Advancing Telemedicine Services for the Aging Population: The challenge of Interoperability

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Abstract. We reflect on our experiences in two projects in which we developed interoperable telemedicine applications for the aging population. While data exchange could be implemented technically, uptake was impeded by a lack of working procedures. We argue that development of interoperable health technology for the aging population should go accompanied by a thorough study into working protocols by consulting all end-users and stakeholders.

Keywords. Telemedicine, Aging Population, Interoperability

1. Introduction

Care for the aging population means providing multidisciplinary care for people that often have multiple chronic diseases. To aid multidisciplinary care and to provide every caregiver with the most important and up-to-date information, interoperability among Health Information Systems (HISs) is extremely valuable. Interoperability is the ability of HISs to work together within and across organizational boundaries in order to advance the health status of, and the effective delivery of healthcare for, individuals and communities [1]. For the context of healthcare, the advantages of interoperability include improved patient safety, improved patient care and a decrease in costs [2,3]. But despite the benefits that interoperability can bring, it is not as widely implemented as one would expect. This is due to the fact that medical information systems have, traditionally, been developed as stand-alone devices. Now that technological progress allows for data exchange, standards such as HL7 have paved the way for smooth

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interoperability among HISs. But in practice, achieving interoperability has been found a hard nut to crack.

In this abstract, we discuss our ongoing efforts in two projects in which we develop interoperable telemedicine technology for the aging population. Based on our research and experiences, we will reflect on why we were (un)able to achieve successful interoperability among HISs for caring for the aging population.

2. Method

In two projects we combined action research and empirical research. During action research all participants play an active part and get a voice in the process of creating change; these efforts are geared towards informing research and making a change in society [4]. In the eLabEL project (which focuses on achieving interoperability among HISs in primary care) we conducted 33 interviews with healthcare professionals to identify requirements for and barriers against using telemedicine services for treating chronically ill patients (including older adults). Next, we mapped their current and desired technical environment. For more details, refer to [5]. Within the PERSSILAA project (which aims at developing interoperable eHealth services for assessing frailty among older adults and to provide training services to improve their health) we held participatory design sessions to create a technology-supported service model, and to inform technical design. Next, we closely monitored the implementation of the technology. For more information, refer to [6].

3. Results

3.1. Interoperability for elderly care in a primary care setting

During our inventory of the requirements and barriers for using telemedicine services in seven primary health care centers, we found that nurse practitioners are the professionals that see older adults most. During home visits, the nurse practitioner monitors the state of frailty and self-reliance by using a questionnaire and by viewing the living environment for signs of potential deterioration. Then, a decision is made to offer the older adult to participate in a program to help this person to live independently as long as possible. If professional help is needed, community nurses will help.

Systems mainly used by the nurse practitioner are the General Practitioner's (GP) HIS, but also collaborative health management systems. A collaborative health management system is an information system that supports multidisciplinary "care that strengthens and supports self-care in chronic illness while assuring that effective medical, preventive, and health maintenance interventions take place" [7]. In the inventoried health ca re centers, we found six different HISs and four different collaborative health management systems. Furthermore, community nurses use their own information system.

Unfortunately, the more different IT systems, the more difficult it appeared to be to achieve interoperability. Despite the availability of standards, we found that most information systems were still isolated and did not support data exchange. Next to this, other main barriers we found during our inventory included security issues, privacy issues, network unreliability, and a lack of standardization.

3.2. Interoperability for detecting and preventing frailty

The consequences of having to deal with isolated information systems was at the core of the interoperability challenge for the PERSSILAA project where different information sources needed to be able to communicate (e.g., a screening website, a cognitive training eService, a physical training eService). This is where we decided to make use of semantic interoperability. The main goal of semantic interoperability is to allow the continuous cooperation of two Information Systems that were not initially developed for this purpose. To achieve this continuous cooperation, the first step was to define and describe the knowledge used in our context: frailty in older adults. Thus, we built an ontology, which can be understood as the formulation of an exhaustive conceptual schema for a certain domain. After that, we defined which information we are going to exchange among the different systems, and which format and protocol we will use. At this point, the use of standards appeared to be crucial, as they provided us with agreed upon means for implementing technical interoperable procedures. According to the EN 13606 association [8], the overall goal of using a standard is to define a rigorous and stable information architecture to communicate (parts of) the electronic health record (EHR) of a single patient among different systems, or between a system and a centralized EHR data repository.

In the PERSSILAA project, we defined a procedure to achieve semantic interoperability, compliant with the CEN/ISO 13606 European standard [9]. This standard follows an innovative Dual Model approach, which defines a clear separation between information (Reference Model, RM) and knowledge (Archetypes Model, AM). Archetypes allow us to create formal definitions of clinical concepts, providing a semantic meaning to a RM structure. So, in PERSSILAA we defined archetypes for each piece of information defined in the ontology, which are in the end exchanged using XML files, where different labels represent the elements defined in the RM.

The next challenge that we were then confronted with was to integrate the flow of information into daily clinical practice. GPs were explicit in their wish: They wanted to have the outcome of an individual's screening as an episode in the individual's personal record in the GP's Information System, and linked to the ICPC code for general decline. However, when we presented the GPs with the screening outcomes (on paper, as the interoperable technology was not in place yet), it appeared to be difficult for them to follow up on this kind of information, as a policy was not present and therefore, a follow-up was lacking.

4. Discussion

In the literature, the added value of interoperable telemedicine technology is paramount, but in the practical context of our projects, it appeared to be hard to reap these benefits. There are technical reasons for this: the multitude of supplier of HISs and related technologies, as well as security and privacy issues, and unreliable networks. Moreover, in care for the aging, we found that a procedural focus is at least as important as a technical one during the development of interoperability.

Our inventory among primary care professionals identified that there are many actors working with this target group who each have their own procedures and HIS (the GP has the GP-HIS, the nurse practitioner a collaborative health management system, the community nurse has a community HIS, while professionals in hospitals work with

a hospital HIS). While technically, connecting them may be possible, due to the existence of interoperability standards, such as HL7 and CEN/ISO 1360, acting upon the new possibilities that this technology provides, proved to be another matter. Therefore, aligning procedures and determining *what* information should be communicated *when*, should be displayed *where*, and should be dealt with *how*, should precede and orchestrate the technological integration. This would be a challenge for patients with a single condition (e.g., communicating data between GP and physical therapist for a patient with lower back pain), but for the aging population this challenge is far more complicated due to most of them having one or multiple chronic conditions for which they see a wide variety of medical specialists, and whose treatments may affect one another. Next, care for the aging is also in the hands of people who do not work in primary or secondary care, namely community nurses and informal caregivers.

The application of participatory design methods, in which end-users and stakeholders collaboratively map the technology-supported care path and the use of interoperable information exchange therein, should become common practice in the development of interoperable telemedicine applications. Only in this way, we can ensure that the different parties that use or are affected by it will not only receive information, but can also act upon it in a way that improves care for the aging population.

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