

A Temporal Perspective on Electronic Medicine Management Work

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Abstract—Poor communication between professionals across levels of care regarding patients’ medication can lead to errors. Norway has invested in several electronic initiatives to improve collaboration in medicine management. This study elaborates on collaborative electronic medicine management work in specialist and primary care, asking what the problems with electronically shared medicine information are and how they can be solved. Based on *community of practice* as a method, three focus group discussions were arranged with healthcare professionals in 2022 and 2023. One theme was selected: the mismatch between the medication list in the discharge summary and the medication list before hospitalization. The analysis illustrates that this mismatch is connected to temporality in the patient’s illness trajectory, their medicines, and the professionals’ work related to this temporality. Overall, this paper contributes to sociotechnical perspectives on eHealth practices, focusing on structures and collaborative work processes. New eHealth initiatives offering digital tools for medicine management must take the temporal structures of medicine management work into account.

Keywords—*electronic medicine management; medicine inconsistencies; information sharing; temporality; community of practice.*

I. INTRODUCTION

Poor communication regarding patients’ medication across healthcare levels may lead to potentially harmful medication errors [1]. When hospitalizing a patient, information about medicines is shared by the General Practitioner (GP) in primary care with specialist care and, later, vice versa. In Norway, governmental strategies encourage digital communication and collaboration between levels of care to make patient health information available for professionals across levels throughout the patient’s trajectory [2]. Medicine management and digitalization are high priorities in the Norwegian e-health strategies [3]. To improve medicine management, several national plans and electronic initiatives have been invested in [4], including electronic prescriptions (2004–2005) [5], the Summary Care Record (2008–2009) [2], eMultidose (2014–2015) [6], and the Patient Medications List (2017–2018) [7]. These electronic initiatives for medicines management may be independently more or less successful, but they have been unsuccessful in coordinating all the information and managing all the work involved.

The existence of multiple electronic information systems poses a challenge for medicine management, as none of them provides a complete overview of a patient’s medicine history. The barriers to exchanging health information are connected to incomplete information and inefficient workflows that do not meet the needs of professionals [8]. This is not a problem unique to Norway. Denmark, Finland, Sweden, and Norway are all at different stages of implementing national shared medication systems to increase access to information and reduce discrepancies between medical information. Despite the implementation of new systems, the information in the lists is not always up to date, systems are not integrated, there is a gap between the integration of information and appropriate working routines, and there are legal and technical issues [9].

To reduce the number of medication errors and improve the quality of care, healthcare professionals need to collaborate regarding medicines and treatment. When a patient is referred between primary and specialist care, the professional’s main digital communication tools are the referral letter from primary care to the hospital and the discharge summary from the hospital to primary care. Information about the patient’s medication is outlined in the medication list. Collaboration and continuity of care in terms of adherence to medication lists when patients are transferred from one health care level to another are challenging [10]. A study of patients’ medication lists documented during their hospital admissions, hospital stays, and return to their GPs reports that half of the errors found originated from incomplete medication lists provided in referral letters [1]. Another study highlights the problem of changes made in medication during hospital stays that are not always explained in discharge letters, making it difficult for GPs to follow up on the medication as intended [11]. Hence, there are inconsistencies between patients’ prescribed medication on admission to hospital and their prescribed medication upon discharge [12].

Several digital systems contribute to the work process related to information sharing. This study does not elaborate on one special technology or system; instead, it focuses on the exchange of medicine information in electronic systems per se, specifically those used for medicine management. The transition between levels of care in an illness trajectory is particularly challenging because of the work related to information exchange. Using physicians’ and GPs’ points of

views, this study elucidates the work related to the sharing of information regarding patients’ medicines between the hospital and the primary care institution. The study asks the following questions: *What are the problems with electronically shared information and how are they solved?* This paper contributes to the literature on electronic medicine management and the body of empirical and analytic investigations of temporality in collaborative work and medicine management.

The rest of this paper is organized as follows: Section II describes the theoretical framework, Section III elucidates the method used, Section IV presents the results and analysis, Section V outlines the discussion, and Section VI provides the conclusions and suggestions for future work.

II. THEORETICAL FRAMEWORK

We frame the work related to electronic medicine management from a temporal perspective. According to Orlikowski and Yates [13], studies of temporality are mainly rooted in one of these two perspectives: time is understood as subjective, existing independent of human action, clock-based, and measurable, or it is viewed objectively as a phenomenon socially constructed through human action. This subjective–objective dichotomy is often presented as the contrast between clock time and event time [14]. Orlikowski and Yates [13] propose joining the subjective and objective into a practice-based perspective in which time is both independent of and dependent on human actions. According to this practice-based perspective, temporality is explored in terms of people working and interacting with the temporal features of their work [13].

Furthermore, temporality can be regarded as the sequence of work activities that occur as the patient progresses through a particular unfolding illness trajectory [15]. While exploring the work related to a particular patient as their illness unfolds, the work of managing that illness also unfolds. For example, the patient’s illness goes through various stages, demanding their transfer between healthcare levels and involving different professionals who make changes to their medicines.

Utilizing Orlikowski and Yates [13], this study combines the subjective and objective perspectives to analyze temporality from a *practice-based perspective*. The study uses the *medicine management trajectory* to illustrate the *timeline* and *work activities* performed. Electronic information systems (e.g., medicine lists) are the tools that make medicine information sharing possible. Based on these perspectives, the problems and solutions related to GPs’ handling of medication inconsistencies are explored in this study.

III. METHOD

This is a qualitative study exploring the practices and dynamics of a group of professionals. It uses a Community of Practice (CoP) approach to emphasize the social nature of learning and the importance of shared practice, mutual engagement, and a shared domain of interest [16]. The CoP

serves as an arena for healthcare professionals to meet and share knowledge, expertise, and best practices related to their work with electronic medicine management. Professionals were recruited who shared a common interest in renewing their medicine practices, engaging in joint activities, and developing a shared repertoire of resources and knowledge.

In Norway, two new hospitals are under construction. These hospitals were selected for this study because professionals in these hospitals were eager to discuss challenging cases, share successful strategies, and learn from each other’s expertise. These professionals were established as the core group and replaced by new participants if participants from the core group were unable to participate. The main aim was to gather a group of interprofessional participants who represented the whole chain of medicine management and were willing to share their expertise. The empirical material was collected from three in-person focus group discussions [17]. Two of these discussions were held in 2022 and one in 2023 (Table 1). The discussions will continue as the project progresses. Furthermore, eight to ten participants were part of each discussion. The participants were encouraged to present 1) a case that each of them considered challenging in terms of medicines management and interaction between levels and 2) the importance of national guidelines for local medicines management practices. The case in this paper is chosen because the participants considered it as a classical example, engaging them all in a shared engagement with and interest in the problem and a mutual interest in finding a solution.

The focus group discussions lasted approximately three hours each, during which participants were presented with the challenges of electronic medicine management. The discussions were audio-recorded and transcribed. The data were analyzed using thematic analysis, identifying, analyzing, and reporting themes in the empirical data [17]. For this paper, the findings focusing on hospital physicians’ and GPs’ work with medicine management and their reflections on problem-solving were chosen. Therefore, the GPs’ and physicians’ utterances were selected. Nevertheless, the meaning of the content was produced by an interprofessional group dynamic. The results reflect the patterns that emerged from the findings arising from the three discussions.

TABLE I. PARTICIPANTS

Year	Represented Professionals in the CoP
2022	Nursing home doctors (2), hospital physician, hospital nurse, nursing home nurse, home care nurse, representative information and communication technology (ICT), community pharmacist, and hospital pharmacist
2022	Nursing home doctor, hospital nurses (4), nursing home nurse, home care nurse, ICT representative, hospital pharmacist, and community pharmacist
2023	GP, hospital nurse, home care nurse, hospital pharmacists (2), and community pharmacists (2)

IV. RESULTS AND ANALYSIS

The results illustrate how medicine inconsistencies were handled in terms of (a) evaluating the problem, (b) evaluating the consequences, and (c) making adjustments to solve problems caused by temporality in electronic medicine management work.

A. Problems with the Information Shared

The hospital physician described a classic example of electronic medicine management work performed when a patient is admitted to and later discharged from the hospital:

A classic example: There are several changes in the medicines [at the hospital]. The physician writes a note (...). In addition, he copies and pastes text from the previous medicines. The GP gets it back [discharge summary]. If there is a medication list that does not match what the GP remembers the patient was on before hospitalization, the GP is in a dilemma: does this mean that the hospital has decided the changes that have been made should be reversed and that he [the patient] should go back to what he used before hospitalization, or does it mean that it is a copied and pasted [version], showing that it is an error? What exactly is the hospital trying to communicate?

(Physician in hospital)

In this excerpt, the physician describes the various stages of working with the information in the patient's medication list. The dilemma is regarding the mismatch between the medicine list in the referral letter and the medicine list in the discharge summary. This problem description of the dilemma caused by information sharing in the treatment trajectory was confirmed by the GP in primary care. From the perspective of time, the sequence of work activities as the patient goes through the treatment trajectory creates an expectation of medicine reconciliation. When information does not match the GP's situated knowledge of the patient, they face a dilemma. Are there old follow-up errors (e.g., copied and pasted medicine information), or has the physician in the hospital made an active reconciliation of the medicines?

From the perspective of time, this problem description is about the temporal context of medicine information. Time is constructed here through the discharge summary as an end point for the physicians' work in the hospital. The information becomes static, and the medicine list is not open to negotiation. When the patient approaches the GP, the GP sees inconsistencies in the medicine information due to which the patient's treatment is organized in returning events. As GPs often look after the same patients over a long life span, they have historic practice-based knowledge of their patients' medicine histories. As a result, temporality is represented in the information, while the information from the hospital has a here-and-now point of departure.

B. Evaluating the Consequences of Inconsistencies

Evaluating the consequences of information is part of the treatment practice. This assesses the severity of errors. The GP described this issue as follows:

Many of the errors reported are errors that go well, nevertheless. There are many errors that do not have consequences (...). Most errors are not critical. If you don't get the dosage you should have for a day or two, it's mostly okay. What is not okay are the occasions they are serious.

(GP)

The GP described how the consequences of information inconsistencies are evaluated according to time and effects. The wrong dosage over a short period of time was described as a non-dangerous consequence of an error. Here, the subjective temporality of clock time is connected to the evaluation of the objective, which is the temporality of the event. The temporality of the event provides the opportunity to change the dosage after a second, practice-based evaluation of the illness trajectory.

Furthermore, the GP provided an example of a non-dangerous error in the discharge summary. This error involved dietary supplements and vitamins: "You choose fights that are important. If they [the physicians at the hospital] forget a dietary supplement [in the list], they [the patient] won't die from it."

Here, the GP evaluated the consequences of errors, considering the effects of prescribing wrong medication and the effort put into the extra workload. In the quotation, "fights that are important" points to the extra work of checking information with the hospital and evaluating the consequences of the medicines taken. Information from the hospital is viewed as temporal in practice. In the same discussion, a pharmacist evaluated errors from another point of view, saying, "Yes, they should remember to take it [the dosage of dietary supplements or vitamins]!" The pharmacists wished to close the temporal event, reducing temporality, while the GP evaluated the *big picture* as a repeated element, depending on time and based on the relative importance of one medicine compared to other medicines.

The GP evaluated the consequences of information inconsistencies in relation to the severity of incorrect or missing medication:

However, if something goes wrong, it will take a lot for it to be a major disaster. It's good to get it in [the medical lists] and communicate it accurately. Once they get a dietary supplement, they [the patients] are happy to continue. It's not like they change dietary supplements.

(GP)

This excerpt illustrates how the GP not only evaluates the consequences of a potential error but also reflects on how long-term dietary supplements or vitamins are prescribed more stably over time. From the perspective of time, this evaluation reflects the temporality during the patient's treatment trajectory. Hence, the temporality in medicine is also connected to *which* medicines are taken during the patient's trajectory.

C. Solving the Problem of Inconsistencies

In the CoP, the professionals discussed opportunities to prepare for best practice. When discussing how the problem of medical information inconsistencies between the hospital and the GP could be solved, the GP suggested the following:

Can you [the hospital] write whether you have reconciled the medicines? Is it a copy-paste [job]? Can you express whether something has been done and thought about? It's almost impossible to determine where to start because you don't really know what has been decided (...) in the end (...)—what reflection is given. The physician who takes over [in the hospital] needs to communicate so that adjustments can be made.

(GP)

Solving the problem of inconsistencies can be performed by providing information on whether the medicines have been reconciled. The GP demands a decision or reflection on the information given. These assessments are the foundation of the new assessments conducted by the GP. Within the hospital, the illness trajectory represents temporality. The patient moves between departments, and information needs to be communicated to obtain a complete overview when the patient leaves the hospital. This information is also the foundation of the adjustments made. In this quotation, the GP illustrates how their work involves individually preparing temporality through making medical adjustments and planning the future.

If nurses reveal inconsistencies in the information that may lead to errors, they circulate information about the action, reattempting the decision-making of the physician or the GP by using the telephone. As the home care nurse said, "Well, then we will call." To this, the hospital physician responded as follows: "No! If I'm unsure, I do what I think is right. I am the one who decides (...). It is not the others' task to make assessments. It is a physician's task."

The home care nurse perceived the information as an open-ended discussion, attempting to collectively create an emergent temporal structure by searching for knowledge. The physician viewed this as an individual responsibility, considering that in the end they have to close the negotiation by evaluating and deciding medicines and further treatment. Here, temporality is represented in the information, which the GP or the physician needs to stabilize until new information occurs. This illustrates the temporal future of the work: that is, temporality as practice-based.

V. DISCUSSION

The results illustrate how the problems associated with electronically shared information are related to temporality. The temporality is both subjective, as the patient goes through a treatment trajectory that is clock-based and connected to time and place, and objective, connected to events that are socially constructed by the patient's and professionals' actions. Temporality is made visible in the

patient's illness trajectory that changes, in the medicines that change, and in the professionals' work that requires adjustments. The problem with electronically shared information is illustrated by the medicine list in the discharge summary. In this paper, this is revealed by the GP who finds information that does not match the GP's situated knowledge of the patient. Practically, it is shown by examples of old follow-up errors (i.e., copied, and pasted medicine names) and active reflections on the medicine list.

Previous studies have highlighted, among other issues, incomplete medication lists in referral letters meant for the hospital [1] and insufficient information in discharge letters, which make it difficult for the GP to follow up [11]. Instead of evaluating the medicine list itself or attributing errors to professionals, this study uses the theoretical framework of temporality to shed light on the properties of practice, time, and events in professional medicine management processes. The work related to medication at the hospital is an event that occurs during the hospital stay, and the timeline is completed when the patient leaves the hospital. Hence, the medicine list has an endpoint when the patient is transferred from the hospital to their home, a nursing home, or home care, becoming the responsibility of the GP. The hospital performs its work related to medicine in a more closed and deadline-oriented manner. By contrast, the temporal structure of primary care is more open-ended and event-based.

Both the physician in the hospital and the GP understand the illness trajectory as temporal and in progress. They have a circular approach to patient illnesses and constantly wish to know what has been happening (looking backward) and what is planned (looking forward) for the patient, attempting to shape the treatment trajectory. They continuously try to find past information and consider what future information they will need [15]. This temporal future of the work (i.e., practice-based temporality) [13], which is connected to patients' medicines and movements in the healthcare system, is the professional and organizational working-life structure. Overall, the trajectory *in house* is temporal because physicians or GPs are responsible for the treatment of patients from the minute they arrive to the moment they leave. Nevertheless, at the hospital, the work related to electronic medicine management is an event representing the closure of work when the patient is discharged from the hospital to a primary care institution. Here, medicine management has a temporal structure that professionals currently use in their everyday work.

When the patient is the responsibility of the GP and potential errors exist in the medicine list, the GP evaluates how to solve this issue in terms of the degree of its consequences over time. By contrast, the nurses and pharmacists evaluate this as an open-ended discussion, attempting to collectively create an emergent temporal structure. The GP has responsibility for the patient and makes decisions on the basis of the patient's history and current situation [15]. A previous study of the Summary Care Record in Norway [18] shows that doctors did not trust manually

updated information in the system. In this paper, the findings illustrate how the GP evaluates information, trusting their own judgment and situated knowledge of the patient. Hence, the study supports previous findings, showing that the GP conducts assessments and makes decisions based on current and previous knowledge of patients' medicines. The changes made by the GP contribute to a constant movement in medicine management, in which assessments and trust are linked to the physician's or GP's individual competence.

Moreover, electronic tools offer opportunities to manage medicine information and produce and negotiate the temporal order of professionals. The tools, which are the referral letter from primary care to the specialist service and the discharge summary from the hospital to primary care, serve as elements initiating discussions of gaps. To elaborate, professionals discuss and search for proposals and agreements about treatment, leading to additional information gathering about medicines. Hence, the patients' medicines constitute a form of temporality in practice.

Developing technology for medicine management must take temporal structures into account. Furthermore, complex medicine management is interdisciplinary work. Work attempting to solve inconsistencies has a different character among different professionals (i.e., different perspectives regarding the degree of medication errors). The discharge summary from the hospital is situationally dependent, representing the here and now, while the GP's practice has a lifetime perspective. Moreover, problem-solving, such as that conducted by nurses and pharmacists, is performed with different strategies by different professionals. For example, nurses call for checkups, working with the medicine list with a clear end in mind. Pharmacists account for all medicines, including vitamins, at this temporal endpoint. Hence, the medicine list accounts for the different temporalities among various professionals. New investments and the implementation of new technologies must take this temporality into account.

VI. CONCLUSIONS AND FUTURE WORK

Medicine management work is complex. The temporal organization of work is considered a practical accomplishment of human activities. The results illustrate that the problems associated with electronically shared information are related to temporality in the patient's illness trajectory, their medicines, and the work of professionals related to this temporality. Furthermore, electronic management systems are stable, while the illness trajectory, medicines, and work of professionals are only stabilized for a short period of time. On the one hand, at the hospital, medicine management regarding one specific patient is event-based, with a beginning and an end to the diagnosis, where the discharge summary represents the closure of an event. On the other hand, in primary care, the treatment practice is more temporally structured, whereas the GP uses a life-course perspective in the treatment of the patient, creating a temporal structure whose character is derived from aspects of the working-life structure. To solve this complexity, new

initiatives involving digital tools for medicine management need to take into account the temporal structure of future work (i.e., practice-based temporality) and connect it with a tool that facilitates temporal medicine information through the healthcare trajectory. The temporality is neither subjective nor objective; rather, it involves a coordination between the different temporalities. This study is concerned with the collaborative work involved in exchanging medical information per se. A limitation of this study is regarding its practical adaption to the development of technology. Future research should continue to explore medicines management work practices to provide further knowledge about eHealth systems and how they can take into account the complexity of interprofessional medicines management work.

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