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Introducing electronic messaging in Norwegian healthcare: Unintended consequences for interprofessional collaboration

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ABSTRACT

Objective: The introduction of health information technologies (HIT) can lead to unintended consequences. We studied a newly introduced electronic messaging (e-messaging) system for communication between homecare providers and general practitioners (GPs) in Norway. The objective of this paper is to identify and discuss unintended consequences of the introduction of e-messaging, particularly how it affected collaboration between the groups.

Methods: Qualitative data from interviews with homecare staff (23), GPs (11), medical secretaries (5) and project managers (4), lasting in average 45 min. Data was analysed using an interpretative approach.

Results: We highlight three unintended consequences, which broadly led to changes in work practices for homecare nurses and GPs. (1) Communicating via e-messaging led to less face-to-face contact between homecare nurses and GPs. Even though e-messaging meant the opportunity to communicate more efficiently both groups emphasised the need for sustaining interpersonal relations via face-to-face communication to collaborate efficiently. (2) E-messaging made it easy to be proactive and send information. Consequently, tasks and responsibilities were sometimes reconfigured in unexpected ways. (3) Nurses said that the fact that e-messages were automatically documented in the patient's electronic patient record (EPR) system gave more weight to their requests. Nurses experienced e-messages as a more powerful means of communication vis-à-vis GPs than other means of communication, thus making e-messaging a tool for empowering them in their collaboration with GPs.

Conclusion: Unintended consequences of HIT affect collaboration between healthcare workers. The consequences may be both desirable and undesirable. Previous research has mostly focused on the undesirable unintended consequences. We show that the introduction of e-messaging led to both desirable and undesirable unintended consequences for interprofessional collaboration. More insight into positive unintended consequences can be a resource in the reorganisation of work that often accompanies the implementation of HIT.

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1. Introduction

The increasing fragmentation and specialisation in healthcare challenges current collaboration models. The challenge is particularly profound with respect to caring for patient groups that need services across different health-service levels [1]. Recipients of homecare services, including many elderly and the chronically ill, are one such group. To provide high-quality, seamless care to these patients, there is a need for collaboration between various health care providers [2].

In Norway, as elsewhere, collaboration between healthcare actors is often hampered by organisational borders, financial structures, a lack of guidelines, disagreement on responsibility, poor communication patterns and little support for collaboration [2,3]. An example of the latter in Norway is incompatible IT systems that make it impossible to exchange information across organisational borders. The use of health information technologies (HIT) is frequently suggested as a means of strengthening communication and the exchange of information, which, in turn, will enhance collaboration between healthcare providers, the quality of care and the efficiency of services [4,5]. HIT is encouraged in Norwegian governmental strategies to strengthen communication and collaboration [6]. However, it is well known that the introduction of HIT is not straightforward and is often associated with failure and unintended consequences [7–9]. Unintended consequences are most often associated with unwanted changes and adverse events [7,10–12]. However, Ash et al. [13] observe that desirable unintended consequences also exist. In this paper, we argue along their line of reasoning that the introduction of HIT may elicit positive changes and that the unintended consequences of HIT should be understood in a more nuanced way.

The health information technology that we focus on is an electronic messaging (e-messaging) system, which was recently introduced in Norwegian healthcare. The e-message system is the result of a national project (Electronic Interaction – Municipality) [14] that aimed at improving information exchange and communication between homecare services, GPs and hospitals. This is in line with the intention stated in a Norwegian recent reform, the Coordination Reform, where the main objective is to improve collaboration and coordination across the sector [6]. The implementation of the e-message system followed the acknowledgement that homecare services, owned and managed by municipalities, had little access to any forms of HIT for communicating with their collaborating partners. Communication and information exchange was predominantly done orally, either via telephone or in face-to-face meetings, and via fax or postal letters. This meant that communication of important patient information could be slow and fragmented, and healthcare workers found it difficult to make contact with each other. As a result, insufficient understanding of patients' needs could arise, jeopardising the quality of care [1,15] The e-message system was consequently introduced to "secure seamless patient trajectories across the health and care sector through electronic all-to-all communication" [14, p. 6].

In a previous paper [15] which drew from the same study as this current paper, we demonstrated how the introduction of e-messaging has enhanced connections between homecare nurses and GPs and made information more easily accessible. It has enabled a better overview of the patient's medication, leading to re-evaluation of the medication information and, in turn, more accurate drug treatment and dosage. However, the users were not satisfied with all the functionality in the system. Furthermore, the users were connected stepwise to the system, meaning that both traditional communication practices (typically the telephone) and communication with e-messages existed side by side, making communication complicated [15]. In a previous study of the introduction of e-messaging we found that a number of organisational challenges needed to be addressed to make the e-messaging system work in an optimal way. For example, it was necessary to develop routines to ensure that messages were read and responded to, even if the healthcare worker who started the communication was not present [16].

In this paper, we discuss unintended consequences related to communication with e-messages between *homecare nurses* and *GPs*. The aim of the paper is to identify and discuss the unintended consequences of the introduction of e-messaging as a tool for communication between these two groups, particularly those that affect collaboration between them. Our motivation for emphasising this topic is as follows: When HIT are implemented, the objectives are most often targeted towards changing structures (e.g. building an infrastructure for communication), and success (or not) is measured against predefined objectives, if at all. Unintended consequences frequently occur and can have severe effects on the overall usefulness of the system [7,12,13,17,18]. We therefore argue for a more thorough investigation into the unintended consequences of HIT. Healthcare is a profound collaborative activity, and it is increasingly affected by HIT [19,20]. Thus, it is important to study how collaboration is affected by new ways of communication, such as e-messaging. In particular, it is important to include studies of the less noticed, unintended consequences of new HIT and learn from them.

Our discussion is based on the reported experiences of homecare staff and GPs.

2. Background

2.1. *Analytical perspective*

In this paper, we apply a sociotechnical approach, meaning that the 'social' and the 'technical' are seen as tightly interwoven [21–23]. From a sociotechnical perspective, the implementation of technology in healthcare can be considered as a complex, unpredictable process where human actors and technologies co-constitute each other, rather than as a linear, predictable process (ibid.). Applying such a perspective means that unintended consequences are to be expected: They will be an intrinsic part of any implementation process. To analytically determine the nature of these unintended consequences, it is necessary to know the intended consequences of the particular HIT.

2.2. Unintended consequences of HIT

Ash et al. [13] provide a useful model for obtaining an overview of the consequences of computerised provider order entry (CPOE) systems, but it can be applied to the introduction of other HIT as well. First, they distinguish between anticipated (intended) and unanticipated (unintended) consequences of a technology. Second, the anticipated consequences are divided into desirable (goals) and undesirable (trade-offs) consequences. Likewise, the unanticipated (unintended) consequences are divided into desirable consequences (serendipity) and undesirable consequences (unintended consequences). Our interest lies in the unanticipated consequences. We are interested in the unintended desirable consequences, which Ash et al. [13] aptly talk about as 'happy surprises', hence the name 'serendipity'. Such consequences are rarely discussed in the literature. We are also interested in the unintended outcomes in the traditional sense (i.e. undesirable consequences of the new technology).

The paper by Ash et al. [13] seems to be the only study to address unintended but desirable consequences. The occurrence of undesirable unintended consequences has received more attention [7,10–12,17,18]. Most work on unintended adverse consequences focused on CPOE systems [7,10,12,13,17]. However, Yu et al.'s paper [11] is an exception, addressing unintended adverse consequences of introducing electronic health records in residential aged care homes. Several of the papers include categorisations of unintended adverse consequences. The categorisations bear many similarities, and they are also outcomes from the same research project on CPOE systems [24]. Campell et al. [12] outlined nine major types of unintended adverse consequences of CPOE systems in three hospitals in the U.S., several of which are relevant to our study. (1) More work or new work both for clinical and nonclinical staff following the implementation of HIT (e.g.) entering information into the system that previously was not required and responding to requests); (2) unfavourable workflow issues related to the system's rigid modelling of workflows that do not correspond to actual practice; (3) never-ending demands for changes and updates both in hardware and software, complicating daily use; (4) problems related to paper persistence, with old and new forms of documentation and information continuing to be used; (5) changes in communication patterns and practices; (6) negative emotions due to the organisational change and shifting work practices; (7) new kinds of errors generated at the human-computer interface; (8) alterations in the power structure because of changes in tasks and responsibilities; (9) overdependence on technology, with staff feeling helpless if the technology breaks down.

In all but one of the studies [10] cited above, the unintended consequences were those that affected staff and relations between staff. Han et al. [10] studied how a CPOE system introduced in an children's hospital in the U.S. to reduce medical errors and mortality affected patient outcomes. Contrary to expectations, mortality among the targeted patient population increased after the CPOE system was introduced. In the study by Han et al., the unintended consequences are dramatic for patients. However, the majority of studies focus on indirect consequences or intermediate variables that affect quality of care and patient safety, such as changes in workload and in work and communication practices. Our focus, changes in collaboration, is also an indirect consequence, but good collaboration between healthcare workers is crucial for ensuring patient safety and providing high-quality care [25,26].

2.3. Factors that affect interprofessional collaboration

In this section, we briefly describe research on interprofessional collaboration and factors that influence this collaboration. Interprofessional collaboration refers to any situation in which people work across organisational boundaries towards a positive end [27]. In other words, we employ a wide understanding of the concept of collaboration. The type of collaboration we study is loose, generally informal and not strictly organised, although it may continue over a long period.

Homecare staff and GPs frequently collaborate, and such collaboration is expected to increase in the future [6]. Although there are many studies on interprofessional collaboration in general [(e.g.) 25, 27, 28] few studies have examined the collaboration between homecare staff and GPs [29,30]. Many of these studies have examined barriers to collaboration or attempted to identify success factors for collaboration [25,27]. HIT can potentially be both a success factor for improved collaboration and a barrier to collaboration.

Effective communication is considered a key factor for successful collaboration [3,25,31,32]. One of the primary tasks of HIT is to support communication and information exchange, and HIT consequently can influence collaboration. However, there are numerous examples of HIT implementation failures [8]. Furthermore, as noted earlier, the implementation of HIT is often associated with unintended consequences on many levels. Therefore, it is difficult to foresee how the introduction of a new technology, such as e-messaging, would influence collaboration.

For some collaborating teams, face-to-face meetings can be an effective way to communicate [31], whereas communication via HIT can be effective for others. Interpersonal relations also influence the development of interprofessional collaboration. The evolution of interpersonal relations is closely related to communication, and research shows that regular team meetings and enhanced communication assist in resolving interprofessional conflict and promoting positive interpersonal relations [25]. When homecare nurses and GPs switch from face-to-face meetings and telephone conversations to communicating via e-messages, this may affect the interpersonal relations between them and hence collaboration. The size and the composition of a team are also important in interprofessional collaboration [25]. In our study, the collaborating partners (or teams) most often consisted of one GP and a team of nurses. Research shows that the status of team members has implications for collaboration [31]. Recognition of the value of other professionals for patient care may affect interprofessional care positively [3]. GPs and homecare nurses have different statuses, which may influence their collaboration, how their contribution to the collaboration is valued, or both [33]. Building trust between collaborators is also important for effective interprofessional collaboration. Modin et al. [29,30] described family physicians' experiences in collaborating with district nurses. Their studies showed that it was essential for

the family physicians to collaborate with and rely on nurses in the medical treatment of homecare patients. Their findings point to the intricate interdependencies between professionals who care for the same patient group and the need for trust and communication. It follows then that, as mentioned above, the different statuses of the team members may challenge trust building, communication and hence collaboration.

Research on ICT and HIT emphasise other points which are not addressed in the research on interprofessional collaboration that can be relevant to understanding the development of collaboration. On a general level, several studies [34–36] show that the distribution of work and consequently the interprofessional relations change after the introduction of HIT. Other studies point to how many forms of ICT, particularly asynchronous communication media, permit a great deal of control over message construction and self-presentation for users [37]. By enabling users to organise their arguments before composing their messages, e-messaging can thus enable users to appear more ideal or self-composed (as compared to e.g. having a telephone conversation). Text-based communication can also be beneficial for individuals who want to restrict or regulate their interaction with others [37,38].

To sum up, the implementation of HIT often leads to unintended consequences, which may alter the relationship between healthcare workers and challenge existing power structures. Effective communication, interpersonal relations and trust are important factors in developing successful collaboration.

3. Methods

The current study is part of a larger study (Bridging the information gap in patient transition [BIG]) on the introduction of e-messaging in Norwegian healthcare and how this technology affects information exchange, communication and collaboration between homecare, GPs and hospitals. We used an explorative approach with open-ended interviews to determine how homecare staff and GPs communicate via e-messaging and how this affects collaboration. This approach is well suited for investigating a phenomenon where knowledge is lacking [39–41].

3.1. *Setting*

Homecare nursing in Norway is organised at the municipal level. The service is free of charge if the client is eligible for support from the municipality. Homecare nursing ranges from distributing medications and providing clinical care to helping patients with getting dressed, preparing food and drink and maintaining their personal hygiene. Healthcare professionals may visit patients in their homes as often as five times a day, or as little as once a week. The staff may be nurses, auxiliary nurses or without formal training. Homecare services are organised in units spread around the municipality, each covering a geographical area.

The homecare staff collaborates with the patients' GPs. All recipients of homecare have a designated GP whom they see on a more or less regular basis. GPs are self-employed but are contracted by the municipality. Depending on the location of their offices, GPs may have many patients who receive homecare (typically in older, established residential areas), or they may have few (e.g. in areas populated by students) because people tend to choose a GP located near their place of residence. GPs may have patients who belong to several different homecare units and vice versa; one homecare unit can provide services for patients who see many different GPs. In addition, patients have contact with other healthcare providers (such as hospitals). This situation requires extensive collaboration to create seamless services for homecare patients, and the collaboration involving this patient group is highly complex.

3.2. *The e-message system*

The e-message system was developed as a module that can be integrated with the different electronic patient record (EPR) systems in use in Norway. There is substantial variation in EPR systems. Homecare services throughout the country use three different EPR systems, GPs use another four (and different versions of EPR systems), and hospitals use another two EPR systems. These systems are not integrated. Therefore, information cannot automatically be exchanged between them. However, by using the e-message system, users can exchange some of the information stored in the record system. When composing a message, a user can retrieve some of the content of the message directly from the EPR. Thus, it is not necessary to re-type information. Furthermore, information contained in a received message can be stored in an EPR. This integration of the e-message system with different EPRs facilitates the implementation of the legal requirement that patient information must be exchanged when necessary [42].

The e-messages are sent via a national closed and secure health net. The health net is a basic electronic infrastructure, which is used exclusively to transmit health information [43]. Currently, the system is being deployed throughout Norway, and figures from a national survey (October 2012) show that 26% of the municipalities use e-messages in their communication with GPs and that 38% of the GPs communicate with homecare services in the municipalities via e-messages [44]. However, only 12 of 429 (less than 3%) municipalities use e-messages in their communication with hospitals [44].

The e-messages that were designed to support communication between homecare service providers and GPs are presented in Tables 1 and 2.

Overall, the messages provide two distinct functions: standardised messages for specific purposes and dialogue messages. All the messages contain prefilled information, such as the patient's name, address and national personal ID number, as well as the sender and the recipient (on organisation level) of the e-message. In addition, both GPs and homecare services can send a so-called 'exception message' if insufficient information is received or e-messages are wrongly sent.

In 2008–2009, an e-messaging pilot was implemented in six out of 428 municipalities in order to improve communication between GPs and homecare services. Hospitals were included in the latter part of 2009. Four hospitals agreed to pilot the system.

Table 1 – E-messages sent from homecare services to GPs, showing intentions, formats and usage in practice.

Type of e-message	Intention	Format	Homecare nurses' usage
Update on municipal services granted (e.g. homecare)	Inform the GP that one of his/her patients is eligible for a particular service	Standardised	Seldom used by homecare nurses
Health information to GP	Inform the GP about changes in a patient's condition, e.g. after a short stay in a nursing home. Should serve as a basis for a medical assessment	Automatically imports information from patient's EPR (activities of daily life [ADL] values, intolerances, medications etc.)	Used frequently Comprehensive information. Nurses often remove ADL-values as requested by GPs. GPs are not familiar with homecare's ADL assessments, and they do not assign any meaning to them.
Medication list	Update the GP on a patient's medications and serves as electronic approval of the medication list	Standardised Imports the medication list from the patient's EPR and intolerances	Used In the homecare EPR system A, additional text cannot be added to messages (e.g. asking question about medications), so the nurse has to add a dialogue message for questions/comments. In EPR system B, additional text can be included in the message.
Information about death	Inform the GP that one of his/her patients has died	Standardised	Not often used
Dialogue message	Enable consecutive dialogue	Free text, not standardised Five types of requests from homecare services to the GP: 1. Medical information 2. Up to date medications 3. Prescriptions 4. Booking an appointment with the GP 5. Other	Most frequently used messages

Table 2 – E-messages sent from GPs to homecare services, showing intentions, formats and usage in practice.

Type of e-message	Intention	Format	GPs' usage
Medical information	Inform homecare services about changes in a patient's medical condition. There are three types: 1. Report following a consultation 2. Respond to a request 3. Information on application for care services	Standardised and free text The vendor decides which information is automatically imported (e.g. the medication list is imported in EPR system A).	Varied usage Sometimes a reply to a request from homecare services or on own initiative following a consultation
Medication list	Update homecare services on patient's medications	Standardised Imports the medication list from the patient's EPR and intolerances	Used frequently For the possibility of adding free text to the medication list, see Table 1
Information about death	Inform the homecare administration that one of his/her patients has died	Standardised	Not used by our interviewees
Dialogue message	Used for consecutive dialogue	Free text, not standardised Five types: 1. Requests regarding municipal services 2. Request patient information 3. Other requests 4. Reply to prescriptions 5. Reply to booking appointment	Most frequently used messages

3.3. Data collection and analysis

Two of the municipalities that were among the first to implement e-messaging in Norway were strategically chosen for this study because the involved GPs and homecare nurses had the most experience with the use of e-messaging. We used a combination of purposive and random sampling when recruiting informants. The first step was to choose homecare units and GPs spread across the municipality to ensure maximum variation and breadth of interviewees [45]. Second, GPs and homecare staff who had used e-messaging were recruited randomly. Contact persons in the municipalities were responsible for the recruitment. Interviewees were selected based on who was available and willing to participate in interviews on the particular days we would conduct the interviews. In this way, we ensured that we interviewed people with differing experiences and attitudes towards HIT.

We also interviewed medical secretaries and project management. In total, 43 persons were interviewed: 23 nurses, 11 GPs, 5 secretaries and 4 project managers. The interviews were a combination of individual interviews and groups interviews. The duration of interviews spanned from 15 min for an individual interview with a secretary to more than two hours for a group interview with four GPs. In general, the interviews with GPs lasted longer than the interviews with nurses. The average time spent with each interviewee was 45 min. The interviews were conducted during 2011.

We used interview guides covering three main themes: (1) collaboration and communication in general, (2) the e-message implementation process in particular and (3) assessment of the use of e-messaging. The interviews were taped and transcribed verbatim by a research assistant. In this paper, we present de-identified interview transcripts in the form of quotes from homecare nurses and GPs to illustrate our results. The secretaries had little involvement in e-messaging, and project managers represent an 'outside' view on collaboration. Their statements are therefore not included in this paper, as we wanted to capture the first-hand experiences of the GPs and the homecare staff. However, even if not explicitly expressed here, it should be noted that what we have learnt from secretaries' and project managers' experiences have informed our overall understanding of the introduction of e-messaging.

The data was analysed using an interpretative and eclectic approach, described by Kvale [46] as 'bricolage', in which the aim was to generate meaning and see connections across the material. The analysis was conducted stepwise. First, both authors started out by reading through the interview transcripts repeatedly and independently to obtain an overview of the material. Secondly, LM conducted a rough thematic coding of all interviews conducted within the BIG project and approximately 90 codes were assigned to the material. QSR NVivo (version 9) was used to organise the material. In the BIG project we also analyse other themes and not just unintended consequences, and a majority of the 90 codes are of limited relevance to this paper. Approximately 20 codes were used in the analysis presented here. In the third phase we focused on the codes comprising GPs and homecare nurses' experiences with e-messages, and/or codes that could contain examples of indirect effects, unintended consequences or cultural factors resulting from the introduction of e-messaging. Examples of such codes were "use of e-messages" (153 instances), "GP's collaborating partners" (56) "homecare-GPs" (75) "Face-to-face-meetings" (25) and "telephone conversations" (46). To identify unintended consequences we looked for experiences and events that were not described in project plans or by managers as an explicit intention of the e-message project. Based on the reading of these codes, we discussed the codes and agreed on three main themes that were particularly evident throughout the material. We do not rule out that other examples of unintended consequences of e-messaging for interprofessional collaboration also exist, but the three themes presented in the result section were by far the most common.

The validity of the results was ensured by continuous discussion among LM and RH and analyses of the interview transcripts, the literature and the codes before establishing the final themes.

The study was approved by the Ombudsman for Privacy in Research (Norwegian Social Science Data Services).

4. Results

Overall, our informants stated that communication via e-messaging improved their access to each other, with communication between homecare nurses and GPs increasing. This was the main objective of introducing e-messages and is an anticipated, desirable and direct consequence of HIT. However, the interviewees also (more or less explicitly) addressed the more indirect and unintended consequences of communicating with e-messages relating to changes in team processes and professional interactions between GPs and nurses. The quotes from the GPs and the homecare nurses in the rest of this section exemplify three types of unintended consequences, namely the loss of interpersonal relations, the reconfiguration of professional tasks and responsibilities and the empowerment of nurses.

4.1. The loss of interpersonal relations

The interviewees reported more efficient but less personal communication after the introduction of e-messaging. In several places, they switched from regular face-to-face meetings to communicating via e-messaging. However, telephone contact still took place. The opinions about not having face-to-face meetings varied. One GP stated:

> If you look at it from a management point of view, I can understand that you are trying to save money [by making communication more efficient]. At the same time, we lose some of that direct, personal contact, getting to know each other, seeing each other and chatting. Personal contact means a lot in this game. Personal knowledge means a lot. (GP municipality B)

Representing a somewhat opposite view, a nurse related the following:

> We feel that we spend a lot of time [at meetings], without getting anything in return. (...). But at the same time, we think it is a good arrangement because it is nice to see

> the face of the GPs – perhaps. … But just a few weeks ago, one of the nurses who has worked here for years suddenly mistook one GP for another. In her mind, she had always thought that NN was a certain person, but it turned out to be another! So it doesn't mean anything. No, it doesn't. (nurse municipality A)

Opinions about the importance of face-to-face contact varied. Some nurses argued that their close and well-functioning collaboration with the GPs was because they had known each other for years and had regular interpersonal contact. Others, as illustrated above, thought interpersonal contact and knowing each other meant little with respect to collaboration. Overall, most of the informants felt that knowing each other was important for collaboration – but how to get to know each other and sustain the interpersonal relationship can probably be facilitated by various means.

4.2. *Professional tasks and responsibilities reconfigured*

The informants reported changes in how much information they sent and received due to the simpler means of communication. We might say that more exchange of information is the structural effect of the introduction of e-messaging that, in turn, leads to unforeseen changes in tasks and responsibilities. Two nurses report how they use e-messages below:

> Nurse A: We answer questions from the GP. We write general information if they [patients] have an appointment with the GP, and if we think they won't remember to bring up everything that they should; then we send some kind of update in advance, so that all issues are addressed.
>
> Interviewer: Before the implementation of the e-messages system, did you provide this information via telephone?
>
> Nurse B: Yes, but not always, because it was so cumbersome via the telephone, so you would just skip it. I think e-messaging has made it easier. You can inform via a few keystrokes instead of waiting on the telephone.

Nurse B points to the fact that she informs the GP more often after the introduction of e-messaging, for example, before a patient arrives for his/her appointment with the GP. It means that the GP may receive information that is more comprehensive and up-to-date, ensuring a better quality of service. Similarly, some of the nurses reported that they use e-messages to inform the GP that patients have been admitted to hospital, signalling that the GP should be prepared for changes in the patients' medications.

GPs are also of the opinion that they send more messages. However, one highlighted a problematic aspect of communication becoming too easy:

> We send more messages. Earlier, we used to let them accumulate until Tuesdays [when they had meetings with homecare], and then some problems were solved at that time. Now we send them at once, right. The volume of the messages they [homecare] receive has increased as a result. And that might be a problem. Cause we often 'shoot from the hip'. We see a problem, and then we send it [a message], so we won't forget. Earlier, we would have thought, "can we try to solve it?", "can we try to find out?", "can we ask the patient to bring the pill dispenser?," can we ask for a "discharge note from the hospital?" It [the increased volume of messages] becomes a burden for homecare services. (GP municipality B)

The homecare nurses did not cite message overload or messages not carefully thought out as frequent problems. Thus, there may be a discrepancy between what is comprehended as 'too much' from a GP's perspective and from a homecare nurse's perspective. It is also necessary to keep in mind that we are examining individual experiences. However, some nurses did talk about receiving too much/irrelevant information via e-message, but this was explained as a consequence of (poor) functionality in the e-message system, where some message types automatically imported extensive amounts of information from the EPR and attached it to the message.

The interviews show agreement across the informants that more information is sent and received, indicating that e-message users have more knowledge of patients than do nonusers. Two unintended consequences are worth noting from the example quotes presented above: (1) e-messaging may become a structural means of change, allowing nurses to become more active organisers and facilitators of GP's work, which in turn can mean better follow-up of patients. (2) It may also be argued that e-messaging becomes a tool for getting things done and eliminating cognitive overload but in doing so unnecessarily transfers one's own work to another actor.

4.3. *Empowering nurses*

Another issue associated with HIT that was not addressed prior to the introduction of e-messaging is the power balance between homecare nurses and GPs. Shifts in the balance of power may occur as a result of the new form of communication. Through the automatic documentation of communication provided by e-messaging, the nurses felt their requests had more weight. Two quotes illustrate this:

> First, it is documented every time we have made an inquiry. And they [GPs] can't ignore an e-message. When there is a message, they have to answer. So, that is very much an advantage. (nurse municipality A)
>
> We haven't been spoilt when it comes to having contact with the GP. It's like…we try to get hold of them, and they are supposed to call back, but it doesn't always happen. Sometimes it feels like we are not taken seriously. But when you have sent an e-message, then it is there [in their EPR system]. And they have to open it, and they have to send an answer. (nurse municipality A)

When the nurses talked about what e-messages meant to them, they often described the positive effect of the automatic documentation on their dialogues with the GPs. Previously, messages for GPs were often mediated through their medical secretaries and could get 'lost', according to the nurses – meaning that the GP never called back. According to the nurses, requests documented in the EPR have more weight than a post-it note from a secretary, and they found that it resulted in a more conscientious follow-up from the GP.

Furthermore, nurses used phrases such as "having their back covered" and "having documented that you have done your job". Such expressions illustrate how nurses use e-messages for attaining accountability and to fulfil the demands of the public, their colleagues, patients and next of kin. E-messaging might be viewed as a tool that empowers nurses if used consciously.

5. Discussion

The aim of this paper was to identify and discuss the unintended consequences of the introduction of e-messaging in Norwegian healthcare, and particularly how it affected collaboration between homecare nurses and GPs.

Homecare nurses and GPs in Norway have collaborated on the care of the same patients for a long time. With new reforms for improving the integration of care [6], continued collaboration is more pertinent than ever. The aim of introducing e-messages was to strengthen information exchange and communication between homecare services, GPs and hospitals and, in turn, secure seamless patient trajectories across the sector [14]. However, the introduction of HIT can lead to a range of unintended consequences [7,12,17,18], which can have profound consequences for the service envisioned. In this paper, we have shown that the introduction of e-messages led to unintended consequences in three areas. In the literature, unintended consequences are usually considered errors or unwanted adverse events [7,10–12]. Our study of unintended consequences and how they can affect collaboration calls for a more nuanced view. Before turning to a discussion of the unintended consequences we found, it is worth mentioning that other parts of our work suggest that information exchange and communication indeed have been strengthened and that the intended consequence was achieved [15].

The main structural consequence of the introduction of e-messaging is that a new way of communication is now possible. Previous studies have shown that effective communication is important for collaboration [3,25,31,32]. However, making communication more effective implies a certain paradox, as we will show. As a result of replacing meetings and telephone conversations with e-messages, the amount of face-to-face contact between homecare nurses and GPs has decreased. In several homecare units, the intention was to replace meetings with e-messaging, and as such, less face-to-face contact can be seen as an intended consequence. However, if we take our analysis one step farther, less face-to-face contact can also imply a loss of interpersonal relations, which are essential for efficient collaboration [25]. The potential loss of interpersonal relations was not addressed by project management prior to the implementation of e-messaging, and weakened interpersonal relations can be seen as an indirect unintended consequence of the introduction of e-messaging.

Our informants problematise what it means to lose face-to-face contact in relation to the benefits of communicating via e-messaging. The informants' opinions regarding the value of face-to-face contact for sustaining interpersonal relations varied. Based on our data material, we cannot say whether less face-to-face contact will ultimately lead to weaker interpersonal relations; however, the GPs, in particular, pointed to the importance of knowing your collaborating partner in order to provide appropriate patient care. Strong interpersonal relations are also likely to affect trust building between the actors. Previous research has demonstrated that trust between healthcare workers caring for the same patients is essential for good collaboration [29,30].

However, alternatively, actors may develop new ways of creating and maintaining interpersonal relations via e-message communication. Research has shown that actors are innovative and fully capable of giving the desired self-presentation via ICT [37,38]. In fact, in our material, we see examples of actors using emoticons in e-messages to create friendly interpersonal communication. However, attempts to personalise communication are discouraged by management based on its desire to 'depersonalise' and standardise e-messages.

The introduction of e-messaging made it easier for the homecare nurses and the GPs to contact each other, which can be regarded as an intended consequence. The unintended consequences are related to nurses taking responsibility for work that lies in the intersection between their own work and the GPs' work. Such unintended consequences are also related to actors using the e-message system as a tool for getting things done (e.g. transferring work to others), and by doing so, decreasing cognitive overload. In the results section we gave examples of such events.

Research shows that it is not uncommon for the introduction of HIT to lead to a redistribution of work among staff [12,34–36], and our research supports such claims. Both nurses and GPs said that they sent more information than they had prior to the introduction of e-messaging. The nurses in our study took a more proactive role by sending patient's information to the GPs – information that they previously would not have sent. On the other hand, some GPs reported sometimes 'shooting from the hip' and sending e-messages to the nurses asking them to take care of the problem instead of trying to solve the problem themselves. In this respect, the introduction of e-messages resulted in more work for nurses. Nurses sent more information than prior to the introduction of e-messaging and also received more requests and information from GPs that they would have to attend to. However, as the nurses observed, they did not feel that the GPs sent too many messages and were mostly happy to provide the GPs with more information for the benefit of the patient. Furthermore, communicating predominantly via e-messages saved them a lot of time previously spent waiting in a telephone queue at the GP's office. It is therefore fair to say that e-messaging did not mean more work for nurses, though it did mean different work.

GPs, on the other hand, would (as intended) spend less time talking to nurses on the telephone; however, they spent time sending information which they previously did not have to send. Based on our data material, we cannot say whether the introduction of e-messaging alters the amount of time spent on patients that receive homecare services. But our research indicates that the time is spent in a more adequate way. However, even more thought-provoking is the suggestion that e-messaging is such an effective means of communication that it is used to get rid of work by transferring one's own tasks to others. In healthcare, the distribution of responsibility

between professionals is clearly regulated by law, but there are grey areas that are subject to negotiation. E-messaging may affect work in these areas. If sending an e-message makes it easier to transfer work to someone else (as exemplified in quote 4 with the GP), there is reason to reflect on practices in sending. Discussions between GPs and homecare nurses to establish responsibilities in the grey areas may be needed.

On the one hand, e-messaging may be viewed as a tool that allows nurses to communicate patients' needs to the GP and take greater professional responsibility. Modin et al. [29] highlighted the importance of nurses providing information to GPs to enable the latter to provide the proper treatment and care to patients living at home. On the other hand, the fact that nurses receive questions/messages from GPs and send information, which is not their responsibility, may support a view of nurses as being in the service of GPs [33]. This unintended consequence named 'professional tasks and responsibilities reconfigured' refers to both the category of new/more work for healthcare workers and to potential changes in power structures highlighted in the paper by Campbell et al. [12].

With respect to power structures in healthcare work, we also found that the nurses experienced e-messaging as an 'empowering tool' in their collaboration with GPs. Homecare nurses and GPs clearly have unequal status, and the differing statuses of the team members influence collaboration [25]. Both parties explained that it was much easier to contact the other after the introduction of e-messaging, but only the nurses said that they felt they were taken more seriously by GPs and that their requests now carry more weight. We argue that the structural change in communication following the implementation of e-messaging had the unintended consequence of challenging the established status between nurses and GPs, giving more weight to the nurses' requests.

In the literature, unintended consequences are usually considered errors or unwanted adverse events [7,10–12,17,18]. Ash et al.'s [13] categorization is one exception in which unanticipated desirable consequences are also discussed. The unintended consequences we have discussed in this paper (loss of interpersonal relations, redistribution of tasks and responsibilities, and empowering of nurses) do not uniquely represent desirable or undesirable unintended consequences, and we argue for a more nuanced view of unintended consequences.

Whether an unintended consequence should be regarded as desirable or undesirable depends on whose perspective we take. Redistribution of work among staff may be experienced as an advantage for some and a disadvantage for others. For example, a nurse may regard extra work (e.g. sending information to the GP that is not her responsibility) as an undesirable unintended consequence of the introduction of HIT, while for the GP this extra work represents the desirable consequence of being better informed. A shift in the power relations between actors will also be considered desirable by those that feel empowered; however, such a shift will most likely be considered less desirable by those that lose power. From a political, and in particular from the nursing profession's perspective, however, the experience of empowerment among nurses can be seen as a positive outcome. To gain a better understanding of the unintended consequences of HIT, one has to determine the consequences for each specific case while also considering each of the different actor's perspectives.

6. Study limitations

The study was conducted approximately six months after the e-message system was implemented and so users had somewhat limited experience with the system. We do not know how the interaction between the users and the system and, consequently, between the GPs and the homecare nurses will develop. Furthermore, although our sample was carefully selected, we cannot say if it was representative of the whole user population. However, the fact that our interviewees expressed both positive and negative attitudes towards e-messaging means that we have captured a range of experiences which strengthens our findings. The extent of unintended consequences related to collaboration can evolve over time. Thus, the presentation provided in this paper must be seen as a snapshot from one particular time. However, we argue that our findings, seen in relation to previous research, represent some general trends.

7. Conclusion

Healthcare work today is highly distributed and asynchronous, and there is a desire to better integrate care across the domain. HIT can be a useful tool for supporting collaboration across time and space. In this paper, we presented findings from our study on the introduction of e-messaging in Norwegian healthcare. We have shown that the e-message system paves the way for potential improvements in collaboration, both in terms of simplifying the communication that traditionally took place and in increasing communication due to a low-threshold technology that makes sending information easier. We focused on the unintended consequences of e-messaging between homecare nurses and GPs and looked at how these consequences affect collaboration. We identified three areas where unintended consequences particularly influence collaboration.

Research on unintended consequences on HIT has mainly been conducted on CPOE systems. These are systems designed for individual users. In the future, we can expect even more technology in healthcare, and the need for collaboration will only increase. This calls for more research on both intended and unintended consequences of collaborative systems. We also think it would be of particular interest to investigate further the positive unintended consequences that follow the introduction of HIT. Such serendipitous outcomes may be utilised for the benefit of the respective organisation.

Conflict of interest

None declared.

Summary points
What was already known?

- The introduction of HIT often leads to unintended consequences.
- Earlier work has provided much insight into the adverse unintended consequences of HIT but less on desired unintended consequences.
- It is a challenge to support interprofessional collaboration across time and space, and HIT may assist such collaboration.

What this study has added to our knowledge?

- The introduction of e-messages led to both intended and unintended consequences.
- Collaboration between GPs and homecare nurses was affected by communicating via e-messages.
- Communication between GPs and homecare nurses increased.
- The desired unintended consequences were improved information exchange beyond the intended goal and a step towards more equality among GPs and homecare nurses.

Author contributions

Line Melby contributed to design, data collection, analysis of data and writing. Ragnhild Hellesø contributed to design, data collection, analysis of data and writing.

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