Hostpial Engineering

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Abstract. Due to changing legal, political and economical framework conditions the European health market and especially German hospitals find themselves in transformation process, which in accordance with acknowledged studies 80% of the 2.200 hospitals this day will not survive beyond the year 2020 [1]. According to this it is necessary for hospitals to strengthen their competitiveness. Especially the lack of qualified personnel, absent transparency of the hospital processes as well as insufficient cost object and process accounting have emerged as important factors to enhance competitiveness. With the implementation of innovative process organisation, the clinical pathway and its support by a process orientated hospital information system in focus solution concepts are presented, in which ICT as success factor is given a central role. Process orientated hospital information systems support the clinical pathway and enable an efficient and effective resource management, create transparency and offer a comprehensive data base for accounting and controlling.

Keywords: Hospital Information System, Business Processes, Hospital Engineering, Clinical Pathways.

1 Introduction

In the next years the complete health care sector with its suppliers and patients will be exposed to an enormous pressure to change. The fundamentally changing age structure of the population shifts the ration between contributors and benefit recipients, in combination with the technological process in medicine this leads to the urgent need of rationalisation and economisation. In the future the outstanding task of the hospital management primarily is the enhancement of the health suppliers' efficiency and effectiveness and to hinder the scaling down of benefits. The demographical change also affects the hospital personnel. Continuously increasing requirements, not only in quality but also in quantity are accompanied by a smaller number of workers. Already today there is a significant lack of physicians and specialised nurses in German hospitals [3].

In this context the labour effectiveness plays an important role. Focussing tasks according to respective qualifications is gaining significantly relevancy in order to secure sufficient health care. The delegation of tasks to less qualified personnel with adequate ICT-support results in a quality assurance, which is a critical factor of success for hospitals in the future. At the same time it is also crucial to support the qualified personnel by adequate ICT optimally. Through this the processes in the hospital,

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oftentimes summarised under the generic term “clinical pathways”, are improved in efficiency and effectiveness.

2 Hospital Engineering – A Process-Orientated eHealth-View

Hospital Engineering describes the systematic design of the business “hospital” from the management and ICT perspective. The design differentiates four levels of architecture “strategy”, “process”, “application” and “software and data base”. The firstly mentioned levels incorporate mainly management tasks, whereas level three and four describe the architecture of the ICT-system. The objective of hospital engineering is the transformation and realisation of a strategic decision in the process level supported by ICT. In the transformation and realisation ICT has the key role as enabler for new process organisation.

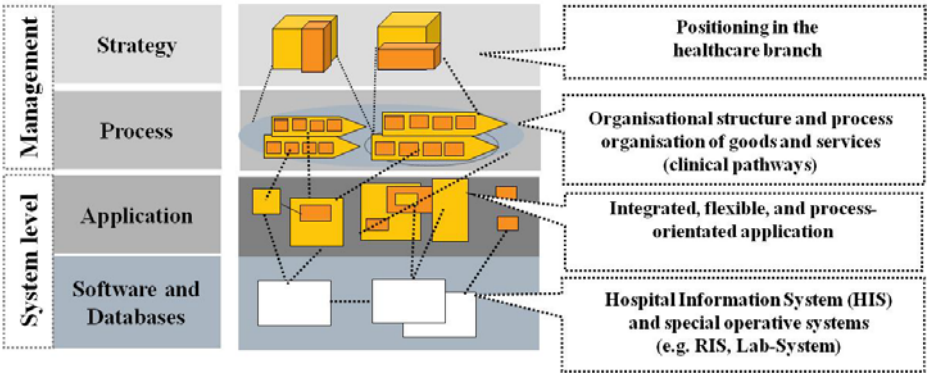

Fig. 1. Hospital Engineering

On the strategy level the definition of the service offering and the position in the competitive hospital market takes place. In general service offering means the establishment of different medical fields with special services in diagnosis and therapy, the supply of other health services and the networking with others players of the sector. Besides the definition of service offering the planning of structural and process organisation is carried out. The detailing of these strategic decisions as practical operation guideline is realised on the process level, through analysis, modelling and implementation of the process organisation. It is imperative to describe processes of diagnosis, therapy and nursing e.g. in the form of clinical pathways, and to ensure their realisation. The support of the process level by ICT takes place on the application level. The application level is the connector between not only the existent software and data base system of a hospital (4^{th} level) as e.g. the central hospital information system, but also special systems (e.g. radiology information system, laboratory system, medications system, planning system etc.). Doing so the application level integrates all existent systems within one consistent view in order to ultimately select the clinical treatment process, as the process of service production of the business “hospital”, as initial perspective of observation.

Current information and communication system architectures used in hospitals barely comply with these requirements. The system landscape can be describe as very heterogenic and poorly integrated. Interfaces between different systems are often only unidirectional. At the same time hospitals have to confront an increasing competition and the hospitals' ICT-architecture is accorded more and more the role as critical competition factor.

3 Clinical Pathways

The creation of value in the hospital over all different fields and departments mainly takes place in the area diagnosis, therapy and nursing. For this reason the to date exercised functional-orientated nursing and medical perspective hinders the integrated view on a patients treatment. The attribution of cost relevant parameters to a patient and his treatment process is not possible. The introduction of DRGs demands the renunciation from the functional-orientated perspective. Instead more and more the treatment process of a patient is the focus, which processes from the hospitalisation over the diagnosis, therapy and nursing to the discharge. This patient orientated process is termed as clinical pathway, planned treatment process or patient path.

3.1 Definition

A clinical pathway is defined as reticular treatment process overall professional categories with evidence-based foundation (guideline). The treatment process considers the patients' expectations, the quality and the profitability to the same extend. [4] Accordingly the clinical pathway represents the central regulation instrument for the whole medical treatment process, which reaches from to the patients care in the hospital to integrated concepts (e.g. nursing services ore homecare concepts). The clinical path not only specifies the inherent logic of the process flow, but also further path elements as economically and medically relevant aspects (cf. Fig. 2).

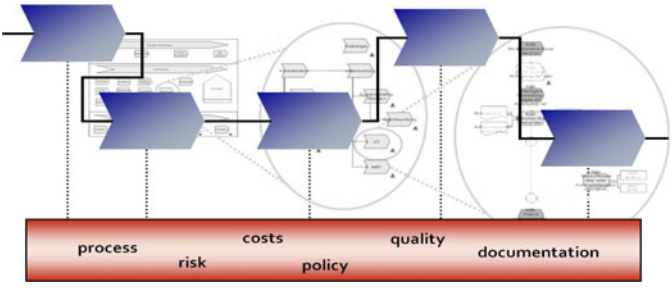

Fig. 2. Clinical Pathway

3.2 Strategic Impact of Clinical Pathways

The focus is the logic and formally correct (evidence based) process as guideline, supplemented with medical, nursing and economical risks. With a hospital's strategic decision to focus on clinical pathways the first step towards structured "service

production processes" is done. In the next step enhanced transparency and better cost controlling as well as more effective and efficient structure and process organisation is enabled. Necessary prerequisite for a successful process management is the usage of suitable application architecture.

3.3 ICT as an "Enabler" of Clinical Pathways

A factor of success for an efficient deployment of clinical pathways is controlling the correct run of the path (path trueness) through adequate measuring instruments, in order to detect undesirable developments timely and to react with suitable actions in the context of process management, e.g. adjustment of the clinical pathway or raising the personnel's' awareness for the clinical pathway process.

For the realisation of these requirements the usage of ICT is necessary, not only for modelling and visualising the clinical pathway run – thus the creating the pathway model – but also for integrated supporting of the implemented pathway.

Accordingly the system works as a workflow management system, which is related to the specialist task of processing information of medical and nursing operations.

In hospitals the (ICT-) reality in the daily routine currently appears very different. Existent hospital information systems only support special functional tasks of the whole clinical pathway. An integrated support of the complete process is not possible, e.g. the entry and the communication of laboratory examination results [5].

A major part of the clinical documentation is paper based and therefore not suitable for automated use. The goal is the installation of a check instrument, which allows ad hoc reporting and the monitoring of the clinical pathway process. For this reason the operation of a process orientated hospital information system (HIS) becomes a critical success and competition factor for hospitals. The process orientated HIS enables the integrated information technological support of the clinical pathway including all diagnosis, therapy and nursing processes.

4 Competitive Advantages through ICT

The implementation of clinical pathways and especially their information technological support by a process orientated HIS result in new chances for the hospital's structure and process organisation, which can show influence the competitiveness.

4.1 More Efficient and Effective Personnel Assignment through ICT Support

Analysing nursing and medical tasks inefficient processes can be found in many areas. The correction through reengineering of the process organisation alone is not sufficient or even not possible. For example in many cases documentation is executed redundantly because of e.g. specialist reason, economic reason (charging the funding agency) or legal requirements [2]. Resulting from this data or respectively information is stored with different objectives in paper based or digital form. Studies number the percentage of documentation 20 to 40 percent of the working time for medical personnel; in the area of nursing similar results can be found [2].

A process orientated HIS allows a consistent data capture and reduces the documentation effort enormously. As electronic patient file all relevant data is collected

and is made available. Administration orientated systems as e.g. charging and accounting systems, are connected via interfaces or, in a service orientated architecture (cf. Fig. 3), are directly connected. Studies and experts' opinion estimate the possible reduction of documentation effort at approx. 20 percent.

4.2 Competitive Advantage through ICT-Implementation in the Field of Transparency

The clinical treatment process is characterised by a high degree of lacking transparency, not only for the persons involved in the process, but also for the persons interested in process information. This concerns physicians, nurses and administrative employees (e.g. management, controlling or medical controlling) to the same extend, as well as patients, who could be better informed about their clinical picture and treatment process in many cases. A process orientated HIS offers the possibilities of detailed entry and structure presentation (monitoring) of all patient related information for the physician or respectively the nurse. The high level of transparency of the medical and nursing patient information in combination with treatment guidelines improves the information setting enormously and enables the analysis of the data for planning objects as resource or capacity planning.

Studies consider an enhancement in resource allocation up to 20 percent through application of qualified ICT infrastructure realistic [6]. Current operating HIS only support the monitoring, regulation and controlling of clinical pathways inadequately. In order to achieve improvement of analysis possibilities and more efficient support of clinical pathways digital support is an essential requirement [7].

4.3 Activity Based Costing

To date fair accounting for the input involved in real time still poses a permanent challenge for the hospital controlling. The introduction of clinical pathways offers inherently the possibility to identify the costs related to the run of the pathway. This requires an adequate entry of all pathway related cost and time variables and a maximised path trueness. From the economically point of view of the hospital controlling a prompt cost analysis has the most efficient regulation potential, given that the entry and the analysis of all time an cost relevant variables is ICT supported. Correspondingly it is possible to identify deviations promptly, initiate qualified counteraction and adapt the service offering.

5 Discussion and Outlook

The health care sector in Germany is going to proceed through a further transformation process and with it the hospital branch. In this transformation process sector specific competition factors are in the foreground, which barely can be managed with conventional concepts. The use of innovative information technology offers great effectiveness and efficiency advantages. For the feasibility of the presented strategy it is to pose the questions: Are there suitable and capable systems in the German

market? Do these systems comply with the criteria of a process orientated HIS? An evaluation of the market clarifies that there is still a great feasibility-realisation-gap and a lack of a solution of-the-shelf, which could be implemented in hospitals as standardised software solution. No remedy is expected in the near future [6].

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