Impact of IT-supported clinical pathways on medical staff satisfaction. A prospective longitudinal cohort study

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\textbf{Abstract}

\textbf{Introduction:} Clinical pathways (CPs) have been evaluated with regard to process optimization, economic effects, quality of care, patient satisfaction and staff satisfaction. IT-(information technology) supported CPs, integrated within the HIS (hospital information system), have been implemented in our department in 2004 for the first time world-wide. Herein, we describe the effect of this new concept on medical staff satisfaction.

\textbf{Methods:} A prospective anonymous and voluntary survey with standardized questionnaires was performed annually from 2006 until 2009 evaluating staff satisfaction concerning CPs. Questions comprised satisfaction with the software, staff's attitude towards CPs and the impact of CPs on work-related processes.

\textbf{Results:} Within the observation period the term "clinical pathways" became more common among doctors and nurses. Knowledge of the aims of CPs increased significantly in nursing staff (43.4–74.5%), whereas doctor's knowledge was on a constant high level. Standardization, process facilitation and cost effectiveness were the most claimed goals of CPs. Comprehensibility of the single steps within CPs was on a constant high level over the observation period. Generally, graphical layout and usability of CPs ranged on a very high satisfaction level. Acceptability of IT-supported CPs is independent from staffs computer knowledge.

\textbf{Conclusions:} Staff satisfaction with IT-supported CPs needs to take into account the job characteristics of the different professional groups. IT-supported CPs are leading to a high staff satisfaction, the aims of CPs are widely understood by medical employees. IT-supported CPs may ameliorate staff satisfaction and thereby enhance workflow efficiencies.

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1. Introduction

Clinical pathways (CPs), derived from industrial workflow management and project planning, have become popular in the late eighties and early nineties of the last century. However, despite the theoretical advantages and the great number of publications concerning clinical pathways, their widespread clinical realization is not yet achieved. One reason for difficulties in introducing pathways may be that the benefits – i.e. cost reduction, quality assurance, process standardization, workflow optimization – are often not fully understood.

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and supported by the medical staff. Clinical pathways were implemented mostly as additional sheets to the patient's records, resulting in additional paperwork instead of facilitating daily routine, leading to poor acceptance of the whole concept. Being aware of this problem, we developed the idea of IT-supported clinical pathways to reduce additional documentation, to automate standard processes and to access all patients' data from the hospital information system (HIS). The feasibility of IT-supported, HIS-integrated clinical pathways has been demonstrated [1–3], and potential benefits, especially concerning economical effects [4] without any negative impact on the rate of complications or re-hospitalization [5] and patient satisfaction, have been highlighted [6,7]. In today's modern health care systems, evaluation of staff satisfaction has become an increasingly important issue [8]. The effect of clinical pathways on staff satisfaction has been described in a number of studies; however, no one has ever evaluated an IT-supported concept. Therefore, we performed an annual survey among nurses and doctors in our department analyzing staff satisfaction with IT-supported, HIS-integrated clinical pathways.

2. Methods

The basis of a clinical pathway is a so-called clinical guideline, which has been defined based on department standards, general guidelines and evidence-based medical literature. Accordingly, clinical pathways for more than 30 diagnoses and/or procedures, corresponding to the majority of patients being treated in our department, were successively generated and prepared for IT-implementation.

The HIS software (SAP, Walldorf, Germany) consists of several modules, including the patient data management system IS-H. The product “i.s.h.med” (Siemens Medical Solutions GSD GmbH, Berlin, Germany) delivers the medical applications including order entry, documentation, and electronic patient record via a common user interface (clinical workstation). It is integrated completely within the HIS by access to one common database. The new software module “i.s.h.med pathways” (Siemens Medical Solutions GSD GmbH, Berlin, Germany) was implemented in our surgical department in November 2004 for the first time world-wide. “i.s.h.med pathways” represents an additional module for creating and managing clinical pathways, i.e. it upgrades “i.s.h.med” with facilities for process analysis, modeling, graphical presentation, testing, implementation, pathway assignment, instantiation, and scheduling. This allows the development of CPs in form of rapid prototyping as well as complete workflow integration, since links to medical functions (e.g. order, access to electronic patient record, documentation) are available directly: the physician can choose and assign the relevant pathway, execute stepwise, and control the workflow with a minimum of navigations. For evaluation of the impact of IT-supported clinical pathways on medical staff satisfaction, a prospective cohort study was performed. Doctors and nurses of the department were interviewed annually by means of a standardized questionnaire from 08/2006 until 08/2009. The staff's participation in the questionnaire was voluntary and anonymous. Personal data comprised occupation group, age, duration of employment and computer skills. General questions on clinical pathways included whether the staff was familiar with the term and concept of CPs, and aims or advantages of CPs were discussed. Furthermore, the staff's attitude towards CPs as well as the impact of CPs on daily routine and work-related processes was investigated. Data acquisition and processing were performed using a standard spreadsheet application (Excel 7.0; Microsoft, Munich, Germany), statistical analysis was performed using the software package SPSS 15.0 (SPSS; Chicago, USA). Values are expressed as mean ± SEM. Overall statistical significance was set at p < 0.05.

Missing answers in the questionnaire were left out so that only correctly given answers were computed and were normalized to 100%.

3. Results

Within the observation period, more than 4700 patients were assigned to a distinct pathway, continuously rising with the number of CPs available (2005: 10 CPs/183 patients; 2006: 17 CPs/715 patients; 2007: 23 CPs/1467 patients; 2008: 31 CPs/2792 patients, 2009: 31 CPs/4785). Staff age increased significantly (p = 0.006) from 34.7 ± 0.8 years (2006) to 39.2 ± 1.2 years (2009). The duration of the employment did not reveal any changes over the years (p = 0.514). Staff age and duration of employment in the department showed a moderate correlation (0.405; p < 0.001).

In our study population, the ratio between medical doctors and nurses was constant over the years, with an overall of 21.5% (medical doctors) vs. 78.5% (nurses). Herein, the term “clinical pathways” was significantly more familiar among medical doctors (95.1% vs. 59.6%; p < 0.001; no response rate 3.7%). However, the knowledge of the term significantly increased among the nursing staff from 51.5% (2006) to 75.5% (2009; p = 0.049; no response rate 5.1%). The self-estimation of computer skills showed no significant change within the study period (no response rate 1.3%).

Within the evaluation period, the term “clinical pathways” became significantly more familiar from 59.2% in 2006 to 80.3% in 2009 (p = 0.028) among both medical doctors and nurses (no response rate nurses: 3.4%, medical doctors 4.7%). Alike, the knowledge on the meaning of the concept of clinical pathways increased from 52.8% (2006) to 79.7% (2009; p = 0.004; no response rate 5.1%) (Fig. 1). Whereas the knowledge of the concept among the medical doctors ranged constantly between 88.5% and 100%, there was a significant increase among nursing staff from 43.4% to 74.5% (p = 0.006).

Standardization (59.8%), process facilitation (31.3%) and cost-effectiveness (25.0%) were considered to be the most important features of CPs, in contrast to quality assessment and e-learning (12.5% and 5.7%; multiple responses allowed). All participants selected at least one of these categories. The professional status influenced the estimation of those items, as standardization and process facilitation were regarded more important for medical doctors than for nursing staff (57.8% vs. 12.9% and 26.6% vs. 7.7%, respectively, p < 0.001 each). The analysis of these factors over the evaluation period did not reveal any significant changes. Both professional groups considered clinical pathways equally as
Fig. 1 – (a) Mean staff age and seniority and knowledge of the term “clinical pathway”. (b) Q: Are you familiar with the term “clinical pathways”? Values are given as percentage. Over the observation period the term “clinical pathways” was known in a high constant level among medical doctors whereas the knowledge of the term significantly rose among nursing staff. Values are given as mean ± SEM or percentage. Black bars representing mean staff age, grey bars representing mean staff seniority. *p < 0.05; 2006 vs. 2009 (Fig. 1a). Black circles representing medical doctors, white circles representing nursing staff (Fig. 1b).

4. Discussion

The frequently stated goals of implementing CPs usually include defining standards and quality in clinical treatment, economical effects such as reducing hospital stay, decreasing clinical documentation [4,9,10] as well as improving patients satisfaction [7]. In recent years, health care staff surveys have become an increasingly important issue. Additionally, in the field of change management, staff satisfaction has become a major topic of interest when implementing new concepts [8]. Hence, it is known that the success of introducing CPs is decisively influenced by the motivation of the medical staff, both nurses and doctors [11]. Staff satisfaction and working condi-

<table>
<thead>
<tr>
<th>Computing knowledge</th>
<th>Poor</th>
<th>Good</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensibility</td>
<td>2.5 ± 0.08</td>
<td>2.8 ± 0.06</td>
<td>0.001</td>
</tr>
<tr>
<td>Usability</td>
<td>2.3 ± 0.12</td>
<td>2.4 ± 0.08</td>
<td>0.251</td>
</tr>
<tr>
<td>Layout</td>
<td>1.9 ± 0.14</td>
<td>2.1 ± 0.11</td>
<td>0.377</td>
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Data is given as the numeric results of a 4-step Likert-scale (1 = bad, 2 = acceptable, 3 = good, and 4 = very good). Values are expressed as mean ± SEM.
Usability of IT-supported CPs

Layout of IT-supported CPs

Comprehensibility of IT-supported CPs

Fig. 3 – Influence of professional status on usability (a), layout (b) and comprehensibility (c) of IT-supported CPs. Data is given as the numeric results of a four-step Likert-scale (1 = bad, 2 = acceptable, 3 = good, and 4 = very good). Values are expressed as mean ± SEM, *p < 0.05.

The longitudinal analysis revealed that the internalization of concept of CPs among the medical staff rose throughout the years. This is not surprising, as the annual questionnaires were analysed and the implementation of new CPs was influenced by this knowledge of staff's attitudes. Despite the increase in the number of implemented CPs as well as an increase in the averaged complexity of the CPs from 2006 to 2009 staff's rating of comprehensibility, usability and layout could be slightly improved. As known from change management, the successful implementation and acceptance of new concepts strongly depends on key users, the so-called “change agents” or “super users” [16,17].

The perceived usefulness and perceived ease of use have been identified as important user acceptance criteria when introducing new technologies [18,19], hence initial positive experiences with this new technology will further enhance the acceptance. This plan was stepwise realized in our institution throughout the whole implementation period of CPs. First basis for the development of CPs was internal standard operating protocols (SOPs), being implemented in 2001. Thereafter, under continuous involvement of all professional groups, those SOPs were converted into clinical pathways. Due to integrating the pathways software module within the hospital information software (SAP/i.s.h.med), this interface-free IT-solution ultimately facilitated and promoted their acceptance among the medical staff by reducing redundant workload. An access of the hospital information software to all other functions of the workstation was ensured (word processor, internet access, electronic patient record).

Standardization and transparency of treatment are often described as the aims of CPs. One of the major findings of the present study is that standardization and process facilitation were regarded as the most important features of CPs, especially for medical doctors. On the other hand, quality assessment and cost effectiveness seemed not to be relevant in medical staffs view.

The role of CPs in the context of e-learning was subordinated in our study. This is not surprising, because CPs do not replace a surgical and nursing basis education in perioperative treatment of surgical patients. The experience of the individual employee may be assisted with IT-supported CPs. For
Clinical pathways, especially in IT-supported structure, lead to a high staff satisfaction. The frequently discussed targets of CPs are perceived by staff to a large proportion in clinical practice as evident. The study indicates that all involved staff widely understands the aims and the benefits of IT-supported CPs. Furthermore, consequent teaching in dealing with IT-supported CPs is necessary to maintain a high standard in clinical treatment. IT-supported pathways as management tool can improve staff satisfaction and may enhance efficiencies by high-tech solutions.

5. Conclusion

Clinical pathways, especially in IT-supported structure, lead to a high staff satisfaction. The frequently discussed targets of CPs are perceived by staff to a large proportion in clinical practice as evident. The study indicates that all involved staff widely understands the aims and the benefits of IT-supported CPs. Furthermore, consequent teaching in dealing with IT-supported CPs is necessary to maintain a high standard in clinical treatment. IT-supported pathways as management tool can improve staff satisfaction and may enhance efficiencies by high-tech solutions.

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Summary points
What was already known:

- Clinical pathways (CPs) reduce costs in health care system.
- High staff satisfaction leads to improved care.
- No prospective studies have evaluated staffs satisfaction in context of IT-support.

What this study adds:

- IT-supported CPs facilitate routine workflow.
- IT-based treatment concepts and aims are well understood by medical staff.
- Nurses, but not doctors, considered IT-supported CPs as an additional workload.

Author contributions

Jochen Schuld drafting the article, acquisition of data, analysis and interpretation of the data, review of the literature, approval of the final version of the manuscript. Thilo Schäfer drafting the article, acquisition of data, analysis and interpretation of the data, review of the literature, approval of the final version of the manuscript. Martin K. Schilling final approval of the final version, analysis and interpretation of data, approval of the final version of the manuscript. Peter Jacob acquisition of data, analysis of data, approval of the final version of the manuscript. Stefan Nickel revision of the article for important intellectual content, approval of the final version of the manuscript. Sven Richter conception and design of the study, analysis and interpretation of the data, approval of the final version of the manuscript.

Conflict of interest statement

None of the authors have any conflict of interest, financial or otherwise, relevant to the conduct or reporting of this study.

References


