# Registered Nurses' Work Environment Associated with Auto-Anamnesis, Auto-Triage, and Online Chat[1]

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**ABSTRACT**

***Background:*** *The aim of this study was to explore experiences of how 1177 Direct, a medical system incorporating auto-anamnesis, auto-triage, and online chat, affected the work environment of registered nurses in Swedish primary health care.*
***Methods:*** *A qualitative study using content analysis of 29 semi-structured interviews was conducted with nurses from the central 1177 service (n = 10), official primary health care (n = 10), and private primary health care centers (n = 9).*
***Results:*** *Three main categories were found with regard to the study aim: 'professional competence and patient interaction', 'job demands' (cognitive and psychological job demands), and 'resources' (job control, support, and desired resources).*
***Conclusion:*** *Registered nurses reported altered patient interactions, increased job demands, and partial reduction in job control associated with 1177 Direct. To mitigate these challenges, they emphasized the need for streamlined contact channels, increased autonomy, reduced accessibility for minor conditions, and a strengthened recognition of their professional role in the digital context.*

**KEYWORDS**

*anamnesis / automation / digital work environment / E-health / job demands / nursing / patient interaction / telemedicine / triage*

## Introduction

Digital solutions play a central role in the Nordic health care systems and they are widely used by health care professionals, patients, and institutions (Birk et al. 2024; Hägglund et al. 2023). Digital primary health care is expanding in the Nordic countries as technology advances and patients become more familiar to interact with health care professionals online (Ekman et al. 2019; Srivastava et al. 2023). While digital innovations aim to enhance work efficiency and improve patient service, they may also introduce new challenges related to the work environment of registered nurses (Borges do Nascimento et al. 2023; Eldh et al. 2020; Entezarjou et al. 2020; Halmambetova et al. 2025; Rydell et al. 2025). The rapid digitalization of health care has transformed the work environment of nurses, introducing technologies such as electronic health records (EHRs), telemedicine, automation, and artificial intelligence (Borges do Nascimento et al. 2023). However, eHealth systems have also been shown to generate invisible work at the organizational level, much of which is carried out by

[1] You can find this text and its DOI at https://tidsskrift.dk/njwls/index.
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nurses (Frennert et al. 2023). A quantitative Finish study found that while increased digital patient contact enhances nurses' digital competence, it may also be associated with increased time pressure and stress, particularly when systems lack usability or proper integration (Kainiemi et al. 2024).

In Sweden, first-line care is delivered primarily through local primary health care centers, which may be publicly operated or privately managed, though all are financed through public funds (Sveriges Kommuner och Regioner 2024). Both public and private centers operate under similar regulations, offer equivalent services, and allow patients to freely choose their primary care provider. To improve access to health care services, Sweden utilizes the national platform 1177, which offers multiple digital and telephone-based channels. The 1177 website provides comprehensive health information, appointment booking, and self-care guidance. However, the specific functionalities available through the website may vary between different primary health care centers. In addition to the website, the 1177 telephone service offers around-the-clock access to registered nurses who provide real-time medical advice. Patients can also contact their own primary health care center directly during office hours for medical guidance or to book appointments. In such cases, they may either be placed in a live call queue or assigned a scheduled telephone appointment with a nurse. Unlike the central 1177 line, the telephone services at local health care centers often have a limited number of available time slots for nurse consultations. Then, in 2023, the eHealth system 1177 Direct was widely implemented in both central 1177 services and in local primary health care centers. The system consists of three components: auto-anamnesis (i.e., medical history taking) using automatically generated online questions, auto-triage for patient prioritization, and an online chat service connecting patients with a nurse. When using 1177 Direct, nurses typically work simultaneously with several other eHealth systems that support their tasks, such as EHRs, and medical and pharmaceutical information and decision-support systems (Sveriges Kommuner och Regioner 2024). The integration of 1177 Direct into primary health care highlights the importance of examining the organizational and social working conditions associated with its implementation.

Research on digital consultations in Swedish primary health care shows that while these systems have improved patient accessibility and efficiency, they have not necessarily streamlined workflows for nurses. The potentially low patient inflow and the perception that the platform supplemented rather than replaced existing functions may contribute to a decline in overall work efficiency (Eriksson et al. 2022). Additionally, an information system with functionalities similar to the current 1177 Direct but from another platform was pilot-tested within the central 1177 service. A pilot study based on nine interviews with nurses found that they experienced increased time pressure when using the chat system inline comparison with the telephone (Cajander et al. 2020). Furthermore, the nurses' ability to exercise professional judgment was limited, partly due to the predefined nature of the triage questions, over which they had no control. The constraints of text-based interactions also hindered their ability to incorporate non-verbal cues into clinical decision-making (Cajander et al. 2021). Hence, more research is needed to confirm and complement the knowledge with regard to the nurses organizational and social work environment in primary health care in relation to eHealth systems such as 1177 Direct.

The Swedish National Board of Health and Welfare (2019) have concluded that since the judgments of health care professionals might vary depending on the context,

the quality of care would benefit from a cooperation between health care professionals and computer to contribute with complementing competence. Humans should focus on the comprehensive perspective and computers on predefined tasks over human oversight. However, for this to be efficient health, care professionals must have digital literacy with regard to the relevant system, AI-systems included (The National Board of Health and Welfare 2019). However, this conclusion not encounters the possibly patients may have on the interaction, as in 1177 Direct. Notably, this conclusion does not account for the potential influence of patient behavior in such interactions, as relevant in the 1177 Direct service.

This study is grounded in the Job-Demands-Resources model (Bakker & Demerouti 2007; Bakker et al. 2023), a theoretical framework that conceptualizes risk factors associated with work-related stress across various occupations. The model is applicable to diverse industries, including nursing practice. It categorizes work characteristics into job demands and job resources. Job demands are the physical, psychological, social, or organizational aspects of a job that require sustained effort and are associated with physiological and psychological costs. This may include time pressure, emotional demands, and role ambiguity. Resources can be physical (such as equipment), psychological (such as autonomy in work, opportunities for professional development), social (such as support from colleagues and supervisors), or organizational (such as career opportunities, job security). The interplay between these elements can either lead to strain and health problems when demands are high and resources are low, or foster work engagement and productivity when resources are sufficient to buffer the demands (Bakker & Demerouti 2007). Job resources, on the other hand, are factors that enhance efficacy in achieving work goals, reduce job demands, and foster personal growth, learning, and development (Bakker & Demerouti 2007; Bakker et al. 2023). Exploring job demands and resources in the work with 1177 direct among nurses is crucial for understanding how to enhance well-being and job performance in the profession (Cajander et al. 2020).

The eHealth system 1177 Direct, which includes auto-triage, has been widely implemented in primary health care in Sweden. While digital solutions aim to improve efficiency and accessibility (Tarafdar et al. 2007), there is a growing concern that they may increase the nurses job demands (Eriksson et al. 2022). Job strain (high job demands and low control) (Karasek & Theorell 1990), and high staff turnover are already prevalent among nurses (Hall et al. 2016). Implementing new technology in nursing might influence job demands and resources such as job control (Cajander et al. 2020). Although a growing body of research addresses digitalization and occupational health, there remains a lack of empirical studies examining how digital tools impact the work environment of frontline healthcare professionals, including nurses (Håkansta et al. 2025). Despite the potential benefits of eHealth systems incorporating auto-anamnesis, auto-triage, and online chat, there is limited understanding of how nurses perceive their influence on the work environment. Consequently, this study aimed to explore experiences of how 1177 Direct influences the organizational and social work environment of nurses in primary health care in Sweden, using the Job Demands-Resources model as a theoretical framework. The novelty of this study lies in its exploration of the 1177 Direct as a new addition to primary health care centers and exploration of existing and warranted resources in relation to the 1177 Direct eHealth system.

## Methods

A qualitative research design was employed to explore registered nurses' experiences with the 1177 Direct eHealth system in relation the organizational and social work environment. Semi-structured interviews were utilized to collect open-ended data, enabling an in-depth exploration of nurses' perspectives. This methodological approach was selected to ensure a structured yet flexible inquiry, allowing for a focused investigation of the research topic while accommodating the emergence of relevant themes during the interview process (Kallio et al. 2016).

## Participants

Information on experiences related to the organizational and social work environment with regard to 1177 Direct was collected through 29 semi-structured interviews with nurses from a county council in Sweden. The participants included 10 nurses working at the central 1177 Direct service, 10 employed at public primary health care centers, and 9 at private primary healthcare centers (Table 1). Participants were strategically selected to ensure balanced representation from the central 1177 unit, public and private primary health care, as well as diversity in age, professional experience, roles (including employees and unit nurse managers), and gender, in order to capture a broad range of perspectives from nurses involved with the 1177 Direct. An interview guide was developed in accordance with the study's aim and methodological recommendations. It included questions exploring various aspects of work related to the use of 1177 Direct (Table 2). Follow-up questions were used primarily for clarification and were posed only when participants had not addressed key topics in their initial responses to open-ended questions.

Participants were strategically sampled through contacts within the county council responsible for the eHealth strategy. Interested nurses received an email containing an information letter and consent documents. Proficiency in the Swedish language was a

**Table 1.** Participant' characteristics (*n* = 29)

| | |
|---|---|
| *Sex* | |
| Men | *n* = 2 |
| Women | *n* = 27 |
| *Age* | |
| Mean (range) | 45 (27–63) |
| *Years in the profession* | |
| Mean (range) | 18 (4–45) |
| >5 years expertise | *n* = 27 |
| *Years at current workplace* | |
| Mean (range) | 5 (1–24) |
| *Primary health care center* | |
| Central 1177 service | *n* = 10 |
| Public primary health care | *n* = 10 |
| Private primary health care | *n* = 9 |

requirement for participation. A total of 29 semi-structured interviews were conducted via the Zoom video conferencing system. All interviews were audio-recorded and transcribed verbatim. Interview durations ranged from 23 to 65 minutes, with an average of 41 minutes per session.

**Table 2.** Semi-structured interview guide related to nurses' experience of 1177 Direct

| Question | Description | Content |
|---|---|---|
| 1. | Overview of background characteristics | Tell me about yourself, including your experience as a nurse, how long you've been in the profession, and your time at your current workplace. |
| 2. | General job experience, job duties, job motivation and challenges | Tell me about your workplace and what a typical workday looks like. What motivates you in your role, and what challenges do you encounter in your profession? |
| 3 | General experiences of 1177 Direct | Tell me about how 1177 Direct works and how you use the system in your daily work. Feel free to share an example to illustrate. |
| 4. | Experiences of the decision support in the triage motor and RGS system | Tell me about your experience with the medical quality of the auto-triage in 1177 Direct and other digital decision-support systems related to the work with 1177 Direct. |
| 5. | Accessibility and equality aspects of 1177 Direct | How do you feel patients' access to primary care has changed since the introduction of 1177 Direct?<br>Tell me about how you think the design of 1177 Direct affects access to equitable healthcare. Feel free to share an example. |
| 6. | Attitudes toward digital healthcare and digital competence | Tell me about your perspective on using advanced technology in your work. How would you assess your own basic digital competence? |
| 7. | Implementation, support and education related to 1177 Direct | Tell me about your experience with the implementation of the new 1177 Direct. How did you find the information and training provided during the implementation process? |
| 8. | Opinions about digitalization and future access to primary health ,care | How do you envision the future of digitalization in primary care and the way patients will access it? What hopes and concerns do you have about these changes? |
| 9. | Closing question | Is there anything else you would like to share regarding 1177 Direct in relation to your work environment as a nurse? |

Note. Sub-question related to the main question could be related to, for example, organizational arrangements, job demands, professional identity, and usability aspects.

## Data analysis

The collected data were analyzed using qualitative content analysis, a method for systematically identifying and interpreting both manifest and latent meanings in text (Graneheim & Lundman 2004). The first and second authors conducted all interviews, while transcription was performed by the paid version of Klang.ai under their supervision. To ensure familiarity with the data, the transcribed text was read multiple times to build a comprehensive understanding before the analytical process began. An abductive

approach, following the principles outlined by Haig (2005), was then applied. This approach involves iterative movement between empirical observations and theoretical reasoning, aiming to generate and refine explanatory hypotheses through inference to the best explanation. Rather than beginning with a fixed theoretical framework or relying solely on inductive reasoning, the abductive method allows to identify unexpected or noteworthy patterns in the data, propose tentative theoretical explanations, and reassess these interpretations in the light of further analysis (Haig 2005). The coding process was carried out in line with the content analysis principles described by Graneheim and Lundman (2004). It began with open coding, where the transcribed material was systematically broken down into meaningful units related to the aim of the study. Each unit was assigned a descriptive code that captured key elements of the participants' experiences and perspectives. Coding was conducted until no new themes or insights emerged, indicating saturation. To deepen analytical precision, codes were continuously compared, refined, and organized into subcategories based on conceptual similarities. These subcategories were then abstracted into broader main categories, ensuring thematic coherence while maintaining a clear distinction between different dimensions of the data (Graneheim & Lundman 2004). The process was inherently iterative, involving continuous reassessment and refinement to strengthen internal consistency across the analytical framework. To enhance the trustworthiness and credibility of the findings, regular discussions among the research team were held to reach consensus on coding decisions and category definitions. Differences in interpretation were critically examined, and alternative perspectives were actively considered, fostering analytical rigor and minimizing potential bias.

## Ethical considerations

This study followed the ethical standards outlined in the Declaration of Helsinki and was agreed by the Swedish Ethical Review Authority (reference number #2024-01058-01). Informed consent was obtained from all participants before data collection, and they were informed about the purpose of the study, their right to withdraw at any time without consequences, and how their data would be handled confidentially. The transcription platform Klang.ai is fully GDPR-compliant and designed for handling sensitive data. The platform employs end-to-end encryption during both data transmission and storage, ensuring that audio files and transcripts remain secure. Access is protected through electronic identification and two-factor authentication. Additionally, all data is stored on servers within the EU, with monitored access logs. To protect participants' privacy, all data were anonymized during transcription, and any identifying information was removed. Interviews were conducted via the Zoom video conferencing platform or in person, depending on participants' preferences and practical considerations. Video recordings were made during Zoom interviews to facilitate accurate transcription; however, these recordings were not saved, and only audio files were securely stored.

## Results

The results about how 1177 Direct influences nurses' work environment from a social and organizational perspective are structured around the main categories derived from

the content analysis involving 'professional competence and patient interaction' (focusing how nurses use their expertise and how chat communication influences patient interaction), 'job demands' (involving cognitive and psychological job demands in relation to 1177 Direct), and 'job resources' (focusing on job control, support, and desired resources in relation to 1177 Direct) (Table 3).

## Professional competence and patient interaction

### Professional competence

The nurses noted that working with 1177 Direct influenced how they can use their professional competence in several ways (Tables 3 and 4). However, the nurses did not perceive the auto-triage in 1177 Direct as threatening their professional competence or role. Instead, they viewed it as a complementary tool to support their daily work. The nurses expressed professional confidence in their expertise, emphasizing that it exceeds the robot's capabilities.

> A robot cannot ask the follow-up questions that I can. If I ask you a question and hear your response, I might think, 'No, it is actually something else' and then adjust accordingly. That is something only a human can do, robots simply cannot. I do not feel threatened in my professional role. To me, it is simply a complementary tool. P11

When nurses were asked about their views on adding other professions, such as physicians and physiotherapists, to 1177 Direct, opinions were divided. Several nurses supported the idea, as it would allow them to refer patients to the appropriate professionals. However, many believed nurses were best suited as the initial point of contact, as it aligns well with their role. The nurses emphasized that their professional competence makes them well-suited for the initial patient contact. Some participants from primary health care centers also expressed concerns, considering the addition of more professions unrealistic due to limited resources.

> I am not sure it (1177 Direct) would actually work well for a physician to take the initial contact with patients. We are, in some ways, better suited for it […] I believe we are better trained to interact with patients and address all aspects of their needs, taking a more holistic approach. C3

A key advantage of the chat was that it allowed patients to share images of wounds, spots, and similar concerns, strengthening reliable assessments. However, the nurses also expressed that their training emphasized using all their senses during patient examinations. This expertise could not be fully utilized in the chat setting, as they could not hear the patient's voice, which often provides valuable cues about their condition.

> When you have worked as a nurse for quite a long time, you develop what we call a clinical intuition […] You use your nose, eyes, and other senses. Over the phone, you are left with the voice. You can listen to their breathing and pick up other things in their voice, like anxiety or other cues. But in a chat, you do not have any of that. C9

**Table 3.** Codes, subcategories, and categories of nurses social and organizational work environment related to 1177 Direct

| **Theme** | **Nurses social and organizational work environment in relation to 1177 direct** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Categories** | **Professional competence and patient interaction** | | **Job demands** | | **Job resources** | | |
| **Subcategories** | **Professional competence** | **Patient interaction** | **Cognitive job demands** | **Psychological job demands** | **Job control** | **Support** | **Desired resources** |
| **Codes** | Professional confidence | Patient misinterpretation of medical terms | Several systems | Intensified work | Improved preparation | Collegial cooperation | Reduced number of channels |
| | Adding professions | Shortcuts in triage | Several channels | Work arrangement | Good search functions | Decision support | Re-fined organizational adjustments |
| | Shared images | Several care channels | Several chats simultaneously | Rapid reply | Cannot control the contact time | Technical support | Increased economical resources |
| | Limited sensory input | Less exposing contact | Lack of system integration | Lack of physician appointments | Cannot control the number of patients | Super users | Limit accessibility for minor conditions |
| | Adjust chat language | Communication style | Disoriented summary auto-anamnesis | Equality concerns | Cannot control patient reply time | Education | Autonomy in chat open hours |
| | Conditions non-suitable for chat | Impatient behavior | Time-consuming handling | | | | Increased cooperation |
| | Over-triage in auto-anamnesis | Searching care for minor conditions | | | | | Empathize the human in digital nursing |
| | | Chat with a nurse despite 'self-care guidance' | | | | | |

The nurses observed that conveying compassion in a chat format could be more challenging. They expressed concerns that their written responses might sometimes come across as accusatory or harsher than intended. The participants also noted that some conditions, such as aspiration problems or severe mental issues, are unsuitable for chat. When this happened, the nurses typically transitioned from the chat to a telephone consultation instead. Regarding the auto-triage in 1177 Direct, the nurses generally reported that it is most often 'over-triaged' priority levels, even though correct prioritization and 'under-triage' also could happen. A potential risk associated with over-triage that was raised is that it may reduce the nurse's caution, as frequent false alarms can lead to desensitization, while a small degree of over-triage was considered acceptable for patient safety.

> A robot makes the initial triage, which is often unreliable. It frequently makes mistakes. We receive cases categorized as priority one, the most urgent, which clearly should not be classified as such. These cases often turn out to be priority four or five instead. C1

## Patient interaction

Regarding the auto-anamnesis and patient interaction, many participants noted that the automated questions were numerous and sometimes difficult for patients without medical training. For example, the term 'impaired general condition' was frequently misunderstood or misused by patients (Tables 3 and 4).

> No, there has not been a single time when I have actually had someone with an impaired general condition who reported it. And yet, many people claim it. However, there have also been those who did have an impaired general condition but did not mention it. C10

**Table 4.** Codes and exemplified quotes professional competence and patient interaction in relation to the 1177 Direct

| Codes | Quotes |
|---|---|
| *Professional competence* | |
| Professional confidence | A robot cannot ask the follow-up questions that I can. If I ask you a question and hear your response, I might think, 'No, it is actually something else' and then adjust accordingly. That is something only a human can do, robots simply cannot. I do not feel threatened in my professional role. To me, it is simply a complementary tool. P11 |
| Adding professions | I am not sure it (1177 Direct) would actually work well for a physician to take the initial contact with patients. We are, in some ways, better suited for it […] I believe we are better trained to interact with patients and address all aspects of their needs, taking a more holistic approach. C3 |

(*Continued*)

**Table 4.** (*Continued*)

| Codes | Quotes |
|---|---|
| Shared images | One advantage is that you can, for example, send images through this chat. For issues like skin-related concerns, it is very useful to be able to see right away what it looks like. Otherwise, it is a challenge over the phone where we cannot see anything or receive images. P9 |
| Limited sensory input | When you have worked as a nurse for quite a long time, you develop what we call a clinical intuition […] You use your nose, eyes, and other senses. Over the phone, you are left with the voice. You can listen to their breathing and pick up other things in their voice, like anxiety or other cues. But in a chat, you do not have any of that C9 |
| Adjust chat language | I need to figure out how to express myself effectively when I cannot rely on my voice and must communicate through writing. How can I ensure that my words come across as inviting rather than accusatory? C5 |
| Conditions non-suitable for chat | In cases like breathing difficulties or mental health issues, it is extremely valuable to hear how the patient sounds in order to make the safest possible assessment. C10 |
| Over-triage in auto-anamnesis | A robot makes the initial triage, which is often unreliable. It frequently makes mistakes. We receive cases categorized as priority one, the most urgent, which clearly should not be classified as such. These cases often turn out to be priority four or five instead. C1 |
| *Patient interaction* | |
| Patient misinterpretation of medical terms | No, there has not been a single time when I have actually had someone with an impaired general condition who reported it. And yet, many people claim it. However, there have also been those who did have an impaired general condition but did not mention it. C10 |
| Shortcuts in triage | When the patients do not even know what they are selecting, or simply do not care just to reach a nurse as soon as possible. That is misuse. It is not easy for AI to handle those situations either. I think it is because we are working with people, not robots. C6 |
| Several care channels | There are too many ways to get in touch. The patient chatting has already contacted the 1177 website and tried calling 1177. Then, all of a sudden, they stop responding in the chat, and you are left waiting. Then, when you check the medical records to keep an eye on things, you see that they have now reached out by telephone. P16 |
| Less exposing contact | Many patients feel much more comfortable chatting than talking. I know that many, especially in the evenings, call in because they are struggling mentally. This is especially true for the younger generation, who are used to quickly expressing their thoughts in writing and feel less exposed when chatting. C1 |
| Communication style | I need to figure out how to express myself effectively when I cannot rely on my voice and must communicate through writing. How can I ensure that my words come across as inviting rather than accusatory? C5 |

| Codes | Quotes |
|---|---|
| Impatient behavior | As soon as you open a case, the patient can see that you're working on it […] I login to their medical record and begin my work there. During that time, if I do not inform the patient that I am handling their case, they start messaging things like, 'Hi, where are you?' P17 |
| Searching care for minor conditions | The people with dry lips never called. And those concerned about spots never called either. Essentially, with the chat we have opened the door to care that is not truly necessary. C6 |
| Chat with a nurse despite 'self-care guidance' | We were told that self-care guidance would ease our workload, as the patients would manage their own care. However, there is still a button that asks, 'Would you like to speak with a nurse?' after receiving self-care guidance. At that point, they are sent back into the system. From what I have heard, very few actually choose not to speak with a nurse and just stick with the self-care guidance R1 |

Additionally, the lengthy auto-anamnesis process frequently led patients to look for shortcuts to speak directly with a nurse more quickly. The shortcuts could be to not answer the automated questions appropriately for different reasons or, in the worst case, to fill in a more serious condition than the actual condition to get access more rapidly. Several participants also highlighted issues with patient contact, including patients seeking help simultaneously through multiple channels, such as calling 1177, starting a chat on 1177 Direct, and contacting 1177.se. This behavior, often intended to ensure quicker access, creates unnecessary strain on nurses.

> There are too many ways to get in touch. The patient chatting has already contacted 1177.se and tried calling 1177. Then, all of a sudden, they stop responding in the chat, and you are left waiting. Then, when you check the medical records to keep an eye on things, you see that they have now reached out by telephone. P16

Although many participants preferred using the 1177 telephone line over the chat service 1177 Direct, they expressed acceptance of the chat, emphasizing its patient benefits. They noted that the chat could help individuals, such as those with mental health issues or personal circumstances that limit their ability to make phone calls, access healthcare more easily. In addition, the participants explained that some patients communicate very briefly, with responses like 'yes' or 'no', requiring follow-up questions and extending the chat. A recurring challenge is that some patients expect instant responses in chat, leading to impatience when nurses take time to review the EHR before replying. Then, some patients reveal impatience with messages such as 'HELLO' in all caps or 'ARE YOU THERE?'. The nurses explained that this behavior is likely a result of a potentially distressing situation and the patients lack of awareness that the nurses often handle multiple chats simultaneously. Additionally, some patients mistakenly believe they are still interacting with a bot when first connected to a nurse, which may affect their communication style. Another issue regarding patient behavior in 1177 Direct involves patients seeking care for trivial conditions, such as dry lips, which were less common in telephone interactions. Finally, while 1177 Direct offers a 'self-care guidance' feature that provides medical advice for minor conditions without involving a nurse, many patients

still choose to click 'chat with a nurse'. Participants suggested that this may stem from a desire for confirmation from a nurse, as patients often find answers from a robot insufficient. This underscores the complexity of integrating technology into nursing care (Tables 3 and 4).

## Job demands in relation to the 1177 Direct eHealth system

### Cognitive job demands

A nurse's job was generally described as demanding, and working with 1177 Direct was no exception (Tables 3 and 5). The nurses faced considerable cognitive demands during medical consultations. Many participants noted challenges in managing multiple IT systems and additional channels for first-line healthcare contact. Some primary care centers offered three to four communication channels, including the telephone line, the 1177 website, and 1177 Direct. In some private primary health care centers, an additional eHealth platform, offering similar functionalities to 1177 Direct was also used alongside 1177 Direct. Most participants wanted to reduce the number of channels or assign them distinct purposes, such as using the website solely for tasks like unbookings and prescription renewals. They also highlighted that 1177 Direct was introduced without eliminating other channels, making the chat perceived as an additional workload. A frequently reported cognitive demand was the need for nurses to manage multiple chats simultaneously, sometimes as many as five at once. This placed a significant cognitive strain on the nurses, requiring them to ensure they did not mix up the patients.

> A disadvantage is managing multiple patients simultaneously, as it can easily lead to mistakes when communicating with several people at once. It really requires you to stay more focused, or sharper, which you always should be, but you really need to make sure you have the right patient on the screen, so to speak. R2

Additionally, there is a lack of system integration between 1177 Direct and the EHR. Participants reported that they manually transfer information from the auto-anamnesis by rewriting the content to ensure it aligns with the format and legal requirements of the EHR, as the original input is not structured for direct use in the EHR. Furthermore, the information in the auto-anamnesis summary was often described as somewhat disorganized, making it difficult to gain an overview quickly. The summary also included several irrelevant negations, such as 'denies suicidal thoughts', even when this was unrelated to the patient's condition.

### Psychological job demands

The nurses reported that working with 1177 Direct intensified their workload in several ways (Tables 3 and 5). Some contributing factors have already been discussed, while others will be examined further. The work arrangement with 1177 Direct varied between the central unit of 1177 and different primary health care centers. In some centers, a single nurse was assigned responsibility for the chat for a full or half day. Others

implemented a shared responsibility model, coordinated through a social communication channel. At centers with lower chat inflows, even the manager nurse occasionally handled the chat to avoid overburdening other nurses in the unit. Although chat was intended to increase efficiency, nurses often find that it extends consultation times due to slow patient responses. Several reasons for preferring the telephone line over 1177 Direct were described, including that each patient interaction via chat generally took longer and extended over a longer period compared to telephone calls, which are typically intended to last no more than 6 minutes.

> It takes significantly longer. We sit and wait as they type slowly, often taking a while to respond. While waiting, I might make a quick phone call to check on something, only to find out someone in the chat just replied. Tasks that take six minutes over a phone call can easily take 20 minutes via chat. P16

**Table 5**. Codes and exemplified quotes of job demands in relation to the eHealth system 1177 Direct

| Codes | Quotes |
|---|---|
| *Cognitive job demands* | |
| Several systems | The workflow also involves multiple systems, including the medical record system, and a decision-support tool for symptom assessment. These are the main tools, but I also need access to other resources, like 1177.se and FASS, depending on the case. C2 |
| Several channels | The summer was really tough. There were only two of us, and I was on my own for a week. We had the 1177 website, Cosmic Link, and the chat to handle. There are just too many contact channels. P16 |
| Several chats simultaneously | A disadvantage is managing multiple patients simultaneously, as it can easily lead to mistakes when communicating with several people at once. It really requires you to stay more focused, or sharper, which you always should be, but you really need to make sure you have the right patient on the screen, so to speak. R2 |
| Lack of system integration | There is a lot of unnecessary repetition. We chat in one system, take notes separately, and then transfer everything into the electronic health record […] I get that chat logs need to be condensed for clarity, but there should be a smoother way to transfer the information. C10 |
| Disoriented summary auto-anamnesis | There is a bit too much unnecessary information, which makes it unclear and difficult to grasp. If it were more concrete, it would be easier to understand the problem and what the patient wants. Sometimes, it is genuinely hard to figure out what the patient really needs help with. R2 |
| Time-consuming handling | It takes significantly longer. We sit and wait as they type slowly, often taking a while to respond. While waiting, I might make a quick phone call to check on something, only to find out someone in the chat just replied. Tasks that take six minutes over a phone call can easily take 20 minutes via chat. P16 |

(*Continued*)

**Table 5.** (*Continued*)

| Codes | Quotes |
|---|---|
| *Psychological job demands* | |
| Intensified work | I work more intensively. The rhythm is faster in chat compared to telephone calls, likely because I am managing multiple cases at once. C8 |
| Work arrangement | When a notification about a new patient is received on our HR central phone, they post it in a shared group that includes everyone available to handle the chat. They share details about the new patient and the auto-triage priority level. Then, the nurse responsible for the chat that day then needs to check the case. R12 |
| Rapid reply | For some reason, I feel more pressured when using the chat. From the start, it was said that we should respond within 15 minutes. C1 |
| Lack of physician appointments | If I had a doctor's appointment readily available for every patient I assessed as needing one, my job would be much easier and even more fulfilling. P11 |
| Equality concerns | I sympathize with the elderly who struggle with this system, they are left with no choice but to wait in a long phone queue. Similarly, foreigners who cannot write in Swedish are unable to use the service, and those without electronic identification. C8 |

Another reported job demand was the restricted amount of physician appointments. This lack of physician availability forces the nurses to spend more time managing patient expectations and seeking alternative solutions, adding to their workload. Many centers faced a shortage of appointments compared to the actual demand, further complicating the nurses work with 1177 Direct, and other contact channels. This issue was described as very frustrating, and even a source to reduced job motivation for some nurses. Moreover, the participants highlighted equality concerns regarding the chat as a contact channel for first-line care compared to other options. For higher triage priorities, nurses must respond to chat requests within 15 minutes. In contrast, patients calling 1177 or their primary health care center are placed in a queue or given a call back time. This means that chat patients are more likely to receive assistance quickly.

> Then I also get the impression that they are slipping through on a banana peel, jumping ahead of others in the telephone queues. That is because we respond to them very quickly in the chat, while those on the phone might be stuck waiting in a long telephone queue. R2

Moreover, the auto-anamnesis feature in the chat is currently available only in Swedish, creating an accessibility gap for non-Swedish-speaking patients. While nurses noted instances of elderly individuals, including those over 90 years old, used the chat occasionally, younger generations were more frequent users of the service. Additionally, some elderly patients and individuals unfamiliar with the Swedish healthcare system experienced difficulties with secure electronic identification authentication. For example, a partner might log in using their own electronic identification, leading to incorrect patient information being displayed to the nurse handling the case. These challenges highlight broader issues of equity in access to digital health care services.

## Resources in relation to the 1177 Direct eHealth system

### Job control

Working with the 1177 Direct was not only associated with partly increased job control but also reduced job control from different points of view (Tables 3 and 6). The auto-anamnesis feature increased job control since the nurses could be better prepared for patient cases compared to handling telephone calls via 1177.

> One good thing about 1177 Direct is that you can read the auto-anamnesis summary before entering the consultation, which is really helpful. It gives you a bit of an idea before the patient notices that you have logged into the case. P17

The search function for completed and closed cases in 1177 Direct was well-received and described as easy to use. It provided a clear overview of incoming cases and allowed users to easily revisit closed cases when needed, for example, in the case of frequent patients. Regarding 1177 Direct and its relation to reduced control, one issue was that nurses could not control the inflow of chat messages or the chat's operating hours. The central 1177 service participants experienced a consistent inflow, including peak periods during the day. In contrast, the chat inflow at primary health care centers varied significantly. Even centers with low chat inflow could feel strained due to the unpredictability of when messages would arrive, creating a sense of reduced control.

> We never know when the chat will come. It is a bit like "the wolf is coming, the wolf is coming," but then no wolf appears. Sometimes we go an entire day without a single chat. Yet we have spent the whole time worrying about it. R3

The nurses also explained that they cannot control when patients respond to chat messages. At times, chat conversations were interrupted due to meetings or other job responsibilities, which could lead to patients dropping off.

### Support

Several nurses shared examples of collegial cooperation in the organization and management of 1177 Direct (Tables 3 and 6). Decision support from a medical perspective was available from colleagues, including nurses and physicians, but primarily from the IT system, RGS Decision Support.

> I base my assessments on the RGS, the decision support system. That is my starting point, and then I rely on my own expertise. So, you ask the questions from the RGS, starting from the top, so to speak, from the acute section. Then you go down through the levels of urgency and ultimately make your own decision. C4

Technical support was available through the county council. However, most participants in this study had neither used nor felt the need to contact it. Instead, some reported that

they would primarily turn to their colleagues or first-line managers for assistance with technical issues. Several participants described a system of super users associated with 1177 Direct. Some were super users, while others had access to colleagues in that role. However, many participants felt that the implementation process was slightly rushed, and the training provided was brief, resulting in partly a learning-by-doing approach. Despite this, data collection for this study took place more than six months after the implementation of 1177 Direct, by which time all participants reported feeling confident in using the system. The training for learning 1177 Direct was conducted via Teams, with test demos provided to simulate real scenarios and enhance practical understanding. Quick reference guides and user manuals were also distributed to help nurses navigate the platform effectively.

### Desired resources

Motivation for adopting 1177 Direct varied throughout the implementation process. Several suggestions were proposed to improve the implementation process of 1177 Direct (Tables 2 and 6). The nurses in this study unanimously agreed on the need to limit the number of contact channels to first-line health care to ensure a manageable workload. Additionally, the participants suggested that adjustments to the work organization of the entire unit, including greater specialization, would further enhance both the efficiency of the organization and the implementation process of 1177 Direct. However, without reducing channels or workload, the participants emphasized the need for increased financial support to enable additional staffing.

> The biggest problem is that no additional resources have been allocated. We still have the same number of nurses, x, who were previously sharing y number of tasks. Now we have been given yet another task, but without any additional resources. This makes things really tight. That is my biggest criticism, not of the implementation itself. P11

Some participants suggested restricting access to the 1177 Direct chat for minor conditions that do not require first-line care. They felt that self-care guidance alone should suffice, eliminating the need for direct chat with a nurse. To improve job control, the nurses desire greater autonomy in determining the operating hours for 1177 Direct. Some participants suggested that the chat should only be available on the 1177 telephone line during quieter periods. In addition, to avoid patients dropping off when the response time was longer, some nurses tried to mitigate this by providing an estimated response time for non-emergency cases. Moreover, some participants emphasized the need for improved collaboration between primary health care units to manage 1177 Direct more effectively, including addressing technical challenges. The requirement for separate logins for each unit hindered seamless cooperation and support across different primary healthcare centers. Finally, the nurses in this study strongly emphasized that while digitalization holds substantial potential in certain areas of health care, nursing expertise cannot be entirely replaced by AI or automation. Unwell patients seek guidance and support from human expertise and compassion (Tables 3 and 6).

> Not everything can be digitalized. That said, if AI can help free up space for those who need in-person care, it is a positive development. However, fully automated assessments are not the solution. There still needs to be a human behind it. Care must feel human for people to feel comfortable seeking it. P1

**Table 6.** Codes and exemplified quotes in relation to job resources associated with the eHealth system 1177 Direct

| Codes | Quotes |
|---|---|
| *Job control* | |
| Improved preparation | One good thing about 1177 Direct is that you can read the auto-anamnesis summary before entering the consultation, which is really helpful. It gives you a bit of an idea before the patient notices that you have logged into the case. P17 |
| Good search functions | I see real advantages in having everything on a single list. I can easily view all of today's incoming cases, organized in one place. The ability to filter is incredibly useful. I can go back and check earlier dates or find completed cases when needed. The search function is simple and efficient, I really appreciate that. P11 |
| Cannot control the contact time | We never know when the chat will come. It is a bit like 'the wolf is coming, the wolf is coming', but then no wolf appears. Sometimes we go an entire day without a single chat. Yet we have spent the whole time worrying about it. R3 |
| Cannot control the number of patients | This is a system that can handle an unlimited number of patients. That makes it something we simply cannot shut down or restrict. We can turn off our phone, we are not supposed to, but we can […] I can lock my front door, but not this system. R1 |
| Cannot control patient reply time | The chats usually take anywhere from five to ten minutes if they respond right away. But if they do not reply, it can take the whole day, or even until the next day. P14 |
| *Support* | |
| Collegial cooperation | We have an on-call physician we can consult, and I can also seek advice from my nurse colleagues and the physiotherapists. In fact, we can consult anyone when needed. We have excellent collaboration at this primary healthcare center. R7 |
| Decision support | I base my assessments on the RGS, the decision support system. That is my starting point, and then I rely on my own expertise. So, you ask the questions from the RGS, starting from the top, so to speak, from the acute section. Then you go down through the levels of urgency and ultimately make your own decision. C4 |
| Technical support | Sometimes, you get kicked out of the chat for no clear reason. In most cases, restarting the system fixes it. But if you are unlucky, you have to call IT. It does not happen too often, I usually manage to sort it out myself. C4 |
| Super users | A nurse colleague attended the training sessions, and then trained the rest of us. I participated digitally and learned that way. R5 |

(*Continued*)

**Table 6.** (*Continued*)

| Codes | Quotes |
|---|---|
| Education | I have had to learn a lot on my own about how things should be and look, and that is why I do not have full control over how the tickets work either. It is partly because the training we received was a two-hour speed course. C10 |
| *Desired resources* | |
| Reduced number of channels | It is important to make some adjustments in other areas of the primary healthcare center to ensure it becomes an efficient way of working. Because if you just keep adding one channel after another, it is obvious that it will not be effective, it will just feel like an increased workload. P10 |
| Re-fined organizational adjustments | Our current ways of working need refinement to function better […] At the moment, we are handling many small tasks across various areas. It would be beneficial to streamline this, focusing more on specialization, assigning specific tasks to specific groups to improve efficiency. R1 |
| Increased economical resources | The biggest problem is that no additional resources have been allocated. We still have the same number of nurses, x, who were previously sharing y number of tasks. Now we have been given yet another task, but without any additional resources. This makes things really tight. That is my biggest criticism, not of the implementation itself. P11 |
| Limit accessibility for minor conditions | In this profession, I believe the challenge lies in the fact that so many people seek care who really should not. I think we need to close this chat door, or at the very least, significantly limit its availability so that only appropriate cases come through. It is simply unmanageable as it is. C6 |
| Autonomy in chat open hours | It is hard to manage something that cannot really be controlled. A possible solution could be to open the chat from 10:30 to 12, then re-open it in the afternoon when it is usually calmer. That way, we would have time to handle the bulk of calls first, which I believe would also help reduce stress. R3 |
| Increased cooperation | Constantly monitoring the chat is very time-consuming. However, I feel that this could perhaps be optimized by having several health care centers collaborate to help each other with the chat, so that a dedicated resource is not needed all the time. R8 |
| Empathize the human in digital nursing | Not everything can be digitalized. That said, if AI can help free up space for those who need in-person care, it is a positive development. However, fully automated assessments are not the solution. There still needs to be a human behind it. Care must feel human for people to feel comfortable seeking it. P1 |

## Discussion

The aim of this study was to explore experiences of how 1177 Direct influences the organizational and social work environment of nurses in primary health care in Sweden, using the Job Demands-Resources model as a theoretical framework. The results in this study reveal the complexity of integrating an eHealth system, including auto-anamnesis, auto-triage, and online chat in primary health care with regard to professional competence,

patient interaction, job demands, and resources, involving both existing and warranted resources. A literature review on auto-triage or AI-driven triage in primary healthcare highlighted the risk of increased or redistributed workloads (Gottliebsen & Petersson 2020), a finding that aligns with this study. Participants using 1177 Direct frequently reported higher job demands due to longer handling times, managing multiple chats simultaneously, resource allocation challenges, and introducing a new contact channel without closing existing ones. Additionally, the number of patient cases increased, with some patients seeking care through multiple channels or using the chat for minor conditions that did not require a nurse's attention. These potential rise in job demands are supported by previous findings (Halmambetova et al. 2025). Incorporating the job control dimension, the results indicated that auto-summary features could enhance job control by improving preparedness for each patient. However, many participants also reported decreased job control regarding contact time, response time, and the number of patients they managed. Opinions on supportive factors such as collegial support and education were mixed, though many participants expressed satisfaction with the collegial support available in this study. Given these findings, there is an increased risk of job strain among nurses (Karasek & Theorell 1990), which is particularly concerning due to the well-documented health risks associated with high job strain (Kivimäki et al. 2012; Theorell et al. 2015), and also the increased risk likelihood of making errors potentially affecting patient safety (Hall et al. 2016). However, the risk of iso-strain, defined as job strain combined with low social support (Karasek & Theorell 1990), does not appear to be as pronounced in this context. Many participants reported strong collegial support, which can serve as a protective factor against iso-strain by mitigating the negative effects of high job demands and reduced control.

Elevated job demands, including work intensification, adversely affect employees' well-being by impeding psychological detachment from work and limiting opportunities for micro-breaks and recovery from work-related stress. For instance, a study found that high job demands negatively impact employees' recovery experiences during breaks, leading to diminished well-being (Albulescu et al. 2022; Demerouti et al. 2009). In this study, participants identified several resources that could alleviate their workload. These included, for example, reducing the number of contact channels, limiting accessibility for minor conditions, enhancing system integration, and increasing autonomy in managing chat hours. Increasing system integration in health care has been associated with improved workflow (Murthi et al. 2024). In addition, supporting nurses' professional autonomy has been associated with enhanced job satisfaction and performance (Judi et al. 2025; Pursio et al. 2024). These findings emphasize the need for organizational and social work environment improvements to enhance workflow, autonomy, and well-being.

The auto-triage system frequently assigned a higher priority level than nurses did for the same patients. According to the Swedish National Board of Health and Welfare (2019), the quality of care could improve through collaboration between healthcare professionals and machines, as each contributes complementary expertise. This principle is applied in 1177 Direct, but the interaction between patients and auto-anamnesis questions requires further exploration. Some nurses in this study noted that patients often misunderstand or misuse medical terminology such as 'impaired general condition', which can inadvertently escalate their priority level. Additionally, due to the extensive number of questions in the automated questionnaire, some participants expressed concerns that patients may seek shortcuts, potentially compromising the accuracy of the

triage process. This highlights the need for a holistic approach when implementing auto-triage or AI-driven triage in primary care, a conclusion supported by previous research (Siira et al. 2024). Collegial collaboration and employee-driven decision-making can also help mitigate work challenges associated with implementation of new (Palm et al. 2024). This underscores the value of restoring human expertise, and complement rather than replace the human in the decision-making process.

Regarding similarities and differences across the central 1177 service and the official and primary health care units, the vast majority of codes from the content analysis were identified across all units. The most notable differences related to the volume of patient inflow and the allocation of resources to manage it. The central 1177 service and larger primary health care centers handled a higher volume of patient contacts. Many private centers also used an additional eHealth platform with functionalities similar to 1177 Direct, alongside 1177 Direct itself. Nurses at these centers reported greater satisfaction with the usability of their own eHealth systems compared to 1177 Direct. Notably, even smaller centers with only a few daily chat cases reported stress due to the unpredictability of incoming cases, which required constant readiness. With fewer colleagues available to manage 1177 Direct, these centers highlighted the need for improved collaboration among primary health care centers to enhance support and distribute workload more effectively. However, such collaboration was often hindered by the requirement for multiple logins across different centers, reducing overall efficiency. A more detailed comparison between the different units will be presented in an upcoming publication.

## Strengths and limitations

Like all research, this study has strengths and limitations concerning its aim and methodology. A key strength was the adoption of content analysis, a well-established method for qualitative data examination (Graneheim & Lundman 2004). Additionally, the use of a semi-structured interview guide combined the advantages of both structured and unstructured interviews, enabling the collection of reliable and comparable data while allowing for flexibility in follow-up questions and maintaining coherence (Kallio et al. 2016). However, content analysis has inherent limitations, including the potential for bias. A limitation to consider is the risk of social desirability bias, where participants may provide responses they perceive as socially acceptable rather than fully accurate (Althubaiti 2016). Another limitation of this study is the use of Zoom for the interviews, which may have influenced interaction dynamics and data quality. While video conferencing enabled broader participation, it may have limited the ability to capture non-verbal cues and build rapport compared to face-to-face interviews.

Furthermore, the gender distribution in the study was skewed, with 27 of the 29 participants being women. However, this reflects the reality of the nursing profession, which remains female-dominated in Sweden and many other countries. Efforts were made to enhance credibility by incorporating interdisciplinary perspectives from co-authors with expertise in human-computer interaction, health sciences, and psychology. The findings of this study are primarily transferable to nurses in Nordic countries with similar health care systems. In other contexts, transferability may be influenced by variations in health care structures and cultural factors. Future research should complement

these findings with quantitative studies and additionally explore the patient perspective on using 1177 Direct, providing a more comprehensive evaluation of its impact.

## Conclusion

This study aimed to explore how the eHealth system 1177 Direct influences the organizational and social work environment of nurses in Swedish primary health care, using the JD-R model as a theoretical framework. A total of 29 nurses were interviewed, and the data were analyzed using content analysis. The findings highlight the complexity of integrating an eHealth system, including auto-anamnesis, auto-triage, and online chat, into primary health care. This integration affects professional competence, patient interactions, job demands, and both existing and needed resources. Nurses reported changes in how they interact with patients, increased job demands, and a partial loss of job control due to their work with 1177 Direct. To address these challenges, nurses emphasized the importance of streamlined communication channels and increased autonomy to reduce job strain and cognitive overload. They also advocated for limiting the system's accessibility for minor health issues and called for stronger recognition of their professional role within the digital health care context. A key insight was that patients often seek confirmation and support from a human nurse rather than auto-generated responses only.

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