IT-based Information Management in Health Care Networks: the MedoCom Approach

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Abstract. Transinstitutional information systems support collaboration beyond the borders of single health care institutions. Information management in health care networks aims at establishing systematic information processing in order to contribute to the network’s strategic goals. Health care networks can be characterized by complex and even conflicting goal systems. Our objective is to propose a framework, which describes organizational characteristics of health care networks. The framework is used to deduce effects of network characteristics on information management. Concluding, we present an architectural approach of a management platform for health care networks. The framework as well as the management platform are parts of our MedoCom approach.

Keywords. Management, Organization, Systems architecture

Introduction

The advancement of medical knowledge and medical technologies are leading to increasing functional differentiation in modern health systems. On the other hand, the coordination of health care activities between professionals, organizations and sectors is conceived as a key requirement for efficient and effective health systems [1], especially with regards to chronic diseases [2]. The concept of integrated care describes a principle of care organization, that encompasses continuity of care, shared care and seamless care [3]. Full institutional integration, i.e. the fusion of health care institutions to large hierarchical firms, has shown decisive drawbacks in providing integrated care, caused mainly by inflexibility and bureaucracy [4]. Therefore, in many countries efforts have emerged to achieve integrated care in health care networks, which consists of legally separated actors [1, 4-6].

Transinstitutional information systems, i.e. information systems that span the border of at least two legal independent health organizations, have been characterized
as a key requirement for integrated and patient-centred care [3, 7, 8]. Given the relevance of information processing in health care and the complexity of organizational, technical and legal requirements, information systems should be managed systematically [9]. A central task of information management is the alignment of organizational goals and the respective information system architecture [10, 11]. In health care networks, which are characterized by mutual dependencies, complex goal systems and non-hierarchical governance forms [4, 12, 13], the coordination of collective network interests and interests of the individual network members with regards to information management remains an unsolved problem. Together with the Institute of Technology and Management of Technical University of Berlin and the OFFIS Institute for Information technology, we started the research project “IT-based management of integrated care networks” in September 2006. Part of the project is the development of an IT-based management platform that is named “MedoCom”.

The goal of this paper is to contribute to the development of transinstitutional information management, i.e. the management of transinstitutional information systems, in health care networks by presenting current results of our research. The following questions are addressed:

- Q1: How can health care networks be classified in a systematic description framework?
- Q2: How can network characteristics affect information management?
- Q3: How can transinstitutional information management be supported by IT?

1. Methods

Research question Q1 is answered by presenting a description framework for health care networks. The development was based on a literature review of publications from the field of health care and from other fields, such as economics and publications with a focus on organizational effects of transinstitutional information systems. Furthermore, we conducted empirical case studies in health care networks, which comprised modeling of central transinstitutional processes (using UML-activity diagrams) and the current state of the transinstitutional information systems (using the 3LGM metamodel [14]). Research question Q2 is answered by analyzing the effects of network characteristics on decision making in health care networks. Schematic illustration of the architecture design is presented by a UML component diagram showing the most important modules and interfaces of the prospective architecture. Since the implementation of MedoCom is in a very early stage, Q3 is answered in the discussion and outlook sections.

2. The MedoCom description framework for health care networks

Health care networks can be defined as “autonomous units that have joined together to achieve a common purpose” [4]. We consider the autonomous units as individual persons, while the abstraction level can be varied to organizational units or whole organizations. Our framework aims at systematizing network characteristics that describe the relationships between the network members.
Transinstitutional relationships can be examined from various perspectives [15-17]. Similar to other approaches of organizational modeling, we therefore discriminate three interdependent levels of analysis: the management level, the process level and the infrastructure level (see Table 1).

Table 1: Levels of analysis in health care networks

<table>
<thead>
<tr>
<th>Focus of analysis</th>
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<th>Focus of analysis</th>
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</thead>
<tbody>
<tr>
<td>(network)</td>
<td>(network member)</td>
<td>(relationships)</td>
</tr>
<tr>
<td>Management Level</td>
<td>structure of management system</td>
<td>management competencies</td>
</tr>
<tr>
<td>Process Level</td>
<td>process system</td>
<td>process elements assigned to network member</td>
</tr>
<tr>
<td>Infrastructure Level</td>
<td>architecture of transinstitutional information systems</td>
<td>property rights regarding information resources</td>
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</table>

The management level focuses on the governance system of a health care network. The network members are described regarding their management competencies, i.e. their competencies of setting goals as well as planning, directing and controlling the network processes. The relationships between the members are conceived as managerial dependencies. The process level describes the collaborative process chain of the health care network. Network members are analyzed with regards to their assigned process elements. Relationships are interpreted as processual dependencies. At the infrastructure level, the architecture of the transinstitutional information system is observed. Network members are examined regarding their rights to use, to change or to control (i.e. their property rights) information resources. According to [14, 18], we consider information resources, as application components or physical data processing

Table 2: Centrality and intensity as characteristics of health care networks

<table>
<thead>
<tr>
<th>Centrality</th>
<th>Intensity</th>
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<tr>
<td>Allocation of managerial authority</td>
<td>Extent of managerial influence</td>
</tr>
<tr>
<td>Low: managerial authority is equally shared</td>
<td>High: managerial authority is concentrated on one or few members</td>
</tr>
<tr>
<td>Low: managerial influence on collaboration is weak</td>
<td>High: managerial influence on collaboration is high</td>
</tr>
<tr>
<td>Allocation of processes</td>
<td>Quantity of process execution</td>
</tr>
<tr>
<td>Low: processes are assigned equally</td>
<td>High: processes are mainly assigned to one or few members</td>
</tr>
<tr>
<td>Low: processes are executed infrequently</td>
<td>High: processes are executed frequently</td>
</tr>
<tr>
<td>Allocation of information resources</td>
<td>Quantity of resource usage</td>
</tr>
<tr>
<td>Low: information resources are controlled equally</td>
<td>High: information resources are controlled by one or few network members</td>
</tr>
<tr>
<td>Low: information resources are used infrequently</td>
<td>High: information resources are used frequently</td>
</tr>
</tbody>
</table>
components that support the execution of activities. The relationships between the
network members are conceived as dependencies that result from varying allocations of
property rights. Using our framework, we developed characteristics that help us to
specify different forms of health care networks. Two of these characteristics are
centrality and intensity (see Table 2). Centrality is a network characteristic that
describes the structure of a network regarding the allocation of power between the
network members. Intensity describes the extent of actual network activities.

3. Effects of networks characteristics on information management

Transinstitutional information management can be defined as the sum of all planning,
directing and monitoring activities with regards to a transinstitutional information
system. In health care networks the goal of information management is systematic
information processing that contribute to the network’s strategic goals [9, 19].

The effects of decentralization on information management in health care networks
can be summarized as follows: due to the legal autonomy of the network members, no
hierarchical structures exist. Hence, mechanisms for the coordination of multiple goal
systems have to be developed. This includes not only activities during the planning
phase but also during the directing and monitoring phase. Second, the extent of
decision implementation is self-governed by each network member. With decreasing
network intensity, i.e. with decreasing relevance of the network, the willingness of
implementing network decisions will decrease as well. Therefore, the relevance of the
network for the individual member as well as the relevance of the member for the
network has to be evaluated. Third, due to the voluntariness of network membership,
the network composition will change dynamically. Therefore, information management
must be adaptable to the current network situation. In figure 1, management decisions
in centralized and decentralized networks are compared.

![Management decisions in centralized and decentralized networks](image)

4. Discussion

Our empirical research showed that the current structures of health care networks are
often very informal. Although most of the collaboration problems are connected to
information problems, the need for systematic information management is not always
perceived. The preceding framework suggests a methodology for systematically
describing health care networks considering network characteristics at different
examination levels. It is our starting point for the development of MedoCom, an IT-
based platform for cooperative management in health care networks.

The next development step of MedoCom will be the extension as well as the
formalization of the description framework. This includes measurable and comparable
parameters for describing networks, e.g. centrality and intensity. Since organizational
modeling has been subject of several research approaches before, we will adapt suitable
modeling approaches, e.g. Business Process Modeling Notation [20] for process
modeling and 3LGM2 [14] for architectural modeling. We are confident that our
approach of characterizing health care networks will contribute to the development of
transinstitutional information management.

However, MedoCom has yet to be introduced and evaluated in real health care
networks. A prototypical implementation of our concept is planned for spring in 2008.
In the outlook section, our architectural concept of MedoCom is presented.

5. Outlook

Figure 2 depicts the architectural approach of MedoCom and shows the component
diagram of MedoCom architecture design consisting of primary modules and
communication interfaces of the application. Currently, the network model consists of a
static network view and the business process view. Since the network model will serve
as the base for management decisions, it is necessary to update it constantly. Therefore,
the model will be linked to operative applications based on web services (eServices).
At the present time, service oriented architecture (SOA) approach is most promising
and broadly approved in order to address problems related to the integration of
heterogeneous applications in distributed environments [21].

Thus, the modelled activities will be coupled to an executive component and could be
requested and accessed by the users over the internet or web-based transinstitutional
information systems. Running the web applications by network participants would
mean the initiation of activities for one particular user, who supplies new data to the
model by passing the process steps. The additional information would be fed back to
the application and auto-generate a new adapted network model.
References


