Medication Process Integration: Health Information Exchange Preparation for Startups

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With the aging population in the Netherlands, the demand for healthcare personnel is increasing each year. The healthcare system cannot keep up with the growing demand. Therefore, the Integral Care Agreement set up several tasks to improve the system, with one key task being electronic health information exchange. This leads to the Electronic Data Sharing in Health Care Act (WEGIZ), which introduces information standards for exchanging health information. One of the information standards derived from the WEGIZ is the information standard Medication Process 9 (MP9) which is still under development. That makes it challenging for startups to integrate this standard due to its uncertainties. The research consists of a structured documentation review and interviews with experts from Nictiz who develop and manage the information standards. The technical and functional requirements of the information standard MP9 are used to find the important factors for startups to prepare for MP9. The research delivers a guide for startup companies to prepare to integrate the medication process information standards into their healthcare information systems and describes the important factors startups need to consider during the process.

Additional Key Words and Phrases: Health Information System, Interoperability, HIE, Startup, WEGIZ, Medication Process 9, Information standard

1 INTRODUCTION

The demand for healthcare in the Netherlands keeps increasing, but the industry cannot keep up with the workload [1]. More people are working in nursing, care, and home care than ever, however, there is still an increasing scarcity of personnel. In the year 2023 in the Netherlands, 476,000 people worked in healthcare, while 872,500 patients were in need of healthcare. And in 2040, it is estimated that in the Netherlands, there will be an increase of 1.6 million people over the age of 65, of which one in three will have chronic diseases, and more than 500,000 people will have dementia [2]. The healthcare industry is under a lot of pressure, due to an aging population, which requires change [3].

Innovation in healthcare is needed to relieve the workload [4]. Innovations in e-health provide more digital care and increase the self-sustainability of patients. Unfortunately, Dutch regulations to minimize (patient) risks do not make it easy to innovate in healthcare. One of the challenges innovations in healthcare are facing is integrating their data in Healthcare Information Systems (XIS) [5]. There are three obstacles that hinder health information exchange (HIE) between XIS: incompleteness of information, inefficient organization and workflow, technology and user needs [6]. The obstacles can be caused by the use of different terminology, which means data is not interchangeable and not reusable. To improve HIE, it is necessary for the development and research communities to agree upon standard classification and description of system architectures and features.

The Integral Care Agreement, set up by the Dutch Ministry of Health, Welfare and Sport (VWS) together with 13 healthcare parties, has put up a number of tasks to keep healthcare accessible to everyone, of good quality and affordable. To achieve this, information exchange between healthcare providers and its network asks for an acceleration [7]. This is necessary because to achieve medication safety, healthcare professionals need to know about patients' medication usage when prescribing, dispensing, or administering medication [8].

For a long time, healthcare professionals did not know in detail which medications and treatments patients were already receiving [9]. Current data is insufficiently or not at all exchanged between healthcare providers and the patient. This poses risks to good care, especially for vulnerable patients [10]. The research on medication safety shows that incorrect use of medication can contribute to nearly 200,000 deaths in Europe per year [11]. The number of hospitalizations due to medication incidents in the Netherlands is growing and almost 27,000 hospitalizations per year are avoidable [10]. Therefore, one task in the Integral Care Agreement focuses on standardizing electronic health information exchange to increase the safety of medication usage [7].

Based on the Integral Care Agreement the Electronic Data Sharing in Health Care Act (WEGIZ) was introduced in the Netherlands. From July 1st, 2023, WEGIZ requires healthcare providers to exchange medical data electronically and this process is currently under development and is being executed in parts [12]. The WEGIZ refers to quality standards, which contain standards between healthcare professionals about quality care and when this information needs to be shared. It refers to NEN-norms [13, 14] which contain the requirements on how to share information. The WEGIZ refers to information standards that describe how information is collected and shared [15].

The information standards being developed based on the WEGIZ are part of the following categories: Intensive care, basic data set for care (BgZ), maternity care, general practitioners observation, youth health care, chain care, laboratories, medication process, paramedical care, eTransfer, and breast carcinoma [16]. In 2024, the WEGIZ information standards were only applied in three of its 11 defined HIE categories, and 51% of healthcare institutions implemented them [17].

Nictiz develops and manages standards that make digital information provision possible and ensure organizations can unambiguously record and exchange health information [18]. This is to ensure the national vision established in the Integral Care Agreement, of having medical data available so that appropriate care can be provided, is achieved [19]. One of these standards is the information standard Medication Process 9 (MP9), which is part of the medication transfer program where Nictiz, together with 'Vereniging van Zorgaanbieders voor Zorgcommunicatie' (VZVZ), works with a large group of partners to implement the standard MP9 in the partner's XIS. This information standard is for better digital recording and exchange of medication data between care providers and between care providers and their patients [20].

The scope of the research focuses on startups based in the Netherlands. Nictiz has stated that for large healthcare institutions that are already working on information standards, and smaller organizations that have yet to start on the information standards, the Self-Scan is suitable [21]. The Self-Scan is an online tool that provides healthcare organizations with insight into where they stand in relation to the required organizational maturity for the implementation of the information standard [22]. However, the implementation of the Self-Scan for MP9 is still pending and expected to be ready in 2025, which means startups encounter challenges and gaps in knowledge as they prepare to implement MP9.

This paper looks at the information standards from a startup perspective, analyzes the important factors a startup may face when they want to comply with the information standard MP9, and fills in the knowledge gaps in preparing startups looking to implement the information standard MP9.

2 PROBLEM STATEMENT

To narrow down the scope of the research, only the information standard MP9 is examined [20]. This information standard is part of the medication transfer program of Nictiz which gives healthcare providers and patients clear insight into what medication is prescribed by the doctor, what medication is provided by the pharmacy, and what medication the patient uses [23].

Before the WEGIZ, it was a challenge for startups to integrate with existing XIS because most systems are old-fashioned, and besides that, the General Data Protection Regulation (GDPR) is important. Therefore, it was not easy in the past to exchange information with an XIS as a small organization [24, 25]. Currently, the lack of a closed ICT chain means that information on medications is not available digitally to caregivers and patients. In practice, this means that data that is not exchanged, is requested again several times, and a lot of energy and time is spent on retrieving current medication data [9].

However, with the new information standards introduced the integration into XIS should go a lot easier [26]. Before, the challenges and obstacles startups faced were caused by organizational issues and technical language barriers. With the new standards, new challenges arise and while Nictiz is making the implementation as easy as possible [27], startups might struggle with preparing for their information standards. This leads to the following research question.

- What are the important factors that startups need to consider when preparing to implement the information standard Medication Process 9?

For that, we answer two subquestions:

(1) What are the current developments in the information standard Medication Process 9?

Results from this question find the challenges startups may face when implementing the information standard and how they are dependent on the development of companies integrating the information standards and Nictiz. This is part of the preparation since knowing in which stage of development the process is, helps startups decide when to start the preparation and implementation.

(2) Which steps do startups need to follow to comply with the information standard Medication Process 9?

Results from this research question identify the steps startups looking to implement MP9 need to take to navigate the MP9 and adapt their operations to meet the requirements. These subresearch questions aim to provide a thorough understanding of the important factors involved in preparing for the implementation of MP9, as well as actionable insights for startups.

3 RELATED WORK

In order to gather related literature to the research domain Scopus and Google Scholar are used. The literature research consists of three streams which are combined to find related research. The first stream is about medication-related information that narrows the research to only information about the medical industry. The second stream is information about data exchange and interoperability. The last stream is about WEGIZ and its implementations. Search terms like “interoperability” and “healthcare” showed much research in the field of interoperability in healthcare [7, 28–30]. Olaronke et al. talk about the benefits and challenges of overall interoperability in healthcare which gives the research a clear understanding of the principles behind interoperability [28]. Benson [29] goes into further detail in the principles of HIE. Canova-Barrios et al. mention the standards of HIE [30]. These papers are used to relate the WEGIZ with interoperability research done by experts to gather a good background on the research.

Since the WEGIZ was recently introduced and is still a work in progress, the combined search terms give limited results in related literature [31–33]. Hogema provides a structured and stakeholder-centric understanding of the HIE market [31]. Kroon looks at the implementation of Basic Dataset for Care (BgZ), an information standard of Nictiz, and its challenges. Kamphuis explores how Dutch XIS can be successful in HIE [33]. The research is viewed from a startup perspective to find the most relevant information to answer the research question.

Despite the existing literature, there is a notable gap in knowledge concerning the important factors for startups aiming to implement these standards. This research aims to fill this gap by identifying and analyzing the important factors that influence the successful implementation of information standards by startups. By doing so, it will provide valuable insights and practical guidance for startups in the healthcare sector.

4 METHODS OF RESEARCH

The research explores the implementation of the information standard MP9 for health information exchange between healthcare information systems, specifically for startups. The research methods combine qualitative interviews with experts from Nictiz and literature for background information on interoperability, the medical industries, and the law WEGIZ. This study aims to bridge the gap in knowledge concerning the important factors for startups looking to implement these standards.

The literature consists of documentation on the information standard MP9 and academic sources to identify the gaps in knowledge. The documentation of the information standard MP9 consists of three main components. The functional documentation describes

how the standard functionally works. The dataset defines the data elements and the transactions. The technical documentation specifies how the messages are to be exchanged.

The academic sources by Olaronke and Benson point out the importance of HIE in the healthcare system by exploring existing research on interoperability and integration. Reading existing information makes it possible to define the gap in implementing the information standard MP9 for startups.

The qualitative interviews of this research are the primary research method to gather insights. Two in-depth interviews are conducted with experts from Nictiz. The first interview is with an information analyst who is deployed to the Medication Transfer program, see section 5.1, where the information standard MP9 is being developed and implemented along with the guideline 'Transfer of Medication Data in the Chain'. Information gathered from the information analyst enables a better understanding of how to navigate the information standard as well as a better understanding of the Medication Transfer program and its current developments. The second interview is done with the software manager of Nictiz and is used to provide an expert perspective on the implementation of the standard by startups, the correct definitions of the type of software startups are developing, and the agenda of the Medication Transfer program.

This research aims to provide important factors and compliances for startups seeking to implement the information standard MP9. The perspectives of the experts from Nictiz are combined into a guide that addresses the gaps in existing knowledge and provides startups with recommendations on how to prepare for the implementation.

5 RESULTS

This section presents the findings from the research aimed at identifying important factors for startups preparing to implement the information standard MP9. The research encompassed an analysis of the interviews with Nictiz experts and documentation on the information standard to find the current developments. It explores the Layer Model and how it can be understood by startups to understand the structure of the Medication Transfer program. The perspective of a startup that has not yet implemented the MP9 is used to find the important factors and information from the functional and technical documentation related to the preparation for the MP9.

5.1 Current Developments of the Medication Transfer Program

To answer sub-research question 1 this section looks at the current developments in the information standard MP9. Nictiz, together with the 'Vereniging van Zorgaanbieders voor Zorgcommunicatie' (VZVZ) and the VWS, are working on the Medication Transfer program [34]. This program aims to ensure the proper and complete electronic transfer of medication data, resulting in an up-to-date and complete medication overview for every healthcare provider and every patient in the Netherlands. Currently, the industries themselves are responsible for implementing an information standard. With the medication transfer program, this is different and the program supports suppliers and healthcare providers in implementing the information standards [35].

To understand how the Medication Transfer program is structured, we can refer to the layer model shown in Figure 11 [37]. The information security layer has three elements that must be optimized in each solution: availability, integrity, and confidentiality. This model helps in breaking down the program into various layers, each with distinct responsibilities and elements [36]:

- Organization Policy: At this layer, the guideline 'Transfer of Medication Data in the Chain' (the quality standard), a basic set of medication data has been agreed upon [38], is situated. This guideline outlines the basic set of medication data that must be consistently available across all healthcare providers who prescribe, dispense, or administer medication. It describes the work processes and responsibilities, specifying who is responsible for what data and when it should be available to users. All sectors that deal with medication data have agreed upon these processes and responsibilities. The quality standard does not specify how the information should be exchanged. The implementation of the guideline and associated information standards is carried out within the Medication Transfer program [34].
- Care Process: At this layer, additional healthcare process agreements have been made with healthcare providers and sectors within the Medication Transfer program. These agreements ensure that the healthcare processes align with the organizational policies and facilitate the smooth implementation of HIE.
- Information: This layer includes the information standard MP9 which is based on the quality standard described in the guideline 'Transfer of Medication Data in the Chain'. It defines the structure and content of the medication data that needs to be exchanged, ensuring that the data is interoperable and comprehensible across different systems and providers.
- Application: The technical design of the information standard falls under this layer. It involves the development and implementation of software applications that adhere to the MP9 standard, enabling the electronic exchange of medication data.
- IT-Infrastructure: This layer encompasses the infrastructure agreements required to exchange information via the National Exchange Point (LSP). It involves the technical and logistical setup necessary to support the secure and efficient transfer of medication data.

By following the layer model, the Medication Transfer program ensures that each aspect, from organization policy to IT infrastructure, is addressed, providing a comprehensive guideline for the electronic transfer of medication data.

To successfully finish the Medication Transfer program, ten steps are taken to create an up-to-date and complete overview of medication data. Based on that overview, medication verification and risk assessment can take place. The sequence of these ten steps has been determined based on the starting situation, the connection between the steps, and the impact [39].

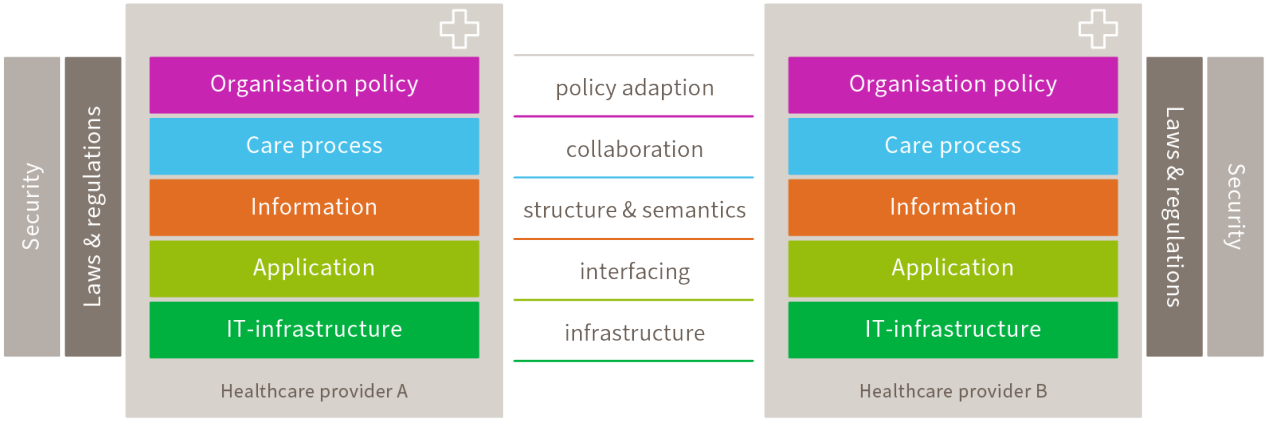

Fig. 1. The Layer Model applied to a simple situation: the relationships between two healthcare providers [36].

The Kickstart program [40] initiated in 2022 is a critical phase in the Medication Transfer program which focuses on five of the ten steps. These are the preparation, prescription, verification and use, dispensation, and administration steps of the Medication Transfer program. This program is currently in its initial phase and is designed to test and implement the information standard MP9 with a selected group of eleven suppliers and 13 healthcare providers in Friesland and Rijnmond [40]. The chosen regions were selected based on their diverse sectors and participation capability [35]. The suppliers participating in the Kickstart program include companies like Asolutions, Careconnections, CGM, ChipSoft, Dedalus, FarmedVisie, Medimo, MedXpert, Quli, Smartmed, and Zorgdoc [35, 41].

The purpose of the Kickstart is to demonstrate in a limited setting that the information standard MP9 and the devised approach and steps in conjunction with the guideline 'Transfer of Medication Data in the Chain' works in practice [42]. By working closely with these selected participants, the Kickstart program will result in an actual chain-wide digital exchange of medication data at a part of the healthcare field.

If the practical tests are successful, the project aims to transition to production in early 2025. For software providers not part of the initial kickstart, adjustments, and implementations are anticipated through 2024 [41, 43]. Startups that are looking to implement MP9 in 2024 have to prepare their systems and wait for the developments of Nictiz and the Kickstart program to successfully finish. Due to software vendors facing challenges with fully integrating MP9 and collaborative decision-making, the program has already taken more time resulting in the final production being delayed.

The Medication Transfer program will not be implemented simultaneously by all healthcare providers and suppliers during the broad rollout, creating a hybrid situation. During the Kickstart and afterward, information systems will have to take into account the exchange of information via the old and new versions of the information standard until the companies involved have made the transition [42]. Startups should stay informed about the discussions and decisions made regarding the standardization efforts [31] in the Kickstart to know when to prepare.

5.2 Steps to prepare for MP9

To answer sub-research question 2 this section looks at what steps startups need to follow to comply with the information standard MP9. To illustrate the important factors and potential challenges in implementing the information standard MP9, this paper looks through the perspective of an anonymous startup (hereafter referred to as "Startup X").

Startup X is developing a smart pill dispenser that helps support patients with taking their medication. This dispenser reminds patients to take their medication and knows if the patient has taken the medication out of the dispenser. These registered insights are shared with pharmacies, general practitioners, and caregivers. In their market research, Startup X found that healthcare professionals do not want another program besides their XIS. Therefore, integration into their existing XIS is important. Startup X is in the process of integrating MP9 into their operations to make sure that healthcare professionals do not have to adapt to new programs.

This case was selected because, although Startup X has not yet implemented MP9, their experiences highlight the importance of startups integrating into XIS and the steps to prepare for the implementation of MP9. The case was used in the interviews to provide an example case of a startup looking to implement MP9 and gather experts' opinions to answer the research question.

5.2.1 Step 1: Define the information system. Before a startup prepares for the implementation of the information standard, it is important to define what kind of information system is developed. The scope of this paper focuses on XIS and aims to create a guide for preparation for HIE with XIS and not a guide for HIE with patients. The development of a Personal Health Environment (PGO) is outside

Transaction Group	Transaction	System Role	Building Blocks
Medication data (PULL)	Making medication data available	MP-MGB	Medication Appointment (MA), Administration Appointment (TA), and more
	Consulting medication data	MP-MGR	

Table 1. System Roles and Building Blocks for Medication Data Transactions

of the scope of this research since the development of PGOs is under pressure. The VWS has put out a tender for PGOs at the European level where they want to move towards one PGO developed by VWS [44] and three different PGOs and stopped subsidies for all other PGOs [43].

5.2.2 Step 2: Define the system role. As a startup, it is crucial to identify a system's role to determine applicable technical and functional requirements. A system role is a role that enables the exchange of certain data. By examining the system's role a startup can find the related transactions for their information system. The system roles are explained in Chapter 7 of the functional documentation of the MP9 [45]. The Kickstart landing page [46] serves as a comprehensive resource containing functional documentation and other crucial information. Startups can identify their relevant system roles to extract relevant details from this page [35]. It offers guidance on implementing standards by specifying requirements tailored to the startup's system, ensuring alignment with broader healthcare processes and standards. This approach supports effective implementation customized to meet the specific needs of a startup.

As an example, Startup X sends the medication usage of a patient to XIS systems. In Chapter 2 of the functional documentation in the process 'use', it is determined that Startup X has the following system roles: MP-MGR, and MP-MGO, amongst others. For this research, MP-MGR and MP-MGO are chosen as examples. The first system role, MP-MGR, is for consulting medication records with patients or healthcare professionals. This means that Startup X's information system can consult medication records, while also receiving them with their system role MP-MGO, meaning receiving medication records from patients or healthcare professionals. The only system roles unique to XIS and PGOs are system roles for sending proposal medication appointments and proposal dispensing requests and sending use and received response proposal dispensing requests [45].

5.2.3 Step 3: Define Transactions. When a startup has defined its system roles, it can look into the transactions of the roles. Transactions describe what information is exchanged and when it is exchanged. Every transaction is explained in the ArtDecor [47]. It is important to have the latest version of the dataset to avoid conflicts with the latest version in case a startup follows an older version of MP9. The latest version of the MP9, as of July 2024, is 3.0.0-beta.3 and can be found on the dataset page in the ArtDecor. With the system roles, the transaction groups, transactions, and building blocks can be determined. Table 1 shows a small section of the table from Table 4 of Chapter 7 in the functional documentation. The first column is the transaction group which is a combination of two transactions. The first transaction is for sending information or making it available. The second transaction is for receiving and consulting this information. The specific transactions for each transaction group can be found in the second column of the table. The third column shows the system roles that are linked to the transactions. These are the system roles that are defined in step 2, see Section 5.2.2, and can be used to find what transactions are needed for the startups. The last column describes the building blocks that make the transactions possible. The building blocks are defined in Chapter 1.3 of the functional documentation and describe what information should be recorded and how [48].

The system roles MP-MGR and MP-MGO of Startup X are part of the transaction group Medication data (PULL) and Medication data (PUSH) with the transactions 'Consulting medication data' and 'Receiving medication data' and are shown in Table 1. In the ArtDecor on the scenarios page, the transactions can be found. The system role MP-GBR can be found under the transaction group 'MedicationDataConsulting' and the transaction consulting medication data can be opened in the HTML hyperlink or directly from the functional documentation [49]. This is important for startups since this contains the building blocks relevant to the transaction. It explains the cardinality of the building block, whether it is required or not, and also specifies what type of data it is (e.g. string, number, boolean). When startups start developing their information system it is important to take into account that their software matches the information standard with the data being captured [35]. If a startup wants to comply with the correct HIE according to the information standard, they have to follow all these data structures [50].

In the templates of the transactions the technical specifications in the ArtDecor of the information standard MP9 the HL7 CDA can be found. HL7 CDA is a defined, complete information object that can include text, images, sounds, and other multimedia content [51, 52]. This applies to HIE between healthcare providers and healthcare providers. The technical specifications for HL7 FHIR [53] are found on Simpliflier.net [54]. FHIR lends itself to all forms of healthcare communication, mainly for HIE with the PGOs.

5.2.4 Step 4: Testing. The medication process information standard has Nictiz qualifications. Qualification takes place per system role [55]. Nictiz offers suppliers the opportunity to test their products and services for the correct implementation of information standards. The test materials are for the transaction groups. In the case of Startup X, MP-GBR and MP-GBO are a combined test material. The qualification materials for each transaction individually since the qualification material is used to test whether specific parts of the transactions are working as intended. The test materials are found on the Kickstart landing page under validation materials.

Each test material contains scenarios and information on the building blocks. In the test material of MP-MGR, this is information on the patient (e.g. name, address, identification number) and

about the medication appointment [56]. The scenarios from this documentation explain what the scenario should entail and the building blocks include the information of, in the case of MP-MGR, the patient.

6 DISCUSSION

This paper aimed to identify important factors that startups need to consider when preparing to implement the information standard MP9. Extensive research in the documentation of Nictiz and interviews with experts from Nictiz were conducted to get the results. This research paper found insights into the current developments of the Medication Transfer program and the Kickstart program to test the information standard MP9 in practice. The results underscore the necessity for startups to stay updated on the latest developments in the Medication Transfer program and the Kickstart program. The literature identified gaps in existing research for startups to know how to prepare for the information standards of Nictiz. Therefore, the research addresses these gaps by providing a guide that offers practical steps for startups to prepare for the implementation of the information standard MP9.

For startups in the Netherlands operating in the healthcare sector, it is important to stay updated with the current developments in the sector that put the themes derived from the Integral Care Agreement into practice. Startups must know about the goals of the Kickstart program and the Medication Transfer program to know that it is too early to start implementing MP9. Since the Kickstart finishes in early 2025, startups can expect to implement MP9 at that time. Startups should keep track of the development per region and keep hybrid scenarios in mind. Moreover, startups should use resources such as functional documentation, ArtDecor, and the Kickstart landing page to prepare for the implementation that will happen in early 2025. These tools provide knowledge on what system roles apply to the startup, what transactions are needed to share information, and what the information in the transactions is built from. Since the literature about the WEGIZ and the information standard does not mention the implementation process from the perspective of a startup this research helps startups with preparing for the implementation.

6.1 Limitations

This study has several limitations that should be acknowledged. Firstly, the implementation of the MP9 standard is still in progress, which means that the full impact and effectiveness of the standard are unknown, even to its developers at Nictiz. The ongoing development and potential modifications to MP9 could influence the findings and recommendations presented in this study. Additionally, the rollout of the MP9 standard has not yet reached all regions. This geographical limitation restricts the ability to assess the implementation process and outcomes across different locations comprehensively.

6.2 Recommendations

Future research should address the limitations by conducting a case study with a startup that has successfully implemented the MP9 standard after the MP9 has successfully been implemented in the region of the startup. Such a case study would provide more concrete insights into the important factors and challenges encountered during the implementation process. It would also allow for validation and refinement of the guide proposed in this study, ensuring its relevance and effectiveness in real-world scenarios.

In the case of Startup X, after the interview with the software manager of Nictiz, it has been concluded that Startup X is not making an XIS. Since Startup X is only sharing specific data from the information standard, developing an XIS is not necessary. It is most similar to an API integration in the existing XIS and PGOs. Research into other systems that are available in the market that integrate specific data in existing XIS and PGOs should be done to be able to define a startup's information system more concisely.

7 CONCLUSION

With the aging population and increasing demand for healthcare in the Netherlands, the healthcare sector is under a lot of pressure and needs to maintain high-quality and accessible care. The introduction of the Electronic Data Sharing in Health Care Act (WEGIZ) and the development of the information standard Medication Process 9 (MP9) aim to lighten the pressure by improving health information exchange (HIE) and medication safety. This paper provides valuable insights to identify important factors that startups need to consider when preparing to implement the information standard MP9. The important factors are to stay updated with the current developments to know that in early 2025, implementation of MP9 will start in all regions. Before that, an important factor is to follow the data structures described in ArtDecor to comply with the correct HIE according to the information standard. Future research should continue to explore the development of health information standards and the steps for startups to successfully implement MP9.

8 TOOLS

During the preparation of this work, the author used:

- Grammarly in order to review spelling, grammar, and punctuation mistakes in the author's texts.
- ChatGPT in order to give the author inspiration on how to write certain paragraphs, find keywords, and find parts in papers that answer certain questions.

After using these tools/services, the author reviewed and edited the content as needed and takes full responsibility for the content of the work.

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