Streamlining Hospital IT Improving the Admission Process

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Abstract. We analyzed the admission workflow in three Swiss hospitals of different size for normal and emergency admissions. Our goal was to detect shortcomings mainly in the administrative admission process due to media breaks. We obtained 9 different workflows (three per hospital) and a total of 22 shortcomings in the admission process which were present or likely in two or more of the hospitals. A considerable number could be traced back to missing information requiring time consuming extra work. We drafted five potential IT-based workflow changes and made, together with the hospital partners, a cost-benefit analysis which solution would be most interesting. As a result, a concept for an open multi center hospital admission portal was drafted, which, in theory, should influence 8 of the 22 problems found. Specifically, the prototype of the portal was designed for a direct triangular interaction between the referring doctor, the patient and the hospital staff.

Keywords. Hospital admission, workflow, IT portal

1. Introduction

In a Swiss research project, we cooperated with several Swiss hospitals to improve the patient workflow with current IT-technologies [1]. In discussion with hospital staff, problems in the transition between outpatient care and inpatient stay came up on several occasions, e.g. media breaks, paper based communication and duplicate data entries. We took the opportunity to examine the admission workflow for the use case of a patient undergoing hip surgery. Studying the literature [1-6] we found some evidence that this is not a specific problem of the hospitals we were in contact. Therefore, we decided to perform an in depth analysis of the admission process assuming the following hypotheses:

- During the admission process media breaks are likely
- Admission workflows will be different between hospitals but commonalities should be present
- We expect to find at least some shortcomings which could be improved with the help of IT and cross-sectoral eHealth connectivity

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2. Methods

A literature search was conducted in Google Scholar, PubMed and BMJ with search words such as admission process, hospital admission, patient entry workflow or hospital admission standard workflow.

Three Swiss hospitals with 200, 250 and more than 1000 beds and between 10'000 and 45'000 inpatients/year participated in this project. The average inpatient stay varied between 5.2 and 5.8 days. A stepwise workflow analysis was performed using the method of Gerken [7] which has been successfully employed in former medical informatics projects [8]. It comprises analysis of organizational structures, forms and paperwork, data items, actions, workflows, communication structures and shortcomings. The latter was the main focus of this work.

Analysis started with an open interview and collection of typical admission paper work in each hospital. A previously drawn default admission workflow served as an interview guideline. Focus were the administrative and to some degree the clinical admission activities to the stage where the patient arrived on the ward. Workflow diagrams were implemented using event driven process chains within Aris [9]. Results were fed back by repeated email contact to the stakeholders. Based on the analysis different IT-based workflow changes were drafted, comparatively evaluated and again discussed with the stakeholders via email or in secondary interview sessions. Explicit confirmation of correctness of the workflows and the detected shortcomings was obtained.

A cost-benefit analysis for five solution proposals was made and defined the demands for an open access hospital admission portal. It's prototype was implemented using a content management system (word press) with the Form Maker Pro plugin. The portal was installed in an XAMPP Apache PHP development environment on windows server 2016 with MySQL database. Adaptations of the CMS database were performed using PHPMyAdmin.

3. Results

3.1. Workflow analysis and weaknesses

For each hospital, 3 comprehensive workflows comprising between 16 to 29 processes plus associated forms, IT-applications etc. were described and consented by the interview partners. The following basics were found in all three examined hospitals: Four different admission types must be distinguished: regular planned admission with referral by GP, self-referral by patient, emergency walk-in admission and emergency admission via rescue services. Regular admission in all 3 hospitals is organized via outpatient clinics and results in most cases in planned hospitalization at a later date. Emergency admission includes typically an emergency triage (e.g. Manchester) and distinguishes at some stage (especially for walk-in cases) between outpatient care and required hospitalization for treatment. In referral cases, information is required from the GP, but, in addition, information and consent from the patient is also needed. Signed patient consent is required at some stage for all hospitalizations. For planned admissions, the hospital sends a stack of paper to the patient which includes information brochures, consent forms etc. All hospitals use IT-systems for patient registration and attempt to re-identify patients which had a former patient record in that hospital.

Some remarkable differences could be identified. In the forms analysis step we could identify many different admission forms for different outpatient clinics, sometimes even specific admission forms for a single physician working in that clinic. Detailed workflows differed considerably between the three hospitals and sometimes even depending on the department or outpatient clinic. One hospital uses team based outpatient clinics on trial basis for some surgical cases. In a team based outpatient clinic, the patient meets the responsible surgeon and the anesthetist simultaneously. In the other cases the patient goes though separate outpatient clinics, often with time gaps in-between. One hospital offers an online portal for self-registration of the patient which saves the visit at the administrative patient registration.

We detected less media breaks than expected. These breaks centered around the patient referral by GP, the documents to be supplied by the patient and the change between outpatient care and hospitalization.

The combined results of the weakness analysis are summarized in table 1.

Table 1. Results of weakness analysis for the administrative admission workflow in three Swiss hospitals

No	Weakness	A	B	C
1	Patient data reconciliation very time consuming	Yes	Yes	Yes
2	Patient consent is paper based	Yes	Yes	Yes
3	Several PIDs in different hospital IT systems	No	Unclear	Yes
4	Appointment dates for multiple consultants not ranked together	No	Yes	Yes
5	In case of name changes and anonymization, relationship between digital docs can be lost	No	Unclear	Yes
6	During consultation patient receives set of disjointed paper docs	Yes	Yes	Yes
7	There is no safeguard that patient consent has been given before intervention	Yes	Yes	Yes
8	Appointment coordination for different participants of consultation is time consuming	Yes	Yes	Yes
9	Outpatient clinics make appointments without consultation of the patient, requiring rescheduling	No	No	Yes
10	Most patients do not know the mechanism for online registration	N/A	N/A	Yes
11	Patient receives invitation for appointment prior to verification of information	N/A	No	N/A
12	If GP performs online registration, but data needs to be manually transferred to hospital information system	N/A	N/A	Yes
13	Most patient communication is via Outpatient clinic w/o information of central admissions	Yes	Yes	Yes
14	In multiple visits patient receives redundant information brochures	Yes	Yes	Yes
15	Despite structured registration forms 70-90% of admissions is done by manual fax or telephone	Yes	Yes	Yes
16	Patient is used as information carrier	Yes	Yes	Yes
17	Patient must phone up hospital to find out appointment date	Yes	Yes	Yes
18	Due to paper archive, comparing information is difficult	Yes	Yes	Yes
19	Communication between hospital and patient is by phone or mail	Yes	Yes	Yes
20	Allocation of data access on change of admission status is manually	Yes	Unclear	Yes
21	Inconsistent registration forms even within on clinic	Yes	Unclear	Yes
22	Informal appointment making by GPs requires additional enquiries	Yes	Yes	Yes

3.2. Concepts for improvement and prototypical online portal

Based on the analysis results five IT-based proposals to improve the admission process have been defined, analyzed and discussed with the stakeholders (table 2):

Table 2. Five IT based proposals to deal with the problems in the admission workflow.

No	Solution proposal	Could influence
1	An online portal which synchronizes the calendar of the different hospital physicians (e.g. surgeon, anesthetist) for patient referral with access for the patient.	4,7,8,9,17
2	An online portal with synchronized referral forms for the referring GP and with access for the patient to upload data	12,15,21,22
3	Centralized dispatch and collection of digital forms through central admission	6,14
4	Digital provision of all outpatient clinic docs for the patient	6,14
5	Direct digital document exchange between referring GP and hospital	N/A

In the cost-benefit analysis a combination of proposal 1 and 2 was selected to serve as the basis for a prototypical realization. An online portal which on one hand synchronizes the calendar between different caregivers, and, on the other hand, synchronizes the different referral forms has the potential to influence the problems No 4, 8, 9, 12, 15, 17, 21, 22 from table 1. This provided the requirements catalogue for a prototypical open access hospital admission portal. The portal should support the common parts of the admission workflow found in all three hospitals and needs functionalities for the calendar synchronization (proposal 1) and for the document synchronization and digitalization. Open access, in this case, stands for a portal where several hospitals cooperate together and where not only the referring GP, but also the patient gets access to receive and upload documents. Thus a triangular information exchange between the referring GP, the patient and the hospital staff can be realized.

The portal prototype, realized with a CMS and plugins plus some additional programming (figure 1) supports multiple forms for multiple hospitals which can be defined in a near paper like format. User access can be limited for the different actors. Email notifications can be generated e.g. when the GP has completed the referral. Also, appointment acknowledgements can be sent via email. Calendar synchronization of the prototype relies on open access calendar tools. This is a known restriction which would prevent its use in clinical routine.

An example for the desired triangular information exchange is the way how the prototype supports data exchange. The referring GP, together with the patient, searches an appropriate date for the coordinated appointments at the outpatient clinic of a selected hospital. The calendars of the clinics would be synchronized with the respective hospital information system. GP and patient can freely choose between those hospitals who participate in the portal. The GP fills his parts of the referral form for this clinic. Next, the patient receives a link to the portal via email with the invitation to fill his parts of the admission documents and to download the specific information brochures for his case. All data which was previously documented by the GP is already present and must not be repeatedly entered. The summarized data of patient and GP is available for the hospital physician and administrative staff.
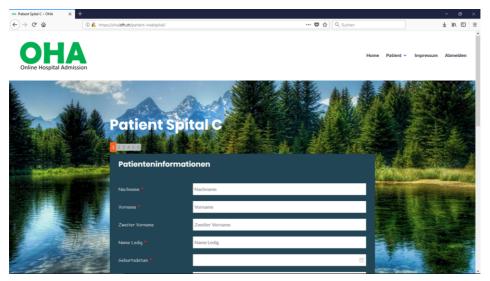
Figure 1. prototypical online hospital admission portal, opened with a patient form. Entries which the referring GP made previously are present (in this case dummy data).

4. Discussion

Hospital portals are established technology. Initially used to offer the patient access to his medical data and prescriptions [11, 12], they are increasingly used for appointment making as well [13, 14]. These portals, however, are often specific for a single hospital or a hospital chain [11, 12, 13]. Thus, they usually do not offer the option for the referring GP to select, together with his patient, among several hospitals. Only recently, first publications report about the effects of linked portal platforms [14]. Typically, evaluation studies report the use of the portal, i.e. how often a function was accessed [12,13], sometimes in relation to the use of inpatient services, occasionally in relation to outcome parameters such as readmission [14].

Our approach focused on the transition process between outpatient and inpatient care. Thus, we started, similar to [15], with a workflow perspective. In this process we identified shortcomings and weaknesses in the admission process of three Swiss hospitals. The portal prototype is a compromise with the goal that all three hospitals could profit. Team or group specific requirements within an institution can be supported in its architecture. The design acknowledges that an existing admission portal of one of the named hospitals is sparingly used, therefore we tried to optimize data reuse and to avoid unnecessary data entries which may deter patient or care provider from portal use.

Desirable functionality such as synchronization of the calendar data with the GP and the hospital information system are yet unsolved in the prototype. A master patient index is required. Documents which must be signed by the patient (e.g. consent forms) need printout or an additional digital signature process with the respective authentication mechanisms. Security issues and complicated access rights (administrative versus clinical staff) must be solved when data is pooled for several hospitals and their patients.

Nevertheless, we see a tendency to move from hospital specific portals to shared structures [14]. Switzerland is introducing an electronic health record (EPD) based on CDA and IHE xds.b profiles [10]. The EPD per se does not solve the workflow problems

described here. It is not suitable for calendar synchronization or for appointment scheduling of a hospital or a clinic. It does, however, contribute to an improved IT infrastructure for cress-sectorial communication which could help to push additional developments such as the open hospital admission portal described here, and it will provide a master patient index. But, initially, a portal solution must be functional also for patients without an EPD. The Swiss EPD is optional for the patient, whereas an institution such as a hospital should provide an admission service which is functional for all patients.

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