Digital Health and Informatics Innovations for Sustainable Health Care Systems
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Linked Care: A Harmonized Workflow for Medication Ordering, Prescription and Dispensing in Mobile Care Settings

Philipp URBAUER[a,1], Gerda HUBER[a], Timothy BERENS[a], Benedikt SALZBRUNN[a], Matthias FROHNER[a] and Stefan SAUERMANN[a]
[a] *Department Computer Science, University of Applied Sciences Technikum Wien, Vienna, Austria*
ORCiD ID: Philipp Urbauer https://orcid.org/0000-0001-7805-1666

Abstract. The growing demand for care amid changing demographics poses significant challenges exacerbated by decreasing healthcare professional availability. In Austria, the Linked Care project aims to address these challenges by developing an intersectoral, harmonized IT-supported workflow for medication ordering, prescription, and dispense in mobile care settings. A human centered design approach, with user-focused interviews and workshops was used to identify requirements and analyze the workflows. Activity diagrams were used represent workflows. The resulting harmonized workflow, developed through iterative collaboration with care organizations, integrates the LC platform into existing care software. To test and demonstrate the harmonized workflow, mockups were created and evaluated for usability, resulting in positive feedback and suggestions for enhancements. Current workflows revealed media breaches and inefficiencies, which the proposed harmonized workflow seeks to address. The paper concludes with implications for future developments, including the subsequent adoption of a HL7 FHIR Implementation Guide for Austria, based on the defined harmonized workflow, to streamline intersectoral communication and improve efficiency in mobile care settings.

Keywords. mobile care, connected health, harmonized workflow, interoperability.

1. Introduction

The changing demographics lead to a significant increase in demand for care, assistance, and therapy, while the availability of healthcare professionals is decreasing. [1] Consequently, there is a heavy workload, compounded by the convergence of various care settings like inpatient, day-care, mobile, or private care, where nursing and therapy services intersect. The WHO enforced the necessity to investigate on technical innovations to face the growing need for home healthcare in an appropriate way and support care professionals.[2] In this context, communication in practice often suffers from incomplete information exchange due to insufficient IT systems support. The consequence of this is, that a substantial amount of time must be spent to obtain missing information, for example by making follow-up phone calls or exchange emails. The

[1] Corresponding Author: Philipp Urbauer, Department Computer Science, University of Applied Sciences Technikum Wien, Hoechstaedtplatz 6, 1200 Vienna, Austria; E-mail: urbauer@technikum-wien.at.

absence of standardized interfaces in the various IT subsystems, communication protocols and harmonized healthcare data/documentation intensifies this situation. Moreover, the wide variations in documentation methods further exacerbate the workload, as data must be redundantly recorded multiple times.

In Austria, the lighthouse project Linked Care (LC) [3] started in 2021 and aims to create an interconnecting software platform and further IT artefacts based on interoperability standards (HL7, IHE), to support processes in mobile care settings, where several professions work interconnected. The project consortium consists of 5 care organizations (CO) from 3 different federal provinces in Austria, 5 software vendors (care related software, general practitioner software, pharmacy software) and 3 universities (Nursing Sciences, Engineering and Ethics). As a result of the LC activities, this paper describes an intersectoral, harmonized IT-supported workflow for medication ordering, prescription and dispense (MOPD), from the requirement identification phase up to mockup solutions and its usability evaluation. This work served as the functional basis for the subsequent development of an HL7 FHIR interoperability specification for this process in Austria.

2. Methods

The target groups were defined as healthcare professionals (primary user group), especially care & mobile care professionals as well as clients (patients), which are not directly affected by the LC solutions, but benefit from improved efficacy and efficiency workflows.

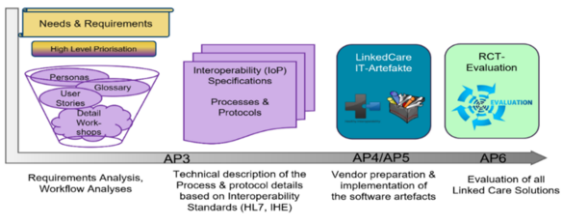

Figure 1. Overview of the Linked Care projects work steps.

Figure 1 shows the LC projects main work steps from user requirements acquisition, definition of interoperability specifications for the requirements technical solutions, its implementation by the vendor project partners and the projects evaluation phase. All steps follow the human-centered design approach [4] supplemented by a mixed methods approach. Out of the user requirements survey over 5 months, based on guided focus group interviews [5], individual interviews [6] and expert interviews [7], 220 user stories were recorded, which were then refined (clean up, merge and duplicates removed) and prioritized (through voting), together with user representatives (n=20 in average in 5 workshops). Due to time restrictions of the project, the top 4 user stories were selected to be elaborated in the project duration.

This paper describes the highest ranked user story, which showed the necessity for a harmonized digital MOPD-workflow. The following two user stories are concerned with the necessity for harmonized, intersectoral documentation between the defined user groups. This work is not described in this paper due to size limitations. For the MOPD-workflow human centered design method according to ISO 9241 – 210 [8], was applied to solve the requirement for a harmonized IT-supported workflow. The first step included

further interviews [7] with the COs, to understand the workflows and recorded these with activity diagrams iteratively, together with each COs. That allowed to identify media breaches in each organization's workflow, causing unnecessary administrative time consumption of the caregivers. Based on the activity diagrams, a harmonized workflow, leveraging the LC platform to eradicate the identified media breaches, was developed together with the caregivers in workshops. To test and demonstrate the harmonized workflow, mockup prototypes were developed, which integrated the LC platform functionality in the COs primary care software. The evaluation was done with a System Usability Score (SUS) assessment. The participants (n=9) from 4 different COs, had to undergo order, prescription and dispense tasks via remote screensharing and during the discussions the "Thinking Aloud Method" was used. Direct participant feedback was recorded.

3. Results

The workflows of MOPD, of 5 COs in 3 different Austrian regions, were analyzed. Figure 2 shows an example activity diagram for one organization.

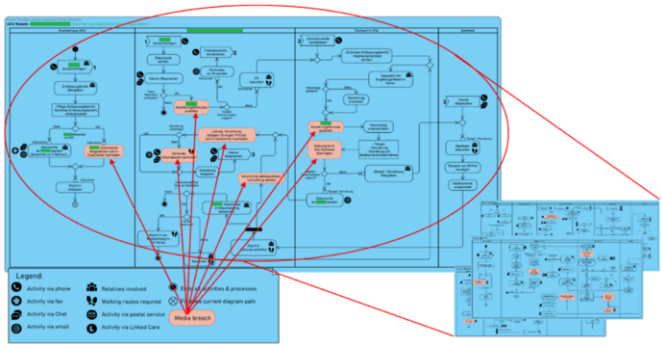

Figure 2. Workflow analysis of participating care organizations, indicating several media breaches.

It is divided into 4 swim-lanes, describing process steps in and between the Hospital (HO), CO, General Practitioner (GP) and Pharmacy (PO) necessary for the MOPD workflow. The bright-red boxes indicate the identified media breaches in the workflows, reaching from using fax, coping data manually from paper to the systems, phoning for additional data, taking photos and uploading them the care software. The black symbols indicate the spots where different media (phone, fax, chat, email, postal service, talk to relatives) and walks are used to gather additional/missing information. Figure 3 shows the proposed harmonized workflow, leveraging LC platform functionality to overcome the media breaches. The identified media breaches are eradicated, and the need to gather additional information through various media sources is minimized. The "L" symbol indicates where the LC platform integrates with the primary care software. All original activity diagrams can be downloaded in high resolution from the following link: https://cloud.technikum-wien.at/s/BzCB7ZzPjDxo7Zs.

Figure 4 shows an excerpt of the mockups to test and demonstrate the harmonized workflow. The changes red marks show locations that are used by the nursing staff within the harmonized workflow. Left part shows the LC Update area (pull-down menu), which informs the caregivers about new documents, messages or required activity in the

MOPD-workflow. On the right side the caregiver can release information to the platform and see information about its status on the LC platform.

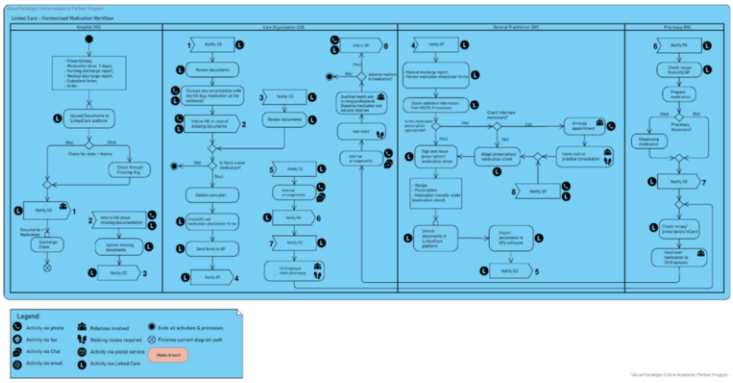

Figure 3. The proposed harmonized workflow to remove identified media breaches, using the Linked Care platform and further Linked Care IT artefacts, like harmonized HL7 based documents.

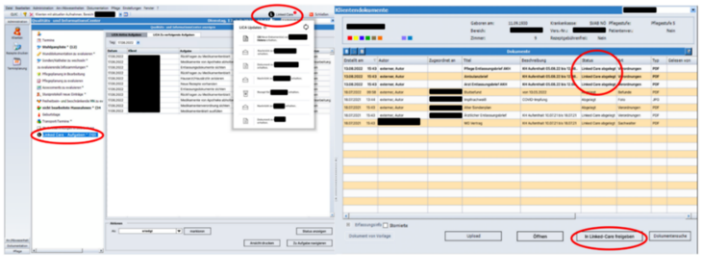

Figure 4. Excerpt of changes (see red circles) in the primary software of a CO to integrate LC solution.

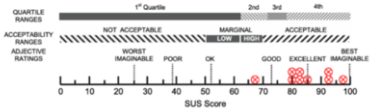

Figure 5. Result of the SUS assessment for the prototypes, as shown in Figure 5 as an example.

Figure 5 shows the results of the SUS assessment, conducted to evaluate the process based on the mockups. The assessment was based on 10 Questions (5 positive & 5 negative formulated). The result of each person was measured between 0-100 and recorded in Figure 5 (red indicators). The average result was 84,44 on the SUS score. The participants direct feedback included requests for additional functionality and alternative placings of the update feature in the software.

4. Discussion and Conclusions

In the Austrian lighthouse project LC, we identified recent problems in mobile care settings and propose a solution for a harmonized workflow for MOPD to resolve revealed media breaks of partner COs, which resulted in high administrative time consumption

and dissatisfaction of the caregivers. The intersectoral work between the HO, COs, GPs, and POs, showed unresolved challenges. This included the current MOPD-workflows itself, but also the intersectoral use of healthcare documentation. There is not only a lack of access for caregivers to certain information, but also missing definition of common documents. However, the project also faced this challenge and developed common data sets based on CDA, as this is still the standard used in Austria's electronic healthcare record ELGA. As a conclusion, it can be stated that this work delivered a valuable contribution as an input to define an HL7 FHIR Implementation Guide (IG) for Austria based on the harmonized workflow. The latter, started in the second half of 2023 and was finally balloted in the beginning of 2024. The IG including the Workflow, User Stories and Resource description are published here: https://fhir.hl7.at/r5-LinkedCare-main/index.html. Currently the vendors implement this new FHIR specification and test & evaluation phase will start in the second half of 2024.

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