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Digitalizing Access to Care: How Self-Check-In Kiosks Shape Access to Care and Efficiency of Hospital Services

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Abstract

Responding to labor shortages and rising healthcare expenses, hospitals increasingly turn to self-check-in kiosks to streamline service delivery and improve patients' experiences. The purpose of this study was to reflect on the implementation of these self-check-in kiosks in a Dutch university hospital, particularly in relation to access to care for more vulnerable patients and intended efficiency goals. We followed a technology-in-practice approach to better understand how new technologies shape care practices in relation to in/exclusion and carried out an ethnographic action study involving desk research, participatory observations, semi-structured interviews, and reflection sessions with developers and hospital staff. Data were analyzed through ethnographic content analysis. Our results show that although self-check-in kiosks work well for some patients, many people experience practical and psychosocial difficulties, especially those who go through a complex care pathway, are low-literate, experience a distance the online world, or have sensory, motor, or cognitive impairments. Kiosks are not yet attuned to these patients and typically leave little flexibility and room for negotiation and personal support in what is, for many, a foreign environment. Therefore, patients frequently seek confirmation and assistance from already downsized or busy staff. In conclusion, we find that digitalization under the banner of efficiency within a healthcare system already under pressure carries risks, as it can unintentionally generate extra (invisible) work for patients and care professionals and threaten access to and quality of care for patients most in need. A more concentrated effort on refining the digitalization of healthcare processes using an inclusive-technology-in-practice approach has the potential to contribute to fairer and more efficient care for all patients.

Keywords

access to care; efficiency; eHealth; health inequalities; hospital ethnography; self-check-in kiosks

1. Introduction

Covid-19 and the healthcare crisis have significantly accelerated the development and adoption of transformative digital health tools. These tools are said to enhance the healthcare system by boosting efficiency, improving patient care, optimizing the use of scarce resources, and helping respond to the growing demand for care due to emerging demographic challenges such as aging and migration (Carboni et al., 2022; Greenhalgh et al., 2019). One such emerging technology is the "digital welcome desk" or "self-check-in kiosk," which promises efficiency for receptionists, offering them the opportunity to allocate their efforts towards alternative responsibilities (Joseph et al., 2023; Letafat-Nejad et al., 2020), and expediting patient experience by eliminating the need to queue (Williamson, 2016). Such kiosks have been proposed to reduce costs, increase information transparency, and significantly reduce time-to-first-identification for patients arriving in emergency departments (Joseph et al., 2023; Letafat-Nejad et al., 2020). Evidence of long-term efficiency remains scarce; nevertheless, the prevalence and future expectations of health kiosks are increasing (Maramba et al., 2022).

How such self-check-in kiosks generate, perpetuate, or reduce health inequalities is rarely discussed (Yao et al., 2022). However, it is increasingly known that access to digital technologies depends on social, economic, health, and cultural resources, such as education and income (Goedhart et al., 2022; Van Dijk, 2020). This unequal access to digital technologies was originally referred to as the digital divide (Morey, 2007) but is increasingly portrayed as a complex problem, encompassing motivation, skills, material, and user access, highlighting the multifaceted nature of the challenges people might face in accessing the online world (Van Dijk, 2020). These obstacles are particularly prevalent among people in more vulnerable circumstances. These groups—who also would benefit the most from improved access to healthcare—include those with a low socioeconomic position (Braveman, 2022; Huxley et al., 2005), limited health literacy, disabilities, long-term health conditions, the elderly, the homeless (Latulippe et al., 2017), and transient populations such as refugees, asylum seekers, and individuals experiencing homelessness (Huxley et al., 2015). They are likely to encounter problems accessing healthcare if self-check-in kiosks become the main route for accessing a hospital. This is problematic, as it is precisely these groups that are highly dependent on good care.

In this article, we reflect on the implementation of self-check-in kiosks in a Dutch university hospital. The aim of this study is to contribute to the integration of more inclusive technology within a (hospital) context by exploring how self-check-in kiosks work in practice and how they relate to (digital) access to care for patients in more vulnerable circumstances and necessary efficiency goals of the hospital in order to deal with an increase in healthcare demand and labor shortages (Huxley et al., 2015). To study this, we build on the principles of the technology-in-practice approach.

1.1. Technologies and Practices of Exclusion

Throughout history, medical sociologists have frequently analyzed medical technologies within the framework of medicalization—a process through which medicine asserts control over society by categorizing various conditions as medical issues (Timmermans & Berg, 2003). Consequently, medical technologies have often been viewed either as direct instruments of medical authority or as static entities, lacking historical context yet possessing a dynamic capacity to influence social practices and interactions (Casper & Morrison,

2010; Conrad, 1979). Timmermans and Berg (2003) divide the approach to technology into three distinct perspectives: technological determinism, social essentialism, and the technology-in-practice approach.

Technological determinism views technologies as decontextualized objects with the power to impact social arrangements (Dafoe, 2015). This perspective assigns significant explanatory influence to technology by isolating it and presupposing a unilinear impact—whether it is predominantly detrimental or beneficial. Technological determinism manifests in different degrees of intensity (Smith & Marx, 1994). Advocates of strong technological determinism contend that technology evolves autonomously, shaping society to conform to its inherent logic. Technological determinism, as it presents itself in medical sociology, usually does not concern the analysis of technology. Often, technological determinists exclusively focus on controversial, innovative technologies that threaten social order. The main theoretical problem with technological determinism is reductionism: Scholars attribute "super technological" powers to tools and practices, powers that do not hold up under empirical analysis (Dafoe, 2015; Henwood & Marent, 2019; Țicău & Hadad, 2021).

Social essentialism, on the other hand, underestimates the role of technology, focusing solely on the social context (Timmermans & Berg, 2003). From this perspective, medical technologies are seen as blank slates to be interpreted and imbued with meaning by culture. While such empirical analyses claim to center around medical technology, they actually delve into topics such as patient compliance, narratives of illness, caregiving and treatment, roles of illness, ideologies surrounding disability, experiences of illness, gender and race dynamics, and issues of inequality. These are all subjects traditionally studied by sociologists, but they are projected onto medical technology while the intrinsic characteristics of the technology remain unexplored. For social essentialists observing interactions influenced by technology, these technologies serve as sociological catalysts: They facilitate interactions or convey social meanings but do not independently act, influence, or evolve (Feenberg, 2000).

An alternative to these ways of understanding technology–society relations is the technology-in-practice approach, where technologies and humans are reframed as actors in a network that shapes technology's meaning (Law & Hassard, 1999; Timmermans & Berg, 2003; Timmermans & Kaufman, 2020). This approach has become a widely deployed alternative to the more traditional models of technological determinism and social essentialism, which are unsatisfactory for studying the complex relationship between technology and society in practice. The technology-in-practice approach has been widely used to study the social implications of (new) technologies without reducing them to the notion of "impact." This includes the study of Zillien and Hargittai (2009), who explore how users' online activities are influenced by their socioeconomic status and context of use. Starting from the technology-in-practice approach, Zillien and Hargittai found that digital inequalities are not only a temporary social phenomenon that will disappear once high-quality equipment and comfort with the technology become more widespread; they showed that despite a potential reduction in status-based disparities related to technological resources and digital expertise, discrepancies in internet utilization based on social standing are expected to persist. The technology-in-practice approach also helps to co-constitute relationships between humans, medical technologies, social effects, and social structures (Gardner, 2023; Timmermans & Kaufman, 2020). Through the examination of multiple case studies, Timmermans and Kaufman (2020) showcase how the elevated expenses, intricacy, and limited availability of critical technologies, such as those essential for kidney dialysis, have contributed to health inequalities.

Ultimately, the technology-in-practice approach enables one to identify whether issues such as social and material influences have consequences for how self-check-in kiosks work, the possible mismatches between their predicted and actual benefits, and their role in relation to health inequalities (Gardner, 2023; Øversveen, 2020; Timmermans & Berg, 2003) since self-check-in kiosks are not developed in isolation, and the organizational context in which they are implemented matters. Therefore, we focus not only on the interaction between patients and the technology but also on the perspectives of professionals, such as desk employees and those responsible for the kiosks' implementation. Our research is guided by the question: How do self-check-in kiosks work in practice, and how do they relate to access to care for more vulnerable patients and intended efficiency goals?

2. Methods: An Ethnographic Action Research

This study is part of the broader participatory action research project Doing eHealth Right, which aims to enhance the health potential of people with a low socioeconomic position and prevent further widening health inequalities (Amsterdam UMC, n.d.). In this sub-study, we reflect on the implementation of self-check-in kiosks in a Dutch university hospital. Employing an ethnographic action research design (Bradbury, 2015), we employed a variety of qualitative research methods, including participatory observations, semi-structured interviews, and desk research. Preliminary findings, for example, using fewer colors and adapting a larger font size (see Figure 1), were shared with members of the program Digital Transformation (outpatient) Care 2025 to improve the design and implementation of the self-check-in kiosks.

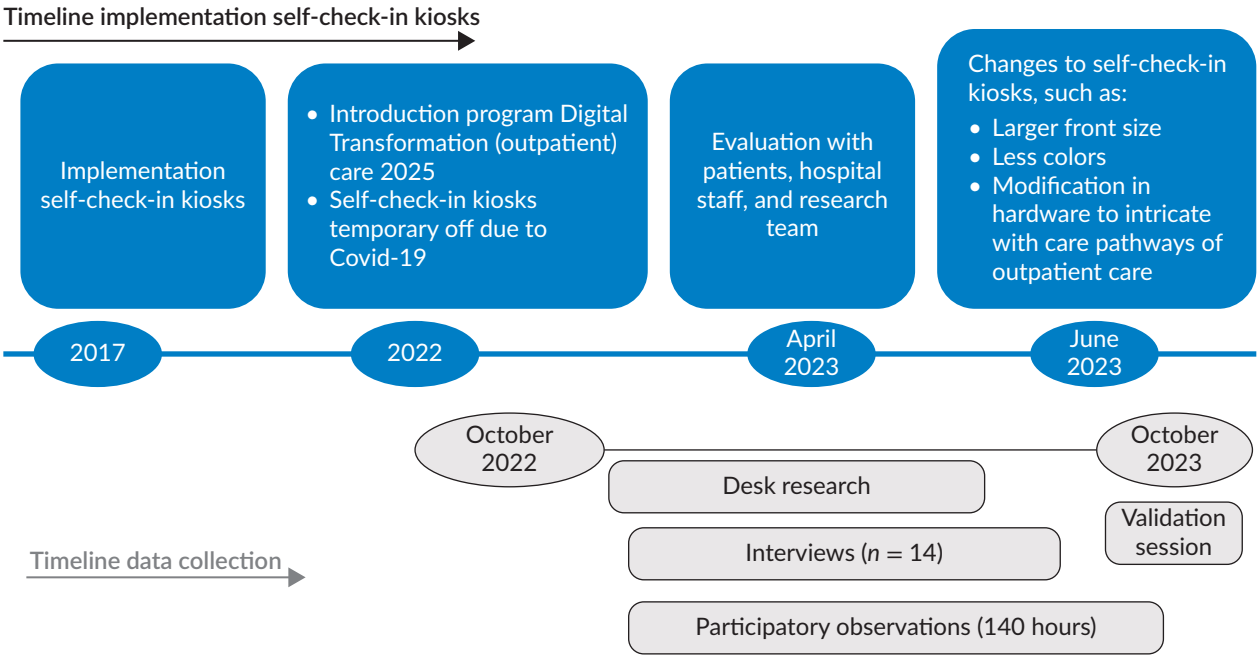

Figure 1. Timeline of the implementation of self-check-in kiosks and data collection.

2.1. Case: Self-Check-In Kiosks in the Netherlands

As in many European nations, health disparities persist between individuals with high and low socioeconomic positions. In the Netherlands, highly educated men have a life expectancy of 5.8 years greater than their less-educated counterparts, while highly educated women live 4.3 years longer than their less-educated counterparts. A gap of approximately 15 years lived in good health also exists between the highly educated and low educated (Rijksinstituut voor Volksgezondheid en Milieu, 2023). Despite efforts by policymakers and health organizations to reduce (health) inequalities through digital means, the Dutch healthcare system's combination of national insurance coverage coupled with market mechanisms of "regulated competition," as well as limited inter-hospital collaboration, results in highly diverse IT systems that do not always aid this goal.

The Dutch university hospital, central to this research, implemented the self-check-in kiosks in 2017 as part of a major digitalization initiative (Figure 1). The goal was to improve care efficiency, empower patients, ease administrative burdens on healthcare staff, and foster meaningful interactions between patients and healthcare providers. During the Covid-19 pandemic, the kiosks were temporarily turned off for hygiene reasons, and a policy program—Digital Transformation (outpatient) Care 2025—was introduced to define, develop, and implement enhanced digital health services. This included renewing the outpatient care registration process to reduce desk-employee workload and cut costs while still maintaining a high-quality patient experience.

From April 2023 to June 2023, time and resources were invested to enhance the user-friendliness of the self-check-in kiosks and to align their hardware/software with the diverse and intricate care pathways of outpatient care. Intermediate findings from the data were used to make these changes. In June 2023, the new registration process was launched. Despite its introduction, the older registration method, via the outpatient counters, persisted in some cases. Throughout the 12-month observational period, assistance availability varied: Sometimes, assistance was provided at the self-check-in kiosks; at other times, it was provided at the counter, and occasionally, it was unavailable. These fluctuations in the development process may influence the results of our study and are addressed when relevant.

2.2. Data Collection

Comprehensive understanding and triangulation of data were ensured by using a range of methods, including desk research, observations, interviews, and a final validation session (Figure 1). We met with members of the program Digital Transformation (outpatient) Care 2025 three times to share and discuss interim findings, enrich data collection, and inform the optimization of self-check-in kiosks. The improvements (June 2023) were partly based on the findings of this ethnographic action research. No new insights were found in the final validation session with the local project leaders.

For contextual understanding, desk research was conducted by analyzing (internal) policy documents. During the participatory observations (total of 140 hours), researchers (authors of the present article IL and NG) offered assistance and engaged in informal conversations with patients, employees, and volunteers in the hospital. Following exploratory observations, an observation schedule was developed to systematically record specific behaviors, such as searching for the self-check-in kiosks, handling these kiosks, searching for

help or assistance, interacting with others, and the consequences of and emotions relating to these patients' behaviors. Field notes were discussed with the team (IL, NG, TZJ, CD). Semi-structured interviews (n = 14) were conducted with hospital staff consisting of policymakers (n = 5), team leaders (n = 3), desk employees (n = 3), a staff member, a volunteer, and an application developer by using purposive sampling (Gray, 2021). The 30- to 60-minute-long interviews were audio recorded and transcribed with participants' consent.

2.3. Data Analysis

Data was analyzed, with the help of MAXQDA, through an ethnographic content analysis, meaning themes "emerged" from the data through a process of open coding and theme refinement without restricting the analysis by predefined codes and themes (Chapman et al., 2015). Intermediate findings were used to adjust the interview guide and the observation schedule. The quotes in the final manuscript were translated into English by the authors.

2.4. Ethical Considerations

This study was evaluated by the Medical Ethical Review Committee of the Amsterdam University Medical Center (AUMC), location VUmc, the Netherlands, which confirmed that the Dutch Medical Research Involving Human Subjects Act did not apply.

3. Results: Practical Obstacles and Consequences for Patients and Professionals

The self-check-in kiosks aim to streamline hospital processes, guide patients effectively, facilitate assistance, and alleviate administrative burdens on healthcare staff, as outlined in internal policy documents. The self-check-in kiosks appealed to numerous patients, particularly those familiar with the hospital infrastructure and those who visit the healthcare facility regularly. Such patients display a distinct behavior pattern, heading directly to the self-check-in kiosks for an efficient registration process before proceeding to the designated waiting area. One couple in their 60s–70s exemplified this as the woman effortlessly scanned her partner's pass, stating "we know the way," emphasizing their 20 years of visiting the hospital.

However, for other patients, this is an unfamiliar environment that they approach with apprehension, uncertainty, or concern about what will happen in their medical trajectory. This manifests in patients searching for the correct department in a large and unfamiliar building, visitors attempting to assist each other in navigating the hospital, and patients appearing stressed and emotional. A service desk employee (R10) said: "Well, patients come to a hospital for a result or with complaints. They don't know what to expect. It's different from checking in with public transportation at the bus." Although a considerable amount of time, energy, and money have been invested in making the self-check-in kiosk more patient-friendly (Figure 1), some patients still experience difficulties. Below, we portray the practical difficulties patients face and describe the consequences of this new service system for patients and healthcare workers.

3.1. Practical Obstacles in Signing Up

The self-check-in kiosks were placed in the hospital without modifying the physical space. In some departments, the signage still directs patients to the counter, meaning patients easily pass the self-check-in

kiosks. A mother of a six-year-old twin said: “The first time, I went straight to that counter, and then I was redirected to the registration kiosks. There was no one there. When no one is present, it’s easy to walk past.” Many people expect to be helped by a person and do not recognize the machine as a way of checking in: “I don’t understand why I have to check in at a kiosk when you’re [the researcher] standing here [between the self-check-in kiosks].”

Patients who did find the self-check-in kiosks were not welcomed but were immediately exposed to instructions: “Hold your patient card or appointment letter under the card reader or touch the screen.” As there is no text-to-speech function, patients are expected to be able to read the information themselves. Some patients struggle with reading, so the small text size and the short message display time (20 seconds) are insufficient to familiarize themselves with what is being asked. Reading is especially challenging for patients with visual impairments: “I am blind in one eye; I can’t do it. Can you help me?” It is also challenging for patients experiencing compromised stability due to illness, dizziness, or who are wheelchair-dependent to approach the self-check-in kiosk and follow the instructions.

In addition, patients who do not speak Dutch, have low literacy, and are unfamiliar with the online world struggle. The phrases used on the screen contain abstract words like “card reader,” “barcode,” and “scan.” The arrow to continue is often not recognized, leading to patients waiting until assistance is provided. “Why isn’t there an OK button instead of an arrow? You have that at the bank, you know,” says a man in his 70s. The registration kiosk adheres to rigid templates, limiting flexibility in terms of color and visual elements. Despite visitors’ different nationalities and migration backgrounds, Dutch and English are the only languages available. “I go where? Very frustrating that I don’t understand this sentence!” states a patient (50–60 years). Finally, the kiosks are surrounded by privacy screens that hinder bystanders from noticing difficulties and assisting.

Many patients encounter difficulty scanning their patient cards, often struggling to identify where or how to scan. Some press the patient card against the screen, others move it back and forth, resulting in unsuccessful scans. Staff often need to instruct patients to adjust the card. Other patients scan their passport instead of their patient card, which is required in other Dutch hospitals, confusing patients receiving treatment at multiple healthcare facilities. In addition, entering data, such as birth dates, can be difficult, especially for patients with sensory or motor impairments. A patient (50–60 years) said: “I have arthritis in my fingers. Typing doesn’t go very well.”

At the end of the procedure, a message with further instructions is shown, for example: “You have checked in; you may take a seat in the waiting area of department 12.” For some, this message is insufficient, making many patients try to re-register or look for confirmation, unsure whether they succeeded. Patients ask staff members questions like: “Did I do it correctly? Is it done this way?” “Am I checked in now?” “Do I need to go to the counter, or can I proceed to wait?” “Do I get a receipt?” A 32-year-old patient said: “When you check in at such a device, you still end up with uncertainties about whether it went well.”

Patients who successfully complete the registration process also face challenges as they cannot always find the right waiting room. The self-check-in kiosks cannot actively guide patients, which is essential because the unfamiliarity and size of the hospital frequently pose challenges for patients in locating the correct department, corridor, or waiting area. Using pointing gestures, a desk employee (R11) explains:

> It's a maze here. Patients should be told: If you walk down this corridor and through the door, you'll find the waiting room on your left. You can sit there. Instead, what appears on that screen is Corridor 8 Waiting Room 3 Route 13 A1.

While many patients experienced practical obstacles, for a button to request assistance is lacking, many were lucky to find a helpful person around. However, this was not always the case.

3.2. Consequences for Patients: Less Interaction, More Responsibility, and More Stress

The success of the new procedure was largely contingent upon the availability of assistance at the kiosk and the counter. Internal policy documents reflect the institutional ambition for personal assistance, for instance: "There is always someone nearby to address any questions you may have" and "you will be well-guided, both online and within the hospital." Due to budget constraints, absence, and a general shortage of personnel, this was not consistent in reality. A frustrated nurse explains: "There is no staff available, and for several weeks, there has been no one at the self-check-in kiosks. Initially, a hostess would greet you upon exiting the elevator and could assist, but we don't have that anymore." Closed counters provided instructions like: "Please check in at the kiosks. The host is happy to assist you" or "Do you have an appointment? Please check in at the self-check kiosks by the elevators. You may then take a seat in one of the waiting rooms." Unfortunately, these self-check-in kiosks were also not always staffed by a host, posing challenges in patient assistance.

The practical challenges outlined above and the fluctuating presence of assistance led to several negative consequences. First, self-check-in kiosks leave little flexibility and room for negotiation, while this is often needed. For instance, if a patient lacks a (digital) pass or a hospital-issued letter, a receptionist can consider the patient's specific situation:

> A pregnant woman forgets her patient card, and a staff member registers her manually, deviating from the protocol, with the rationale: "It's convenient for the patient." Her colleague adds: "I find it sad to send people back to the reception; I can, but it is sad."

Additionally, patients who are more than 15 minutes late for an appointment cannot check in via the kiosk, while desk employees could, in fact, help them. A desk employee (R11) said:

> There's always 1% that arrives slightly late, but there's no one at the counter. How does that work? Then, patients look for someone at the counter, but there's no one there anymore. We placed a note at the counter, allowing them to proceed to this room [office of medical assistants and nurses].

Second, patients are not emotionally supported or reassured during self-check-in processes. Many patients still prefer human interaction on arrival. A policymaker (R3) said: "It's interesting because contrary to our expectations, the number of digital check-ins actually decreased during the time assistance was present [at the self-check-in kiosks]. In all the enthusiasm and hospitality, a lot has actually been taken over." Personal inquiries such as "How are you?" "Were you able to find it?" "Did you manage with the wheelchair?" or simple compliments, like "Hello, little brave boy, you have a nice jacket on," are seen as essential to comfort the patient. A desk employee (R11) said: "If someone is approaching, I can observe if the patient is tense, sad, or very cheerful, and then you can interact accordingly. That's not possible with a kiosk."

Third, while the self-check-in kiosk is convenient for some patients and can be an empowering way to streamline their registration, others feel more dependent on the help of others. If there is no direct help near the self-check-in kiosks, patients are forced to bring a relative or to search for help at a different floor or department:

> Two women with a child were walking around searching and conversing about registration. Researcher IL asked them if he could help them. They explained that they didn't know how to check in and that there was no one at the self-check-in kiosks. The mother mentioned that she is not able to read Dutch well, so she brought a relative for translation, but she also didn't know what to do.

Fourth, self-check-in kiosks do not monitor patients' wellbeing in the waiting areas and cannot provide appropriate assistance when necessary:

> A woman (30–40 years old) asks: "Can you walk with me [to the coffee machine]? I'm feeling a bit out of it." She comes to the pain clinic every four weeks for an injection, and this makes her feel dizzy and unfocused. She says: "Digitization is not good for people who feel a bit out of it." There is no one to chat with her or get coffee. "What if I fall now? There's no one to help me." She feels anxious. She cannot have someone with her every four weeks; besides, she does not want to depend on others.

Fifth, the self-check-in kiosks add stress for some already stressed patients. "Am I doing it right?" asks a lady (70–80 years old). She apologizes for her question: "I'm a bit stressed. I have a second opinion coming up, and if this doesn't go well, I don't know what to do." When individuals are already insecure about their language or digital proficiency, stress tends to occur more readily:

> A man (30–40 years old) steps out of the elevator and asks if I can help with the check-in. He says: "I get short-circuited when you mention that digital stuff. I can get somewhat angry and irritated about it. You're forced to work digitally. I've lived abroad for a while, and I can immediately see that I've missed a lot."

The malfunctions that often occur in the self-check-in kiosk cause further stress. Patients often do not recognize the malfunction (a freezing welcome message from the developer) and try to continue. Patients express relief when the staff informs them of the malfunction: "I thought it was my fault."

3.3. Consequences for Desk Employees and Other Hospital Staff: More (Invisible) Work

The core idea behind self-check-in kiosks is to reduce desk employee workload. In some cases, this holds. A desk employee (R12) said: "It definitely relieves pressure because, if there are two people instead of six at your counter, it reduces the pressure." However, self-check-in kiosks sometimes only take over part of the work and responsibilities, and often cause extra work instead.

Desk employees continue to assist patients at the desk, as registration often involves actions such as filling out a questionnaire, measuring blood pressure, or weighing a patient, tasks that are not yet feasible through a machine. Similarly, desk employees receive numerous inquiries about the registration process, such as "Do I need to register here again?" or "I just registered at the registration kiosk; is that sufficient?" These questions sometimes take just as much time as registration.

Moreover, desk employees increasingly find themselves dealing with unsettled, insecure, or angry patients at their desks. The kiosks sometimes unintentionally expose patients to new medical information, necessitating desk employees to address medical questions. For example, during the observations, the desk employee of the oncology department shared a story about a patient who suspected she had been diagnosed with a form of cancer after seeing various appointments on the self-check-in kiosk:

> When a patient sees multiple appointments like radiotherapy on the self-check-in kiosk, the patient knows something is wrong. Why else would they have an appointment for radiotherapy? They then come to the counter and ask why they have an appointment for radiotherapy, and it's up to me to explain. Patients can also become emotional because of this.

Also, if system errors occur, patients' (angry) responses often end up at the desks. For example, a woman (20–30 years old) checks her father in. After waiting an hour, she returns angrily to report that the self-check-in went wrong. Irritated, she says: "This is not okay."

As a consequence, some desk employees feel that to deal with mistakes by the machines, they should keep track of all patients. A desk employee (R11) said: "We prefer them to come to the counter, and secretly, we keep track of that, even though they might have checked in via the kiosk." In some departments, to avoid issues, the desk employees turn off the self-check-in kiosks. Another desk employee (R12) said:

> Patients assume that both appointments will be quickly registered when they arrive. However, they are only registered for the ultrasound. After the ultrasound, the sonographer says: "You can take a seat in the waiting room." But they haven't been registered for the second appointment yet.

Self-check-in kiosks also cannot actively guide patients, relying on desk employees and passing staff members, including doctors, nurses, and janitors, to direct patients to the appropriate waiting area or search for them in hospital corridors. A desk employee (R10) said: "The doctors keep walking back and forth, searching for patients. That's not really efficient." Searching for patients is inefficient and can potentially negatively influence waiting times for other patients. The belief that self-check-in kiosks alleviate the workload of desk employees is open to question, as are the efficiency gains. Outpatient-department desk employees and other hospital staff are needed to make the kiosks operational, either by conducting the activities the kiosks cannot do (such as reassuring patients or showing them the way) or by addressing the issues caused by them (such as dealing with medical questions or angry patients).

4. Discussion

This study aimed to reflect on the implementation of self-check-in kiosks, particularly in relation to (digital) access to care for more vulnerable patients and the intended efficiency gains of a digital process. The technology-in-practice approach has proven valuable in examining the subtle complexities of interaction between self-check-in kiosks and patients within a complex hospital context that is under pressure due to staffing shortages and budget cuts. We demonstrate that self-check-in kiosks are not black boxes with uniform effects on all patients (e.g., Latulippe et al., 2017; Timmermans & Kaufman, 2020). While self-check-in kiosks are effective for certain patients, it is essential to recognize that the success of kiosks is contingent upon individual preferences, skills, needs, and context. Patients who find the self-check-in kiosks

convenient for streamlining their registration process appreciate the speed and autonomy provided. However, even though a considerable amount of time and energy has been invested in making the self-check-in kiosk patient-friendly, the standardized and uniform self-check-in kiosks create practical and psychosocial difficulties, such as increasing stress or insecurity and reducing autonomy and access, particularly for those already facing multiple challenges in life.

Negative experiences with self-check-in kiosks might heighten existing stress related to illness or feelings of inferiority (Darzentas & Petrie, 2019), meaning patients in more vulnerable circumstances are once again unable to meet the requirements of society and are confronted (again) with their dependence on the assistance of third parties (Goedhart et al., 2022). This can lead to emotions of shame and distrust and potentially worse health outcomes (Greene & Samuel-Jakubos, 2021; Milia et al., 2021). It might also affect consultation dynamics and retention (Westendorp et al., 2021). As Leavitt and Leavitt (2011) stated, stress may cause a patient to forget 40% to 80% of doctor-conveyed information. Long-term consequences of forgetting doctor-conveyed information may extend to patients' mental health and potentially worsen health disparities (Leavitt & Leavitt, 2011; Melita et al., 2021).

4.1. Invisible Work for (Some) Patients and Staff to Make the Self-Check-In Kiosk Work in Practice

The results highlight, perhaps seemingly small, limitations of self-check-in kiosks, often related to the absence of a "human face." This includes the inability of kiosks to provide a warm welcome in a, for many, foreign and uncomfortable environment. Kiosks are also unable to convey information through gestures or monitor patient wellbeing in the waiting room. Even though there was an institutional ambition for assistance next to the machine, budget constraints and a shortage of personnel meant this was not consistent in practice. Without assistance, the machine cannot provide the empathy and psychosocial intelligence necessary to manage patients' emotions and respond to their (complex) social contexts. Suchman (2007) empirically underscores the deficiencies of machines in enacting psychosocial relations and advises against designing machines that imitate humans. Patients are expected to autonomously manage their sign-in process without assistance, thereby assuming greater responsibility. This applies not only to self-check-in but also to all subsequent actions, such as finding the way to the right waiting room or taking care of oneself in the waiting room. As a result, patients are made implicitly responsible for achieving broader systems objectives such as cost reduction or enhanced efficiency (Øversveen, 2020). Patients who fail or refuse to take up these responsibilities are compelled to invest effort and time to ask for help, bring a family member or friend, or find other improvised ways to check in.

Our findings further reveal that self-check-in kiosks also unintentionally create additional tasks for employees. Workarounds to meet patients' needs are developed on the spot, often at the cost of the staff's time and energy, such as incorporating physical signage with patient instructions or resorting to manual patient tracking methods. This aligns with research from the field of science and technology studies of invisible and visible work (Oudshoorn, 2008; Star & Strauss, 1999), as these new technologies first render much of the work of what it means to check a patient in functionally invisible, which then results in the technologies' functioning becoming dependent on the work of various actors, including patients, healthcare staff, and informal caregivers. Since this work was first rendered invisible in the formal accounts of the task of doing a check-in at hand, the burden these kiosks place on patients and caregivers alike could possibly have been prevented. The workarounds needed could, optimistically, be seen as adding "a 'human face' to

the use of new technologies" (Dupret, 2017) but also, more critically, highlight the substantial consequences of there being a mismatch between a technology's intended purpose and its actual use (Mörike et al., 2022). When representations of work scripted in technological artifacts and instructions for users neglect the (in)visible work of healthcare professionals and patients, technologies risk becoming "technological monsters"—technically sophisticated but unable to support their users (Oudshoorn, 2008).

The invisible (extra) work for staff and (some) patients underscores the necessity of considering socio-organizational processes in further evaluations of the effects of medical technologies on inequalities. This consideration extends to digital access to care for more patients in more vulnerable circumstances. Current discourses on digital inequalities often focus on digital participation, assuming that individuals can only engage if they possess basic skills and material access (Smit et al., 2023; Van Dijk, 2020). However, in line with Smit et al. (2023), this study emphasizes that the normative understanding of digital participation, which dictates that individuals can only engage if they possess the requisite digital skills to utilize self-check-in kiosks, is unsatisfactory. Instead, we found that people employ intuitive and pragmatic tactics to use the self-check-in kiosk. In future policies regarding the consequences of medical technology, it is imperative to address digital inequality not solely from the perspective of individual digital capabilities but also by supporting tactics for those lacking sufficient digital access or skills. Considerations should be given to these tactics for health inequalities and organizational efficiency goals.

4.2. From Technology-In-Practice to Inclusive-Technology-In-Practice

Strengthened by the recent Covid-19 pandemic, hospitals in the current healthcare system, struggling with staffing shortages and budget cuts, increasingly prioritize the rapid deployment of health technologies. This research shows that, even in this pressurized context, technologies that promise to contribute to efficiency must be questioned and adapted based on empirical findings. For example, neglecting patient-related aspects such as sensorimotor and cognitive impairments in medical technology design will lead to exclusionary effects for at-risk patients (e.g., Al-Dhahir et al., 2022; Latulippe et al., 2017). Particularly, studies drawing upon theoretical insights from feminist technology studies and/or intersectionality have paid attention to problems in and around designing technologies, including biases in design. These studies highlight that technologies can unfairly discriminate against certain groups (see, for example, Costanza-Chock, 2018).

Although it is undoubtedly important to attend to design practices and make them more inclusive, a technology-in-practice approach remains vital to study technologies beyond the more formalized design stages, as the emphasis is placed on *how* the technology is used in practice (e.g., Timmermans & Berg, 2003; Timmermans & Kaufman, 2020). The focus on the in- and exclusions that happen in this process—the politically and analytically pertinent question of cui bono, who benefits, and who does the dishes (Star, 1995)—is crucial to ensure that this approach is equally sensitive to those who are marginalized through this version of technology-in-practice. To avoid technologies that materialize and prescribe expectations that only the most resourceful patient will be able to live up to, future studies utilizing the technology-in-practice approach should, therefore, continue to place special attention on questioning and adapting the technologies to the needs of patients in more vulnerable circumstances to be able to address exclusions as they happen in use. The approach can thereby help foster feedback loops that continue the design of technological practices well beyond the technology design stage, through which technologies are

continuously evaluated and tailored to meet the diverse needs of various patient populations, thereby fostering inclusivity. This process goes well beyond including patients in the design of digital health tools. In formalized approaches where only a limited number of individuals can verbally articulate their needs in a formal meeting setting, the nuanced challenges in interactions between technologies and patients within complex hospital contexts may remain unseen, as revealed in this study.

This study showed that continued and explicit attention to the invisible (extra) work of staff and (some) patients is needed to minimize the negative effects for some patients, particularly those in more vulnerable circumstances who are highly dependent on good care. Different studies have shown that making invisible work visible can help develop more appropriate and equitable technology (Engeström, 1999; Ming et al., 2022). Ming et al. (2022) studied the invisible work of different home health aides and highlighted their undervalued and underappreciated roles as frontline health workers. They faced invisibility in various aspects of their work, including tasks performed beyond their job requirements, serving as unrecognized conduits of knowledge within the healthcare system.

To avoid these shortcomings in future studies, we advocate for utilizing a technology-in-practice approach that maintains an explicit focus on intersectionality, (in)visible work, and feedback loops beyond the technology design stages. In other words, we propose an emphasis on not just a technology-in-practice approach but an explicitly inclusive-technology-in-practice approach where continued attention is given to how certain health technologies generate, perpetuate, or reduce health inequalities. In practical terms, this means that the pace of digitalization requires careful moderation, and the focus in the evaluation of technology should not be placed on easily measurable outcomes such as the number of online check-ins. Continuous critical examination of the interaction between patients, staff, and the technology is necessary to identify both the beneficiaries and non-beneficiaries of the technology. Explicit budget allocation is thereby needed to facilitate transformative changes in the technology that address the diverse needs of patients and promote inclusivity.

4.3. Strengths and Limitations

Our study was conducted in an academic hospital within the specific context of the Netherlands, and results may vary in other healthcare contexts. Despite this, it contributes to the growing body of knowledge on self-check-in kiosks through a detailed ethnographic evaluation of the patients', caregivers', and staff members' experiences in the registration redesign process. The applied ethnographic action research design facilitated the quick learning circles in practice, enhancing the accessibility of the self-check-in kiosk. The collaborative learning process is still ongoing. Finally, the first author's Moroccan background and proficiency in multiple languages facilitated communication with various patients from diverse backgrounds. This was well-received as "comfortable and pleasant," aiding in recognizing patients' questions, providing assistance, and providing space for more honest accounts of their experiences.

5. Conclusion

While self-check-in kiosks are efficient for some patients and reduce costs in the short term, their efficiency in the long term is questionable. The invisible work of, and easily ignored negative consequences for, patients and staff should be central in monitoring future practices to ensure efficiency and equality. In this case, the promised workload reduction seems elusive or is, at the very least, unequally distributed. This compels us

to reflect on the effects of tasks and processes being digitalized in a given context. While a self-check-in kiosk effectively registers a patient, it falls short in delivering a hospitable, empathetic experience for many patients in a foreign and stressful hospital setting. A more concentrated effort on refining the digitalization of subsequent healthcare processes using an inclusive-technology-in-practice approach has the potential to contribute to better, fairer, and more efficient care for all patients.

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Conflict of Interests

The authors declare no conflict of interest.

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