express concern that ethical questions are often overlooked due to the absence of formal accountability mechanisms or relevant institutional routines. Taken together, these insights reveal that while ethical concerns are deeply felt across roles, they are not yet structurally integrated into assessment or implementation practices. HTA 2.0 can help address this gap by treating ethics not as an external constraint but as a legitimate and necessary dimension of technology assessment, linked to everyday dilemmas, institutional responsibilities, and anticipatory governance.

3.3.7 Diverging Perspectives Across Professional Groups: Can HTA 2.0 Support Cross-Professional Dialogue?

The preceding sections have shown how the six dimensions of HTA 2.0 resonate differently across professional groups. While the same themes recur, their interpretation, and prioritisation vary depending on institutional context, practical tasks, and professional roles. For some, technology represents systemic efficiency; for others, it introduces moral tensions, hidden costs, or relational disruptions.

These divergences do not reflect misunderstanding or resistance, but rather the multiple logics through which digital technologies are assessed in real-world settings. *Table 1* summarises how each group foregrounds different rationales and identifies where alignment or friction tends to occur. Several informants also reflect across domains, pointing to hybrid roles and emerging cross-professional awareness.

Group	Primary Rationales	Areas of Alignment or Tension
Innovation and Digitalisation	Focus on implementation capacity, scalability, and system-level efficiency	Possible tension arises when solutions lack clinical anchoring
Healthcare Professionals	Emphasis on usability, time pressure, and quality of care	Risk of resistance if implementation is top-down or adds workload
Academics and Educators	Promotes critical reflection, competence development, and pedagogy	Potential controversies between critical reflection and efficiency
Professional and Regulatory Organisations	Attention to evidence, equity, and cross-sector governance	Emphasize coordination and standardization while possibly overlooking practical situatedness

Table 1: Diverging Rationales and Tensions Across Health Actor Groups

What emerges is not a need for consensus, but for structured ways to articulate and negotiate these perspectives. HTA 2.0 does not erase institutional difference, it gives it form. By surfacing tensions that are often tacit, the framework can serve as a common language for critical dialogue, enabling healthcare actors to reflect on what technologies do, not only in terms of function, but in how they shape practice, responsibilities, and care. In the following section, we explore how these findings inform the design of continuing education initiatives and what it would take to embed HTA 2.0 as a boundary object that supports collective sense-making in complex healthcare environments.

4 Discussions and conclusions

4.1 Synthesizing Empirical Findings

The findings indicate a broader shift in how healthcare actors perceive the role of continuing education. Rather than focusing merely on the use of technologies, participants describe education as a space for developing the capacity to enact technologies responsibly in context to interpret, adapt, and negotiate digital systems within complex organizational and ethical environments. The informants thus see continuing education not as an add-on to implementation, but as a mechanism for translating technological ambitions into workable and meaningful practices.

The empirical material highlights how practical constraints, such as limited time, unclear responsibilities, and fragmented processes, challenge the implementation of digital technologies in everyday healthcare. At the same time, the analysis reveals that classical

HTA domains fail to capture critical aspects that matter to professionals, particularly ethical dilemmas, and environmental concerns. These insights underscore that effective education must move beyond technical training to also engage with the institutional logics and interpretive differences that shape technology use. *Table 2* summarises how HTA 2.0 responds to these challenges by providing a framework that can both support structured assessment and enable shared reflection across professional boundaries.

Phase	Findings	Implications for HTA Education
The inductive coding of interviews	1. Impact of technology in practice 2. Structural barriers in the healthcare system 3. Digital competencies and critical tech literacy 4. Leadership and organizational change 5. Technology integration in everyday work	HTA education must address real-world constraints such as lack of time, resources, and training support. It can focus on critical reflection, hands-on assessment skills, and integration of clinical realities into assessment.
The deductive coding of interviews	Six core dimensions of HTA 2.0: Technology, Economy, Organization, Patient/Citizen, Ethics, Environment	HTA education should go beyond technical assessments and integrate all HTA 2.0 dimensions. Tools to evaluate technology across disciplines and multiple societal dimensions are needed.
Synthesis of the two analytical approaches	Our synthesis identifies educational challenges: contextualizing assessment models, navigating value tensions, and enabling reflective dialogue across professional roles.	HTA 2.0 can serve as both an assessment tool to improve implementation of digital health technologies and a learning tool that can scaffold continuing education.

Table 2: Synthesis of findings from inductive and deductive coding and resulting implications for HTA education.

4.2 HTA 2.0 as an Educational and Reflective Framework

The HTA 2.0 model offers a structured yet flexible framework for interdisciplinary assessment of digital health technologies. It is both a pedagogical scaffold and a reflective tool that can be applied in clinical, municipal, and educational contexts. Based

on our findings, we suggest that HTA 2.0 can function as a model robust enough to structure shared dialogue, yet adaptable to local priorities and professional roles. The next step is then to see in practice how that works out.

Interviewees express a shared need for more reflective and situated assessment models, but they also articulate diverging expectations shaped by individual experiences, different roles and professional identities. This suggests that educational interventions should not seek consensus, but instead foster dialogical spaces where tensions between managerial, clinical, technical, and pedagogical logics can be surfaced and negotiated.

4.3 Continuing Education as a Boundary Object

A central insight from our study is that continuing education can act as 'boundary object' (Star & Griesemer, 1989): it does not merely transmit information or skills but enables reflection, anticipation, and sense-making in complex and dynamic work settings. This aligns with frameworks such as Responsible Research and Innovation (Stilgoe et al., 2013) and critical proximity (Amanatidis & Børsen, 2024), which emphasize inclusion and responsiveness in technology governance. By embedding HTA 2.0 in professional education, practitioners gain tools to assess not only efficacy, but also the societal, ethical, and organizational implications of digital transformation.

4.4 Policy Context and Anchoring of HTA 2.0

Several policy frameworks emphasize the need for context-sensitive digital health implementation. At EU level, *Regulation 2021/2282* calls for harmonized HTA procedures that support evidence-based implementation adapted to national contexts (European Parliament and Council, 2021). The *WHO Digital Health Action Plan* stresses governance, digital literacy, and equity (WHO, 2022). Nationally, the *Danish Strategy for Digital Health* (Sundheds- og Ældreministeriet, KL & Danske Regioner, (2018), the *Resilience Commission*'s recommendations (Robusthedskommissionen, 2023), and the *Life Science Strategy* (Uddannelses- og Forskningsministeriet, 2023) highlight innovation, workforce optimization, and digital competencies as key priorities.

Despite these ambitions, it remains unclear how such frameworks are to be translated into concrete institutional practices. While values like sustainability, inclusion, and ethical responsibility are prominently featured in strategic language, their operationalization in professional education, technology assessment, or implementation guidance is often vague or lacking.

In this context, HTA 2.0 may offer one possible contribution. As a reflective and practice-oriented framework, it could support the operationalization of policy ambitions**,** but only if it is adapted to local conditions and embedded for example in continuing education for health actors. Such integration could support a more grounded and critical approach to

digital transformation in healthcare, but it would require political initiatives, institutional support, and ongoing dialogue across groups.

4.5 Methodological Limitations and Future Directions

A limitation of this study is the underrepresentation of frontline health professionals. This may have constrained our ability to capture how assessment frameworks resonate with day-to-day care practices. Future workshops should aim to include more voices of healthcare professionals, to ensure that education and assessment tools align with practical concerns. Moreover, the overrepresentation of informants with innovation roles may have skewed some findings toward strategic or optimistic framings. While their insights are valuable, broader inclusion could reveal further tensions and implementation barriers.

In conclusion, HTA 2.0 has the potential to support more inclusive, critical, and context-sensitive approaches to digital health assessment and education. Rather than serving as a one-size-fits-all model, it offers a flexible framework that can scaffold interdisciplinary dialogue and reflective practice. Its integration into continuing education, could help bridge the persistent gap between technological ambition, implementation reality, and ensure that digital transformation in healthcare remains responsive to both professional expertise and societal values.

Our findings indicate that healthcare actors tend to view continuing education in HTA as a strategic mechanism for bridging the gap between digital ambitions and clinical enactment, by fostering reflections, negotiations, and a shared language across professional boundaries.

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