Research paper

Making information infrastructure visible. Field research on the collaboration of pharmacists and GPs enabled by the EHR systems Pharmacom and Medicom

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List of abbreviations

EHR	Electronic Health Record
II	Information Infrastructure
LSP	Landelijk Schakelpunkt

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Abstract

This paper reports the findings of an exploratory case study on health data exchange in Dutch primary care, with particular focus on the collaboration among pharmacists and general practitioners (GPs) enabled by the electronic health record (EHR) systems Pharmacom and Medicom. Therefore, purpose of this study is to examine how different forms of health data exchange, as supported by these systems, reveal infrastructural issues in practice. Based on interviews with pharmacists and targeted desk research, I identified three distinct forms of exchange. First the exchange via the national infrastructure. Second the regional collaboration within a Pharmacom/Medicom cluster. Third the intra-organizational integration in the case of dispensing GPs. Drawing on the relational perspective of information infrastructures (IIs) proposed by Star and Ruhleder (1996), the study shows that while technical access provides the foundation for health data exchange, effective collaboration is strongly influenced by organizational routines, professional roles, and interpersonal trust. Issues that can be categorized into Level 1 (technical access), Level 2 (workflow alignment), and Level 3 (interpersonal relationships) may arise. The findings contribute to a more nuanced understanding of how EHR systems as technological components of the II not only enable but also constrain collaboration in primary care, with implications for pharmacists, GPs, system providers, and policymakers aiming to improve II in healthcare.

1 Introduction

The ongoing global digitalization is opening many new opportunities for the exchange of health data on global, national, regional, and local levels (Bogumil-Ucan & Klenk, 2021). Such information infrastructures (IIs) are often understood as entanglements of technologies and practices (Orlikowsky, 2007), where each one continuously influences and transforms the other (Almklov et al., 2014). Thereby, IIs enable a widespread exchange of data by reducing transaction costs (Zhang et al., 2022).

Against this background, my field research investigates how the socio-technical entanglement both shapes and is shaped by the exchange of health data in Dutch primary care, where the exchange itself constitutes an infrastructural component. More specifically, the analysis focuses on the collaboration between pharmacists and general practitioners (GPs) as the main unit of analysis. To further narrow down the scope, I focused on the electronic health record (EHR) systems Pharmacom and Medicom, which are developed and provided by PharmaPartners. I identified that the exchange of health data between pharmacists and GPs can be characterized into three different forms of exchange, based on the technical possibilities offered by the systems Pharmacom and Medicom.

First, the exchange via the Landelijk Schakelpunkt (LSP), which represents the most common and standardized method for sharing health data in the Netherlands. Second, the regional clustering within a Pharmacom/Medicom environment, where pharmacists and GPs are part of the same regional network and can, for example, jointly maintain tables such as those for contraindications. Third, the intra-organizational integration, where pharmacists and GPs work within the same system, which is only possible for dispensing GPs (GPs that also have a pharmacy in their organization) and allows for the most seamless and collaborative form of health data exchange.

Drawing on the relational view of II by Star and Ruhleder (1996) as the theoretical foundation, I find that these forms of exchange differ significantly in terms of the types and levels of issues involved. I further emphasize how the notion of the double bind, which is extended by Star and

Ruhleder from Bateson's (1972) theory and will be further explained in the theoretical background section, manifests across the three possibilities. This leads to the central research question of this paper:

What forms of organizational and social coordination issues emerge across the three forms of health data exchange enabled by Pharmacom and Medicom?

Following the case study methods of Yin (2014), I conducted structured field research, especially through targeted desktop research and interviews with several pharmacists in the Netherlands. The focus on health data exchange through the system Pharmacom and Medicom was chosen because of their central role in Dutch primary care. With a market share of nearly 50%, Pharmacom not only dominates the EHR system market for pharmacies but also strongly influences how pharmacists work in practice and how collaboration with GPs is organized (Campmans et al., 2018).

Starting off, I explain the theoretical foundation by Star and Ruhleder and elaborate on why it is highly relevant for the collaboration. Building on this theoretical lens, I introduce the proposition that emerged during the research process. Thereafter, I explain the methodology of my field research, which is based on the methods of Yin (2014). To provide a comprehensive picture of health data exchange in the collaboration, I present my findings with particular attention to the notion of the double bind as it may arise across the different forms of exchange. In the subsequent discussion, I critically reflect on my findings to arrive at possible implications that might further improve the collaboration between pharmacists and GPs. Finally, I address the limitations of my research and suggest avenues for further research.

2 Theoretical background and proposition development

The relational perspective on II developed by Star und Ruhleder (1996) provides a valuable lens for analyzing the different forms of health data exchange identified in this study. Their theory helps to conceptualize II not as static technical systems, but as evolving socio-technical arrangements. This perspective is particularly relevant for understanding the varying issues in the forms of health data exchange discussed in the results section.

2.1 The relational view of II and the underlying issues

Star and Ruhleder (1996) state that, unlike many common metaphors, infrastructure should not be seen as a static object but always as a relational and dynamic construct. Therefore, decisions of the practice and technological innovations are embedded within II and manifest as articulated components. II is not a neutral or passive background but rather a dynamic and context-depended network of relationships, which often becomes only visible in moments of breakdown and failure.

Drawing on Bateson's (1972) theory of learning and communication, Star and Ruhleder (1996) differentiate between three levels of issues, which are particularly relevant for the exchange of health data within the collaboration of pharmacists and GPs in Dutch primary care. The first level issues refer to technical access and can be addressed through appropriate training and documentation. For instance, in the case of Pharmacom and Medicom, the developers of these systems from PharmaPartners offer training videos and workshops.

The second level issues emerge when technical requirements or features come into tension with habitual practices. At this stage, issues are no longer purely technical but arise from misalignments between the technological components of the II systems and the habitual ways in which people work and collaborate - for example, when pharmacists and GPs follow different documentation routines. This can create hesitation in using shared systems like Pharmacom and Medicom. In this case, arising problems are not attributable to individual errors but to systemic misalignment.

At the third level, issues are rooted in deeper social and cultural dimensions. They go beyond technology or routines and involve fundamental aspects such as trust and professional roles. In the context of health data exchange, this can be seen when pharmacists and GPs have access to shared systems like Pharmacom and Medicom, but their use is limited by a lack of trust or differing views on data responsibility.

A central concept in Star and Ruhleder's theory is the so-called double bind. This term, originally introduced by Bateson (1972), refers to situations where actors face contradictory expectations. In the context of the health data exchange, participants are expected to use II as if they were simple and unproblematic, while challenges are officially assumed to be solvable through Level

1 measures such as training. However, the actual barriers they encounter often belong to higher-level issues (Levels 2 or 3), which cannot be addressed by technical fixes alone. This contradiction between the expectation of effortless use and the reality of socio-technical obstacles is what constitutes the double bind.

This theoretical perspective is particularly well-suited to analyze the collaboration between pharmacists and GPs, as I find that the double bind is highly relevant in the different forms of collaboration. Especially through my interviews with the pharmacists, it becomes evident that II for health data exchange is not a neutral background technology, but a socially embedded system.

2.2 Development of the main proposition

The proposition presented in this paper emerged gradually during the research process and was not defined a priori. However, to provide a clear structure and facilitate the understanding of my research findings, it is presented in this section.

Based on exploratory interviews with pharmacists and targeted desktop research, it became evident that the collaborative forms enabled by Pharmacom and Medicom differ not only in terms of technical configuration but also in their degree of organizational integration, shared workflows, and social relationships. The delimitation of the forms of exchange has raised the question of what levels of organizational and social coordination play a role in the different forms, also to compare them with each other - issues that can be meaningfully interpreted through the theoretical lens of Star and Ruhleder (1996). Therefore, I propose the following:

P1: *The three forms of collaboration among pharmacists and GPs for the coordination of patient care, which are enabled by the EHR systems Pharmacom and Medicom, reflect different levels of infrastructural issues, particularly Levels 2 and 3 as described by Star and Ruhleder. Thus, the challenges in health data exchange lie not in purely technical barriers, but within the dynamics of the double bind.*

This proposition provides a conceptual basis for interpreting the research findings and for understanding the underlying dynamics of health data exchange in Dutch primary care as enabled by Pharmacom and Medicom.

3 Technological components of the exchange

The collaboration between pharmacists and GPs for the exchange of health data in the Dutch primary care system is enabled by various technical components, including EHR systems used by professionals such as Pharmacom or Medicom and the national exchange infrastructure (LSP). To build a common understanding of the health data exchange in the scope of this paper, I will briefly explain these main components.

3.1 Pharmacom and Medicom

As there are very few academic and independent publications that explain the functionalities of Pharmacom and Medicom, the following explanation is primarily based on information provided by the system developer PharmaPartners.

Pharmacom is an EHR system and is used by approximately 50% of Dutch community pharmacies (Campmans et al., 2018), including those that are integrated into GPs (dispensing GPs). It is designed to support the digital management of pharmaceutical care processes. The system allows pharmacists to verify and record prescriptions and to create medication plans.

A key feature of Pharmacom is the possible technical integration with Medicom. This integration plays a central role in the different forms of health data exchange identified during the case study. In addition, Pharmacom includes an alert system that supports pharmacists in performing safety checks, for example, when checking for contraindications. The system also offers functionalities for providing patient-specific medication information and optimizing pharmacy-logistics. This includes features such as customized prescriptions, which are prescriptions adjusted to individual patient needs, such as dosage and form. Additionally, the system offers features for stock management, especially when working in conjunction with other pharmacies that also use Pharmacom.

Due to its high market share, Pharmacom represents a central component of the Dutch health data infrastructure. It aims to support both the safe delivery of pharmaceutical care and the interoperability between pharmacies and other healthcare providers.

Medicom, in contrast, is an EHR system used by GPs in the Netherlands. Its main purpose is to streamline processes within GP's settings. One of its central features is the shared patient file, which is accessible not only to GPs but also to nurses and medical assistants within the practice. Medicom is used to document, review, and update patient records, manage medication plans, and facilitate communication with other healthcare providers, especially with pharmacists.

The proportion of GPs who use Medicom is significantly lower than the proportion of pharmacists using Pharmacom. It is estimated to be around 20%. Since no publicly available independent data on market share exists, this information is based on information published by the system provider PharmaPartners from 2025.

3.2 The LSP

The following elaboration of the Dutch LSP and its role in the exchange of health data is based on the research of Thiel et al. (2018), published as part of the Smart Health Systems report by the Bertelsmann Stiftung.

The LSP is the central digital infrastructure for the exchange of health data in the Netherlands. Launched in 2006, it enables authorized healthcare providers, such as pharmacists or GPs, to exchange essential data, including medication history or clinical records. Thereby, the LSP functions as a central routing and authorization hub, indexing patient data using the BSN, which is the citizen service number. Access to the LSP is regulated through institutional authorization and is subject to automatic logging, meaning that every access attempt is recorded to ensure both accountability and transparency. Crucially, patients must give explicit opt-in consent at their GP and their pharmacy.

By the end of 2016, around 92% of the healthcare providers in the Netherlands were connected to the LSP, and around 150,000 health data messages were exchanged daily. While EHR systems such as Pharmacom and Medicom in the Netherlands can technically be connected to the LSP, there is no direct communication between EHR systems from different providers.

The exact data that can be exchanged and that is relevant for the exchange among pharmacists and GPs are certain parts of the health record, which are relevant for the other healthcare provider.

This may include information about intolerances to medication, allergies, and contraindications (ICA data), information about the prescribed medication and the medications that were picked up as well as laboratory data and test results (Volg je zorg, 2025).

4 Methodology

My field research follows a multiple case study design as outlined by Yin (2014), which is particularly well-suited for investigating complex processes in real-world contexts where the researcher has limited or no control over the setting. Therefore, the use of multiple cases enables a more nuanced understanding of the collaboration between pharmacists and GPs.

Due to the limited availability of academic literature and public reporting on this topic, I began the research process by directly contacting pharmacists in the Netherlands to gain an initial understanding of the collaboration in practice. Although I initially attempted to contact Dutch GPs, the response rate was very low, and I was not able to conduct an interview. As a result, I decided to focus my efforts on pharmacists. In parallel, I also sought to arrange an interview with representatives from PharmaPartners to further triangulate insights from the interviews with pharmacists and findings from my desktop research, which was also unsuccessful.

To identify and contact interview partners, I primarily relied on direct phone calls and direct sight visits during June 2025, which proved to be the most effective method. Attempts to reach out via LinkedIn and email were not successful. The initial conversations were typically brief at around two to three minutes, and served to get a first impression of the practical use of Pharmacom and Medicom and how these systems enable collaboration between pharmacists and GPs.

The research process was iterative in nature: each conversation with pharmacists generated new insights and simultaneously gave rise to further research questions and areas of inquiry. Figure 1 stresses this iterative research process. After my initial desk research, I found new research directions regarding the forms of exchange, which I wanted to explore further through the initial short interviews with the pharmacists. Based on these short interviews, I then switched back to desk research to enter into new discussions with pharmacists having new insights. I then either

collected new findings for the case study or returned to the desk research phase. Overall, the aim of this phase was to identify the different forms of exchange made possible by Pharmacom and Medicom.

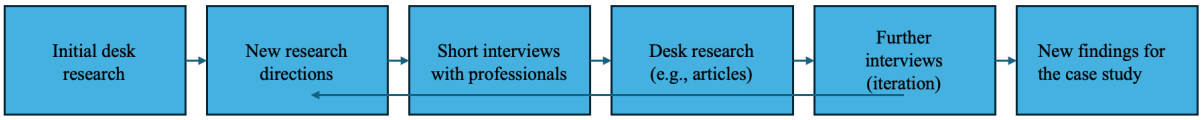

Figure 1: Process of the initial field research

After completing the initial exploratory phase, I conducted two pilot interviews with pharmacists located in Heerlen and Maastricht. These interviews were designed to refine my understanding of the collaboration between pharmacists and GPs, particularly in relation to the emerging assumption that in the context of Pharmacom and Medicom, three distinct forms of health data exchange exist. The aim of these pilot studies was to assess the plausibility of this preliminary assumption and to work out a possible structure and focus of the final interviews by identifying relevant participant profiles.

In contrast to the brief and informal conversations during the initial contact phase, the pilot interviews were more structured and lasted approximately five to ten minutes. The questions posed during these pilot interviews were more targeted and based on an initial interview guide. This guide served as the foundation for the standardized protocol used in the subsequent main interviews.

The selection of cases for the pilot phase followed a theoretical sampling strategy. This approach ensured variation in the way the pharmacists collaborate with the GPs to capture diverse perspectives. All selected cases involved the active use of Pharmacom, as the study specifically focused on health data exchange supported by this system. Due to Medicom's relatively lower market share among GPs, the pilot study did not aim to include only pharmacists who collaborate with GPs using Medicom.

For the final data collection phase, I conducted two in-depth interviews with pharmacists who regularly use Pharmacom in their professional practice and are involved in health data exchange

with GPs. These interviews followed a standardized research protocol to ensure methodological consistency across the two cases.

To ensure the methodological standard of the case study, I applied Yin's (2014) criteria for high-quality field research.

Construct validity refers to the extent to which the study accurately captures the concepts it intends to investigate. It was addressed through triangulation (interviews and desktop research) and participant validation.

Internal validity is particularly relevant to explanatory case studies and was considered through explanation building during the discussion phase, where patterns were linked back to theoretical assumptions.

External validity was ensured by clearly defining the scope of generalizability in the discussion. While some insights may be limited to users of Pharmacom and Medicom, others offer broader relevance for healthcare professionals using comparable EHR systems.

Reliability was addressed through transparent documentation of the research process, including the use of a standardized interview protocol and consistent data collection procedures.

Due to ethical considerations and privacy concerns, all interview participants were anonymized. The two pharmacists involved in the main case study interviews are referred to as Pharmacist 1 and Pharmacist 2 throughout the paper. Although the pilot studies also provided insights into the opportunities for collaboration made possible by Pharmacom and Medicom, my results section refers exclusively to the two main interviews, as only these followed the standardized protocol and provided transparency about the findings.

5 Research findings

In this section, I will first present the three different forms of health data exchange between pharmacists and GPs that I identified during my field research. Each possibility reflects a distinct form of technological and organizational collaboration, ranging from basic interoperability to more

integrated forms of cooperation. For each of these three possibilities, the potential double bind will be explicitly considered.

5.1 Exchange via the national infrastructure (LSP)

The first and most used form of health data exchange between pharmacists and GPs takes place via the LSP (van Ostaijen, 2012). This form of exchange is especially relevant when healthcare professionals work independently and use different EHR systems. For instance, as there is no direct interoperability between Pharmacom pharmacists and GPs who do not use Medicom, they must exchange health data via the LSP (Thiel et al., 2018).

In the interview with Pharmacist 1, who is based in Amsterdam, it became evident that LSP-based exchange is part of his daily routine. He uses Pharmacom in his pharmacy and collaborates with GPs who use a variety of EHR systems from different providers for the health data exchange. He stated that the collaboration via the LSP enables him to get important information from the GP, such as patient histories and laboratory results. In communication with GPs, the pharmacist particularly relies on the exchange of information regarding allergies and contraindications, while GPs are mainly interested in the dispensed medication.

In addition to the LSP, protected e-mails are frequently used for follow-up or clarifying questions. Interestingly, the pharmacist emphasized that personal relationships with nearby GPs play a crucial role: “If we have a question, we just ask them - we all know each other in this region”. He further elaborated that if he needs certain information, they also often directly call the GPs.

The pharmacist also noted that LSP access allows him to see everything the doctor has written down in the patient file, which has improved transparency. Furthermore, he said that there is a technical option in Pharmacom to mark specific information as private - this is typically only used if explicitly requested by the patient, which, according to his experience, is rare.

Although collaboration within a Pharmacom/Medicom cluster, which is the next form of exchange, was known to him, he stated that it is not yet widespread in his area. This results from the fact that GPs use a wide range of EHR systems, many of which are not integrated with Pharmacom. However, he expects that this form of collaboration may gain relevance in the future.

5.1.1 The double bind in the exchange via the LSP

Looking at the first form of the collaboration in the context of Pharmacom and Medicom, the LSP appears to offer a simple and universal solution to enable health data exchange between pharmacists and GPs, regardless of the EHR systems the GPs use. From a technical standpoint (Level 1 issues), this II allows for access to essential patient data such as medication profiles, ICA data (intolerances, contraindications, allergies), and laboratory results. However, during the interview with pharmacist 1, it became clear that this assumption falls short in practice. While the technical access is available, the pharmacist described several challenges that they face via the exchange through the LSP. These can be broken down into Level 2 and Level 3 issues based on Star and Ruhleder (1996).

Pharmacist 1 indirectly highlighted that different workflows between GPs and pharmacies complicate the exchange of health data. For example, as the pharmacist must call the GP or write a protected e-mail for necessary health information that he needs for the medication dispense, this stresses that the LSP cannot address the exchange of health data-related information at all stages. Furthermore, as he stated that the GPs use various EHR systems from different providers, the question arises whether those systems may structure or display data inconsistently. Regarding this problem, a study finds that the lack of standardization of EHR systems in the Netherlands makes it difficult for pharmacists and GPs to work together (van Ostaijen, 2012). As a result, pharmacists and GPs cannot always rely solely on the LSP to obtain the information they need in daily practice and must frequently resort to protected emails or direct phone calls.

These issues reflect misalignments in routines and documentation standards, which are characteristics as Level 2 issues following Star and Ruhleder. They are not purely technical but arise from a lack of aligned workflows.

In addition to structural misalignment, the pharmacist described how personal relationships (Level 3 issues) with GPs play a crucial role in compensating for the system's limitations, as he stated that they all know each other well in the region and that it would therefore be possible to write an email or talk to the GP for follow-up questions.

This illustrates that trust-based informal networks are needed to resolve ambiguities or validate data. The LSP, as the technical component of the II, does not have mechanisms for dialogic feedback or collaborative decision-making, as it only serves as a central routing and authorization hub (Thiel et al., 2018). Instead, the quality of exchange depends heavily on practical familiarity and interpersonal trust.

Such dependence on informal relationships means that while the infrastructure may seem functionally adequate from a distance, its actual performance is contingent on local and regional organizational and social dynamics. This creates the double bind: pharmacists and GPs are expected to use the II "as designed", but the real conditions for effective use lie in shared workflows and social relationships that remain unaddressed by the II itself.

5.2 Collaboration in a regional Pharmacom/Medicom cluster

The second form of health data exchange I identified is the collaboration within a regional cluster in which both sides the pharmacist and the GPs, use Pharmacom and Medicom, respectively. This form of collaboration enables a higher degree of integration, as both parties operate within a shared database environment (PharmaPartners, 2025). In this case, the data is not exchanged via the LSP, but via a direct interface between Pharmacom and Medicom (van Ostaijen, 2012).

In the interview with pharmacist 2, who is part of the regional cluster Niuew-Vennep near Amsterdam, the assumption was raised that this collaboration allows for a more structured and efficient exchange of health data. The pharmacist said that all GPs in their cluster use Medicom, based on a collective decision in the past to standardize and strengthen the collaboration. As a result, pharmacists and GPs can work within the same database and tables, especially for critical health data such as ICA data and a shared medication dossier. According to the pharmacist, this significantly reduces the risk of information being lost or overlooked, as the data is centrally stored and updated in real-time. There is also the option of asking clarifying questions via an integrated chat function and a direct phone connection that does not go via the practice number. However, he noted that incorrect entries regarding the ICA data and the medication dossier automatically and directly affect everyone in the cluster, which can also be dangerous.

He further explained that this close integration facilitates better coordination, but that access-rights are still dependent on the assessment of the patient. Pharmacists do not have full access to all medical information in cases where the data is considered sensitive from a patient privacy perspective. Nonetheless, he further elaborated that the typical information they exchange is sufficient for ensuring a safe and informed medication dispense.

As he estimated that around 50% of the pharmacies in the Netherlands use Pharmacom, but only relatively few use Medicom with 20%, the scalability of such systems for a cluster-based collaboration would be limited. In principle, he said that the implementation process was straightforward with only a few regulatory or technical barriers.

Contrary to his statement on the implementation process, PharmaPartners itself states that there are high regulatory requirements, and in addition, some Pharmacom/Medicom clusters have their own foundations, which support the pharmacists and GPs in the clusters about regulatory requirements and implementation for a small membership fee payment (Stichting MedZwolle, 2018).

5.2.1 The double bind in the collaboration through a regional Pharmacom/Medicom cluster

The Pharmacom/Medicom cluster seems to offer an efficient solution for health data exchange, as both pharmacists and GPs work within an integrated system. From a Level 1 perspective, the technical infrastructure provides real-time access to shared tables, such as ICA data and the medication dossier, reducing the need for external communication channels.

However, this integration also introduces Level 2 issues. As the pharmacist noted, incorrect entries immediately affect all parties in the cluster, and he did not mention built-in mechanisms for joint error correction or role clarification. Thereby, collaboration in a Pharmacom/Medicom cluster assumes aligned routines and documentation practices (Level 2 issues), which may not exist across all actors. Instead of supporting coordination, this form of collaboration also depends on it. Furthermore, this integration can only be used for collaboration if the technical basis was first been created by PharmaPartners, which also requires agreement on shared workflows.

Despite this, the interview with pharmacist 2 stresses that the agreement on this collaboration depends on personal relationships and trust, as he said that they know each other and opted together for a system that supports their day-to-day practice best. Looking at these Level 3 issues, access to certain sensitive data is still restricted, depending on patient consent and individual judgment. This creates uncertainty about roles and trust, particularly when access rights are not clearly communicated. While the II enables close collaboration, it does not support the social relationships required to maintain it.

5.3 Intra-organizational integration of Pharmacom and Medicom

The third form of health data exchange is the collaboration between pharmacists and GPs within the same organization, particularly in the case of dispensing GPs. Due to the limited time available, it was not possible to find pharmacists who use this form of collaboration in practice. Therefore, the presentation of this form is based exclusively on the descriptions provided by PharmaPartners. In this setting, the GPs and pharmacists are supported through an integrated system, which is called Medicom with a Pharmacom screen.

The GP uses the Medicom interface, while the dispensing pharmacist works with the Pharmacom. Both systems are fully integrated, enabling direct exchange of information such as dispensed medication and label instructions. A central patient index and a shared medication status form the technical basis of this setup. According to PharmaPartners. This integration allows for consistent medication monitoring and supports safe pharmaceutical care.

The system is hosted centrally, which ensures all-day access to data for out-of-hours care. The model is especially designed to facilitate local cooperation and aims to address medical and pharmaceutical care within a single workflow.

5.3.1 The potential double bind in the intra-organizational integration of Pharmacom and Medicom

Based on the information provided by PharmaPartners, the third form of health data exchange, in which pharmacists and GPs operate within a shared organizational context using a tightly integrated technical system such as Medicom with a Pharmacom interface, seems to address many typical coordination and communication barriers. The integration enables real-time access to shared medication and patient data, which reduces the need for workarounds or duplicated documentation, as seen in regional clusters.

Nevertheless, this high level of integration does not necessarily mean that all issues identified by Star and Ruhleder are fully resolved. Differences in shared workflows, responsibilities, or interpretations and trust of shared information can still lead to frictions in practice. These issues may remain subtle and not immediately visible, yet they can still influence the quality and efficiency of collaboration.

Although no direct interview data were available for this form of exchange, it is reasonable to assume that some issues described in Star and Ruhleder's framework may still apply, even if to a limited degree. While many challenges may appear to be addressed, certain tensions can persist in the background of day-to-day interactions.

6 Discussion

As it has been shown, there are three different forms of health data exchange that are enabled by the EHR systems Pharmacom and Medicom. Within this discussion, I will address the proposition I developed during the case study and then derive practical implications from my research findings. I then present the limitations of my case study and present ideas for further research.

6.1 Reflection on the proposition

My proposition suggested that the three forms of collaboration between pharmacists and GPs involve different levels of infrastructural issues, particularly Levels 2 and 3, as described by

Star and Ruhleder (1996). This would imply that challenges in health data exchange are not solely technical in nature but are shaped by organizational practices, social relationsships and relational dynamics, often resulting in double bind situations.

Based on the interviews conducted with pharmacists involved in the first two forms of exchange (via the LSP and within a regional Pharmacom/Medicom cluster), this proposition can be clearly supported. In both cases, the findings revealed technical access as only one part of the exchange process, while key barriers were linked to different workflows and interpersonal relationships - elements consistent with infrastructural issues beyond Level 1.

For the third form of collaboration, which involves pharmacists and GPs working within the same organization using an integrated system (Medicom with Pharmacom interface), no direct interview data were available. Therefore, this part of the proposition cannot be empirically confirmed. However, based on the available system descriptions and the organizational setup, it can be cautiously assumed that infrastructural issues may still emerge despite the apparent technical integration. While the system seems to address many coordination challenges on a structural level, misalignments in expectations or difficulties in accessing or interpreting shared information may still persist. This remains a tentative insight in the absence of direct empirical evidence.

6.2 Practical implications of the research findings

This section aims to help pharmacists and GPs to get a better understanding of the possibilities the different forms of health data exchange offer for their collaboration.

To support this, the following table summarizes key characteristics of each form of exchange and highlights differences in the scope of the exchange, patient consent, the technological components of the II, and coordination requirements, which are important for evaluating when and how each form can be used effectively in practice. It should be noted that the information on intra-organizational integration in the table is based exclusively on assumptions derived from the presentation of the exchange of PharmaPartners.

Form of exchange	Scope of exchange	Role of patient consent	Technological Component of II	Coordination requirements
Exchange via the national infrastructure LSP	National/regional	Essential (opt-in)	Standardized exchange infrastructure	Moderate
Collaboration in a regional Pharmacom/Medicom cluster	Regional/local	Relevant for sensitive data	Shared database	High
Intra-organizational integration of Pharmacom and Medicom	Local	Internally managed	Fully integrated sytem	(Moderate)

Table 1: Comparison of the three forms of the health data exchange enabled by Pharmacom and Medicom

The Scope of exchange reflects the geographical and organizational range of health data exchange. In the case of the exchange via the LSP, the scope is national or regional, covering a broad network of care providers. Regional clusters operate at a regional or local level, typically within a specific city or region. In contrast, intra-organizational integration is local, limited to the boundaries of a single organization.

The Role of patient consent differs across the three forms of health data exchange. For the LSP, explicit patient consent is essential, based on an opt-in model where patients must authorize the sharing of their records. In regional clusters, consent becomes particularly relevant for sensitive data, although routine exchanges may occur without explicit consent. In intra-organizational settings, consent is internally managed since data exchange happens within one legal and operational entity.

The technological component of II refers to the underlying digital system and technical architecture. The LSP relies on a standardized national infrastructure, governed by interoperability protocols and legal frameworks. Regional collaboration is based on a shared database, where both GPs and pharmacists have access to patient information in real time. In intra-organizational setups, a fully integrated system is used, allowing seamless and immediate access to data across roles and locations within the same organization.

The coordination requirements refer to the degree of organizational and interpersonal alignment necessary to ensure effective use of the information infrastructure in practice. In the case of the LSP, coordination is moderate, as care providers operate within a nationally standardized system, but still need to align on procedures such as consent management and the interpretation of shared data. Regional collaboration in a Pharmacom/Medicom cluster demands high levels of coordination, since multiple independent actors must actively decide to work in a regional cluster, which requires mutual trust, shared responsibilities, and aligned workflows. For intra-organizational integration, coordination demands might be a little bit lower compared to the regional cluster, as data exchange takes place within a single organization under unified management and established routines. While no empirical data were collected for this form of health data exchange, it can be carefully assumed that internal integration reduces the need for active coordination across roles and institutions. Nevertheless, effective collaboration in this context probably also depends on the coordination of workflows and mutual trust in the consistency and quality of the documentation of health data from the GP or the pharmacist.

6.3 Limitations of the case study and avenues for further research

Like any other academic work, this case study is not without limitations. First, the data collection was based on desktop research and exclusively on interviews with pharmacists. While this provided valuable insights into the practical use of EHR systems and the forms of health data exchange, the perspectives of GPs are not included. As a result, the findings may not fully capture the dynamics and challenges from all stakeholder perspectives. Future research could address this gap by explicitly including the perspective of GPs, for example, through interviews or surveys. This would help to explore how GPs perceive the technical and organizational conditions of health data exchange and whether their experiences align with or differ from those of pharmacists. In addition, the perspective of responsible persons at PharmaPartners would also have been interesting, especially regarding how the infrastructure is shaped by the practical application.

Moreover, the number of final interviews was limited and concentrated on two pharmacists, which restricted the possibility of comparing the forms of health data exchange more systematically. In the case of Pharmacist 2, language barriers also limited the depth of the interview and made it more difficult to explore detailed follow-up questions.

Due to limited time and access, it was not possible to fully triangulate all sources of information. Academic publications on the specific use and integration of Pharmacom and Medicom are scarce, which makes it difficult to validate findings through independent literature. Therefore, much of the technical understanding relied on information provided by PharmaPartners or derived from the interviews.

Finally, the scope of this study was limited to the specific functionalities and collaboration forms enabled by the EHR systems Pharmacom and Medicom. Other systems used in Dutch primary care, or alternative forms of digital cooperation, were not considered and may reveal different forms of collaboration. Further studies could examine how interprofessional collaboration is shaped by varying EHR systems beyond Pharmacom and Medicom to assess the generalizability of the findings presented in this case study.

7 Conclusion

The case study's goal was to explore how different forms of issues shape the exchange of health data within the collaboration between pharmacists and GPs in Dutch primary care. Based on the relational understanding of infrastructure proposed by Star and Ruhleder, I identified and analyzed three distinct collaboration forms enabled by the EHR systems Pharmacom and Medicom: exchange via the national infrastructure (LSP), regional clustering through a shared Pharmacom/Medicom environment, and intra-organizational integration in the case of dispensing GPs.

The findings show that while technical access plays an essential role, the success of the collaboration depends heavily on professional relationships and the alignment of workflows. In particular, the first two forms of exchange reflect infrastructural issues beyond the technical layer, as described by Star and Ruhleder. The third form of exchange, while not empirically confirmed

through interviews, probably also involves social and coordination issues but may represent a more stable form of integration, although this remains an avenue for further research.

Overall, the study contributes to a better understanding of how EHR systems affect interprofessional collaboration in practice. It emphasizes that successful cooperation requires not only technical interoperability but also organizational support, cultural alignment, and mutual trust. These insights are particularly relevant for pharmacists and GPs who aim to improve data exchange in everyday care, as well as for system providers and policymakers seeking to create meaningful and usable IIs.

While issues may be clear to individual pharmacists and GPs, it is crucial to summarize and categorize common problems within the healthcare system in an overarching manner. Only with this, issues can be confronted in a comprehensive and exhaustive way. Visualizing shared problems ultimately leads to actionable possibilities for improved IIs. To understand and see through this seemingly invisible II can make a visible difference.

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The websites of PharmaPartners, Volg je zorg, and MedZwolle were archived for reference purposes on 23 August 2025. All website-based information cited in this paper refers to the content as it appeared on that date.