Applicability of Lewin´s Change Management Model in a Hospital Setting

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Summary
Objectives: Today's socio-economic developments in the healthcare area require continued optimization of processes and cost structures at hospitals, often associated with process changes for different occupational groups in the hospital. Formal methods for managing change have been established in other industries. The goal of this study was to assess the applicability of Kurt Lewin's change management method to a health informatics-related project at a German university hospital.
Methods: A project at the University Hospital Erlangen introducing changed requirements in the documentation of costly material in the surgical area was conducted following the concept of Lewin's approach based on field theory, group dynamics, action research and the three steps of change. A data warehouse contributed information to several steps in the change process.
Results: The model was successfully applied to the change project. Socio-dynamic forces relevant to the project goals were identified and considered in the design of the new documentation concept. The achieved documentation level met the new requirements and in some areas even exceeded them.
Conclusions: Based on the project experiences, we consider Kurt Lewin's approach applicable to change management projects in the hospital sector without a requirement for substantial additional resources, however, specific hospital characteristics need to be taken into account. The data warehouse played an important role by providing essential contributions throughout the entire change process.

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1. Introduction

Hospitals are facing an increasing need to optimize processes and cost structures [1–3]. Such reorganization and optimization efforts usually require changes which in many cases involve the IT infrastructure and often affect large numbers of employees spanning multiple organizational levels. It has been shown that the sole adaptation of processes and IT systems is insufficient, and that the "human factor" has to be taken into account in order to achieve the acceptance and commitment of all participants [4–11]. As one well-described example, Aarts et al. illustrated that the introduction of a large computerized physician order entry system (CPOE) failed not only because of limitations of the system, but also due to limited understanding of the impact the system had on clinical workflows and staff attitudes [7]. In a different hospital, however, the same system was implemented successfully by taking into account staff needs and IT experience [8]. Furthermore, experiences from the failed introduction of a statewide medical IT system in New South Wales, Australia, showed that apart from technical and usability issues organizational aspects like workflow integration, staff commitment and distribution of decision-making throughout implementation have to be taken into account [9]. Finally, in a hypothetical case, Ash et al. discuss the impact of sociological considerations on a successful implementation, which are not taken into account by simple project management methods [10]. This necessity for "change management" (CM) was formally addressed already in 1947 by Kurt Lewin [12, 13], identifying relevant socio-dynamic forces and phases by which the process of introducing change can be segmented. Since then, change management methodology continues to be actively developed [14, 15]. The application of proven CM methods from other disciplines to the health information technology sector has been actively encouraged and the publication of further case studies suggested [16, 17]. Thus far, nursing literature in particular has discussed change management methods in health care with the aim of enabling nurse managers to deal with change [18–24]. In their case study Kassean et al. [20] describe the successful implementation of a new system of bedside handover, facilitated by the use of some aspects of Lewin's CM model, while Lorenzi et al. [17] suggest that the field theory of Lewin's CM model may be applicable to conflict situations in health care. However, a thorough application of all aspects of Lewin's CM model to health informatics change projects is still lacking.

1.1 Project Environment

Currently a cost unit accounting system is being introduced at Erlangen University Hospital, based on the German InEK (Institute for the Hospital Remuneration System) guidelines [25]. These guidelines recommend allocating costs according to the input involved in a patient care period and analyzing each patient as a cost unit. Hence, establishing an accurate documentation of costs which can be directly allocated to a patient care period (e.g. implants, costly antibiotics and blood products) is an essential prerequisite for this calculation. This project (hereby termed the CUAS project) was initiated in 2007 and is carried out by an interdisciplinary team with medical, economic and IT expertise. Its implementation process involves numerous reorganizational issues with different levels of socio-technological aspects. In this paper we focus on one particular subproject, undertaken in the surgical suite.

Erlangen University Hospital comprises 15 surgical departments, all using a centrally maintained surgery information system which supports surgery planning, documentation of diagnosis and procedure codes and a comprehensive medical documentation performed by physicians and nursing staff. Material consumption was one area of documentation usually performed by nursing staff. Prior to the CUAS project, materials were mainly documented as freetext items as illustrated in ▶Figure 1. Consequently, this documentation could neither be linked to the related pricing information, usually available in a hospital's materials management system nor could any detailed statistics be provided on material usage. In order to allocate such material costs to a particular patient, it was therefore necessary to

- map the list of costly materials which are required to be documented according to the InEK guidelines to our hospital's material management catalog,
- define this material subset as a hierarchically structured catalog within the surgery information system,

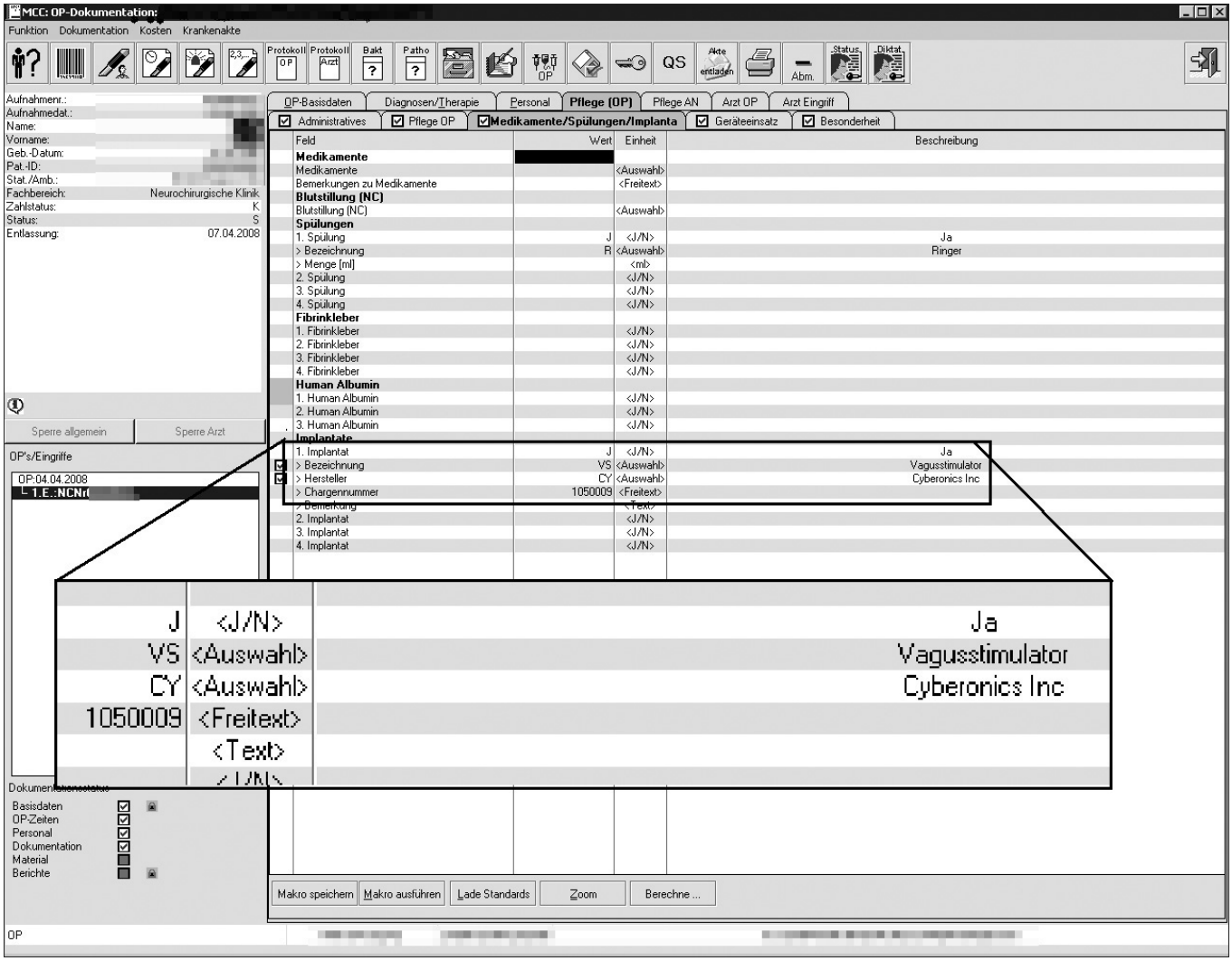

Fig. 1 Screenshot illustrating details of the documentation of a surgery´s material consumption before the CUAS project. Material numbers were documented as freetext without any link to the material catalog of the material management system and its pricing information.

- automatically associate those catalog elements with pricing information from our material management system, and
- change the actual documentation process to apply this detailed and fully structured material catalog.

This subproject began in January 2008 with an initial meeting presenting the project motivation and project plan. It also introduced our internal controlling tools based on data warehouse reports which should be applied to measure project progress. The need to invest efforts into the mapping between the InEK material catalog and the materials used at Erlangen University Hospital and the modification of the documentation process from freetext data entry to material selection from a structured catalog was clearly communicated in this meeting and seemed to be obvious to everybody. However, we came to realize in the subsequent months that understaffing of the surgical nursing teams and an already high load of documentation requirements for many other purposes led to an implicit rejection of the project. This was never directly communicated, but nursing resistance to change from the traditional documentation processes could be interpreted from several "messages between the lines". As an example, it was very complicated to even coordinate project meetings where all nursing team leaders from the different disciplines would be able to participate and it seemed impossible to define free time slots of key members of the nursing team in order to define the materials catalog for all 15 surgical disciplines. Realizing that our traditional approach for project management was at high risk to fail, we decided to greatly increase our consideration of human factors and to implement a data warehouse-supported CM approach. Lewin's change model was chosen because it consists of clear and manageable components:

- field theory,
- group dynamics,
- action research, and
- three steps of actual change named *Unfreeze, Move, Refreeze*

that are thoroughly described in the literature, offering enough flexibility for our requirements [12, 13].

1.2 Data Warehouse

Data warehouse systems are rapidly gaining ground in the healthcare sector. Originally focusing on the standardized analysis of administrative data [27–29] clinical warehouses are also currently being applied for study recruitment [30], process mining [31] and detection of adverse events [32] as well as for explorative statistical data mining [33]. At Erlangen University Hospital, a clinical data warehouse has been in use since 2003 based on a Cognos Business Intelligence™ platform. Data from administrative as well as various hospital-wide and ancillary clinical information systems have been integrated into a unified data model allowing complex analyses across all departments. Dimensions and measures were modeled according to established national or international standards (e.g. ICD diagnosis catalog) in order to facilitate data integration and interoperability. The data warehouse is accessed by clinical as well as administrative staff and provides individualized reports (e.g. clinical coding statistics, revenue distribution, cost center reports and clinical workflow visualizations [34]) across data consolidated from disparate sources. Since a complete manual mapping process to create the required materials catalog proved to be too time consuming, we applied various data warehouse tools and reports in order to support every phase in our CM lifecycle.

2. Objectives

In this context, the goal of this paper is to illustrate how the application of Lewin's change management methodology to an existing health informatics-related project at a German university hospital could successfully help to overcome the socio-technological barriers identified within a first project phase. By describing how the different components and steps of Lewin's CM model explicitly facilitated project progress we wanted to assess its applicability for future change projects in a hospital setting. Applicability of Lewin's CM model was determined according to the following criteria:

- transferability of each step of Lewin's CM model to the change situation within the CUAS-project;
- level of acceptance of the new approach among our surgical team;
- level of success of the process implementation, measured by documentation completeness;
- persistence of the changed process, measured by the long-term documentation quality.

3. Methods

3.1 Lewin's Change Management Model

The model published by Kurt Lewin in 1947 [12, 13] is considered the starting point for contemporary theories of CM [14]. The model contains the following elements: field theory, group dynamics, action research and the three steps of change. Field theory indicates that a present situation is being maintained by a set of symbolic forces [10] that affect group structures, which in turn influence individual behavior. Lewin considered change as the consequence to changes in the forces within the symbolic field. Thus, identification of those forces provides the key to understanding people's motives and enables a project manager to influence people's behavior. In order to identify the field forces of a given situation Lewin suggests to look at subjective (cognitive) and objective (behavioral) aspects of group life by e.g. conducting interviews with the persons concerned as well as examining the total circumstances of the situation. The circumstances would mainly include groups and subgroups involved, their relationships with each other and their value system as well as social habits. Furthermore, Lewin suggests that driving forces originate in ambitions, goals, needs and fears whereas restraining forces oppose driving forces[12, 35–39]. Group dynamics claims that individual behavior is constrained by group pressure. The focus of CM should therefore be at the group level rather than at the individual one[14, 37, 40, 41]. Action research postulates two main aspects: Firstly, individuals need to feel the necessity for change, which involves both the ability to understand one's momentary status quo and the gap compared to the desired future status quo. Secondly, the most appropriate solution to the situation at hand should be chosen and implemented. This in-

cludes the analysis and continuous evaluation of all possible solutions [26, 42]. Finally, according to Lewin, a complete CM process can be segmented into three steps: *Unfreeze*, *Move*, and *Refreeze*. A familiar process is supposed to be "unfrozen" by sensitizing the process participants to the necessity of change and by overcoming their defence mechanisms. The second step (*Move*) aims at strengthening all changing forces in order for the change to actually take place. The final step (*Refreeze*) reinforces the maintenance of the newly achieved status quo in order to deter the participants from reverting to their previous state [12]. Lewin's model of CM seemed capable of structuring our change project while offering sufficient adaptability for a hospital context.

3.2 Application of the CM Model

3.2.1 Field Theory/Identification of Field Forces

Following Lewin's suggestion to look at subjective (cognitive) and objective (behavioral) aspects of group life and to identify driving as well as restraining forces, we analyzed the given documentation situation in the operating rooms by looking at it from different viewpoints (the economic view of our hospital administration, the perspectives of the surgical nursing team, and the view from the IT management). For this purpose we performed bilateral informal interviews with members of all those groups, but also considered the total circumstances of their given documentation situation based on personal observations. Based on this we identified forces that we considered important to a successful outcome of our change project. We initiated follow-up workshops with the nursing team leaders to openly discuss both the identified forces as well as the ongoing process implementation in order to compile a final list of forces primarily relevant to our project.

3.2.2 Group Dynamics

As a first step within the new project approach according to Lewin we obtained the support of the hospital's board of directors, including the administrative, medical and nursing directors, by providing background information on our project goals and a detailed road map. This top level backup was important as a message of commitment for all hospital staff members during the further course of the project.

Concerning group dynamics we then had to identify change promoters as well as possible change opponents among the nursing staff by means of informal interviews and during the workshops. Two steps were then established in order to gain the project commitment of both groups. First, we devised individual documentation approaches for each surgical specialty, taking into account the nursing team leaders' respective motivations. This would result in a solution which could accommodate a flexible level of detail for the predefined material catalog. Furthermore, we realized that continuous feedback loops based on data warehouse reports related to the surgery documentation were helpful in maintaining the pressure on the team high to jointly achieve the defined goals. Secondly, we made sure that every nursing team leader was continuously involved in the discussion of the new documentation approach and that all vital decisions concerning the final documentation concept were made in their presence. This aimed to establish a joint group feeling and distribute the pressure to succeed on the whole group and not on single team members only.

3.2.3 Action Research

In order to create the feeling of necessity for change among the nurses we conducted workshops providing background information on our motivation. In order to clearly point out the prevailing documentation gap we designed different types of data warehouse reports by which target-performance comparisons could be easily performed. This was accompanied by an observational examination of existing documentation processes and documentation contents in the operating rooms by means of informal interviews with the nursing team leaders. During the workshops we actively asked for input from the nursing team leaders, encouraging them to identify the existing documentation problems themselves. Additionally, the final setup of the material catalog in structure and depth was created in a stepwise process, always taking into consideration individual customization and design proposals from the nurses, and using data warehouse reports to illustrate the strengths and weaknesses of different design options. Even though this part of the project required an extremely high level of support from the data warehouse and the CM team, it was always clearly stated that the responsibility for the long-term maintenance of the material catalog and material sets would be transferred to the nursing staff themselves.

3.2.4 Three Steps of Change

Bearing field theory, group dynamics and action research in mind we conducted the project following Lewin's three steps.

The *Unfreeze* step was the most sensitive phase, where major input from our CM team was required to carry out a series of workshops in order to inform the nursing staff about the background and requirements of a new documentation approach, in particular using data warehouse reports (as described in 3.2.2) in order to sensitize everybody to the problems of the "traditional" documentation and convince the whole group of the need to change. We proposed a coarse solution concept, gathered team feedback and coordinated a timeline for this CUAS subproject.

During the *Move* step the actual construction and implementation of the material catalog as well as the surgery type-related material sets took place. Subsequently, this new documentation concept was set in production. The surgical departments were given individual support according to their respective requirements. This included visits on site in order to adapt individual solutions and train the staff as well as to gather feedback on the acceptance of the new documentation approach. The data warehouse was used to quickly identify relevant materials for each clinical specialty based on documented procedures and cost center-based material ordering reports. Based on a periodic comparison of the list of procedures performed within each discipline and the InEK list of required material documentation the CM team continuously identified procedures for which the relevant InEK materials were not yet defined in the material catalog. Throughout the entire *Move* phase additional workshops were organized in order to provide this information and discuss feedback. In order to ensure a

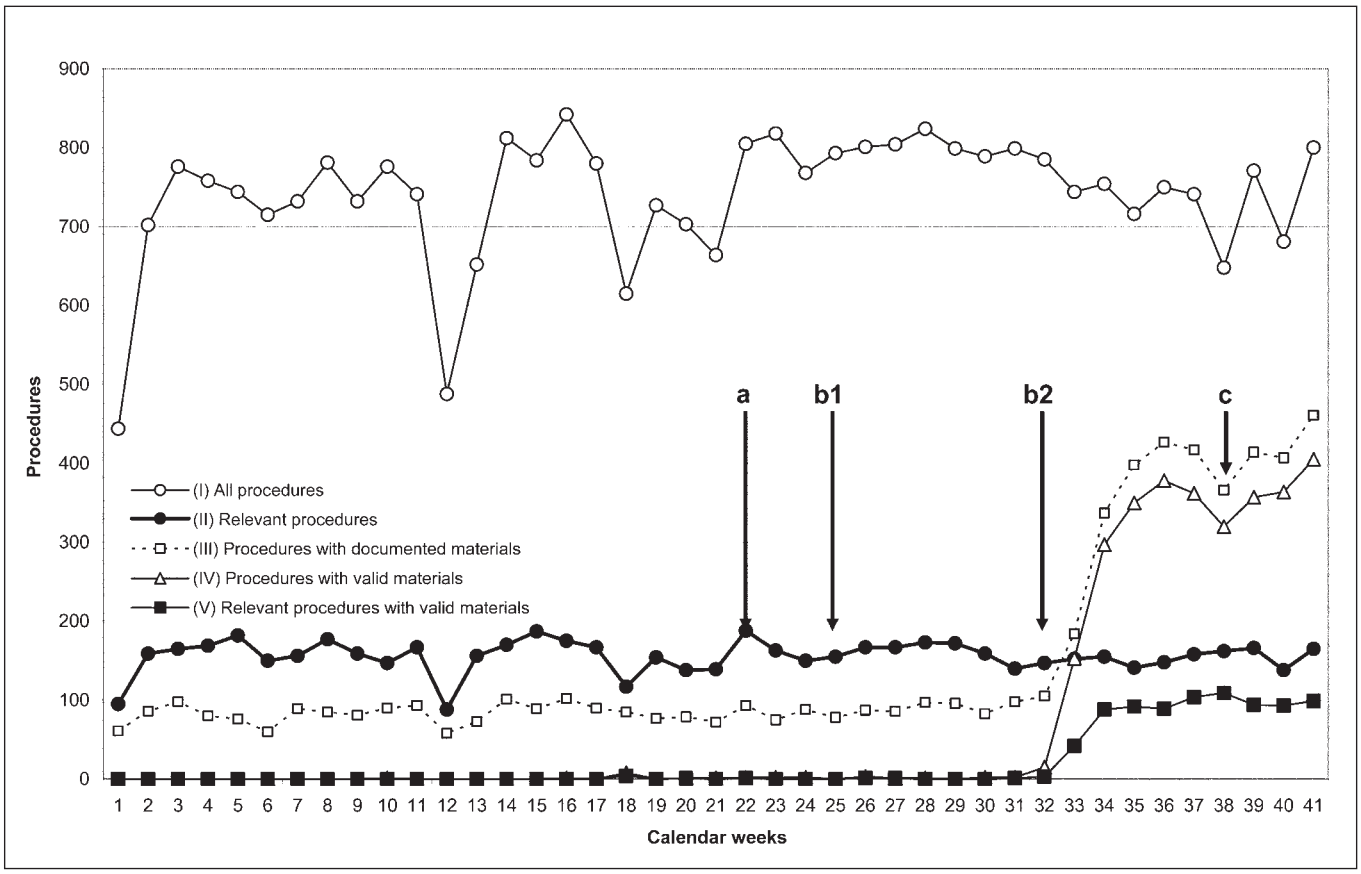

Fig. 2 Weekly documentation of procedures and related material consumption in 2008. Project phases marked by arrows: a = *Unfreeze* phase, b1 = start of first *Move* phase, b2 = start of second *Move* phase, c = feedback meeting/*Refreeze* phase. Relevant procedures were subjectively defined as all procedures in which, according to the knowledge and clinical experience of the physician member of the project team, InEK-relevant materials were typically consumed. As valid materials we count all material documentation based on the predefined material catalog with associated price information.

smooth transition on the first day of new documentation we made sure that at least one project team member accompanied the process on site.

To kick off the *Refreeze* step we convened a feedback meeting with the nurses in charge in order to present the results from the ongoing documentation phase. Using data warehouse reports, the development of the gap between required and documented material records over the time was illustrated. Such data warehouse reports on the congruence between actual and required documentation will be further used as a controlling tool in the hands of the nursing staff and administrative director as well as the nursing team leaders. In a final workshop (▶Fig. 2: c: feedback workshop) we made sure to commend the new documentation level that each individual surgical team had reached as well as the overall documentation standard achieved across all disciplines.

4. Results

4.1 Project Timeline

The change project was implemented at Erlangen University Hospital between June and September 2008. The time flow is shown in Figure 2 in conjunction with the total number of weekly procedures carried out and documented. The *Unfreeze* phase (a) started in calendar week (cw) 22 and lasted for three weeks. The following first *Move* phase (b1) lasted for seven weeks, which comprised the gathering of documentation requirements, the actual compilation of material sets and their implementation in the surgical information system. The second *Move* phase (b2) continued in calendar week 32 with the productive use of the new documentation concept in the operating rooms. Out of 15 surgical specialties participating in the project, 13 took part in b2, whereas two departments are still in the process of implementation due to critical understaffing. The *Refreeze* phase (c) was formalized in calendar week 38 by a feedback meeting with the nursing team leaders.

The transferability of all parts of Lewin's CM model to our change project was possible and its results displayed as follows.

4.2 Field Theory

According to field theory we identified the following forces that appeared to be relevant to group and individual behavior in the operating rooms: 1) priority of patient care over (administrative) documentation work, 2) perceived high documentation workload, 3) interest in the economic survival and prosperity of the hospital, 4) participation in cost-relevant decisions. Forces 1 and 3 appeared to be equally present in all staff members, whereas opinions towards forces 2 and 4 were

divided. While forces 3 and 4 were in favor of the proposed documentation change, forces 1 and 2 stood against it. Therefore it became necessary to devise a solution which enabled more detailed material documentation with less effort in the long term.

4.3 Group Dynamics

Concerning group dynamics we identified two explicit change promoters among the 15 nursing team leaders, i.e. supportive of force 4, as well as two explicit change opponents, i.e. supportive of force 2, leaving 11 nursing team leaders more or less undecided, but with a light tendency towards the category change opponents. Change promoters showed high commitment by devoting extensive time and resources to the project as well as an active participation in the process development. They perceived the change in the documentation concept as a chance for further adjustments in related fields, e.g. the ordering process of medical equipment. Once the concept was clearly communicated, change promoters were in favor of a very detailed documentation approach that would even go beyond the initial request based on the InEK guidelines. They considered this change as an excellent opportunity to obtain a comprehensive overview of material usage not only in regard of the "InEK materials" but on all materials applied in their respective operating rooms. The change opponents, i.e. supportive of force 2, (strongly) displayed scepticism as regards the feasibility of the much more detailed documentation approach always insisting on their understaffing or insufficient documentation time during short surgeries. In preparation for the concept development workshops during the *Move* phase we adjusted the documentation process as much as possible considering both groups' input from previous workshops and informal conversations. Change opponents received even higher support from our CM team for the process of defining the relevant material catalog for their respective discipline. In a follow-up workshop we then addressed all positive suggestions, but also all fears related to the new documentation approach using specific documentation examples. ▶ Figure 3 illustrates such a sample documentation scenario, where nurses can drill down in the hierarchically organized material catalog to either select surgery-specific material sets or specific material items. All items defined in this tree structure are now directly linked to material items from our hospital's material management system and associated with price information. These illustrated examples allowed everyone to easily follow the discussions and development steps. This approach for presenting the planned new documentation concept finally convinced the majority of participants. Thus, group pressure led to the final decision to continue, even though a lot of configuration and definition work was still required to prepare for the new documentation process. In this critical phase all discussions were kept open and respectful, making sure that the opinions of all nursing team leaders were heard and considered to the furthest possible extent and that any decisions on vital aspects of the new process were made in presence of all.

4.4 Action Research

A careful and comprehensive examination of the existing documentation process and contents by our CM team led to the discovery of both a high degree of individual freetext documentation as well as recurring groups of materials associated with certain procedures. Based on these findings we proposed to define entire material sets which could be documented with just one mouse click instead of documenting individual materials per procedure (e.g. total hip replacement set including implants, sutures and other consumables). Individual discipline-specific solutions included variations ranging from basic sets containing only mandatory high-cost materials to comprehensive sets consisting of all materials used for a certain procedure regardless of price (e.g. the ophthalmic clinic with a high turnover of short procedures was in favor of a limited, highly standardized documentation of costly materials, whereas the general surgery clinic required a highly flexible, extensive documentation of high- and low-cost materials). After extensive support in defining the most optimal documentation sets for each specialty based on various data warehouse reports during the *Unfreeze* and initial *Move* phase, the benefits resulting from those changes became apparent to all concerned. From this point on it was agreed that further maintenance of these sets as well as future construction should be carried out by the nursing staff based on their first-hand knowledge of surgical procedures. This task should be supported by periodic data warehouse reports on procedures performed, materials consumed and newly ordered materials from the materials management system.

4.5 *Unfreeze* Step

Gaps between the given and the required documentation status varied in their extent among the surgical teams but existed in all cases. The data warehouse was utilized to display the gap between procedures carried out and materials ordered for the related cost centers. Reports were implemented to determine the documentation workloads and prioritize lists of procedures most involved in the use of costly materials. Over the course of the workshops the report data and implementation strategy were discussed and adapted to the individual surgical specialties according to their feedback. Fears of head nurses regarding the complexity of the software and the increase in administrative work were addressed.

Furthermore, the importance of the project as well as the commitment of the hospital's top management towards necessary process changes was reinforced by the board of directors which issued a decree and thus encouraged hospital-wide support for the project. The level of discussions with the nurses in informal interviews or during workshops suggested a thorough understanding of our project motivations.

4.6 *Move* Step

A major concern mentioned by all nursing project members was, that their routine daily work was governed by a tight surgical schedule where normally no free time is available for project meetings. Thus, our change management team agreed on meeting with the nurses outside the normal routine on weekend shifts or alternatively with short-term notice from the nurses during weekdays. However, a precondition was that from each

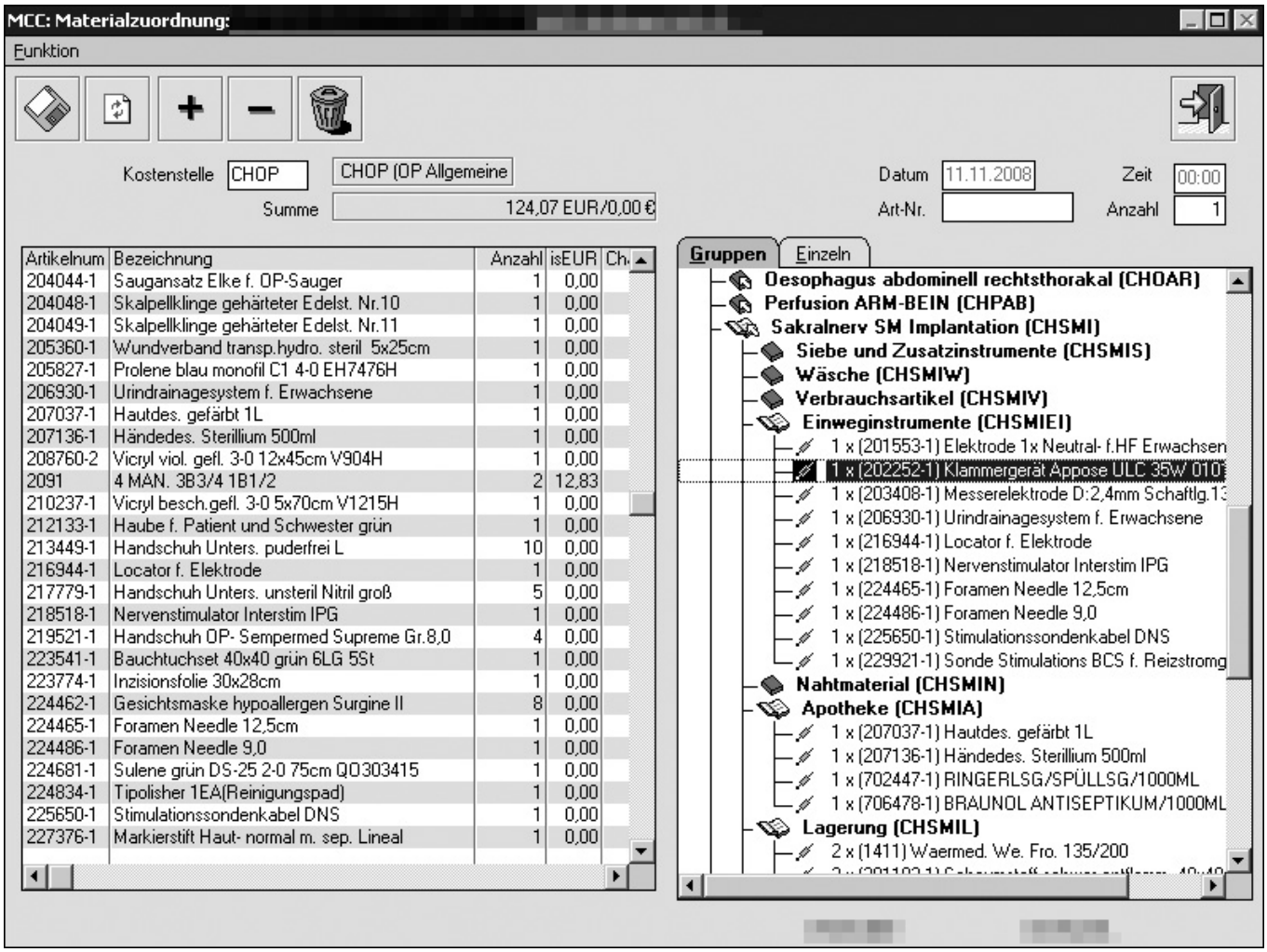

Fig. 3 Screenshot illustrating details of the documentation of a surgery´s material consumption after the CUAS project. Material items have been defined in a hierarchical material catalogue (right part of the screen window) and even aggregated to complete material sets, which can be directly linked to special procedures. All items of this catalog are associated with pricing information from the material management system. Material documentation was performed either by picking complete material sets or single material items from the catalog window and adding them to the list of materials consumed within a particular surgery (left part of the window).

surgical discipline one key person from the nursing team would be appointed to be our direct contact person, responsible for implementing the new documentation concept in their respective operating rooms and who would double as a resource for training and on site support. The offer to be absolutely flexible in our meeting schedule and fully adjust work required in the problematic situation of understaffed nursing teams were important steps in alleviating the nursing teams' concerns over limited time resources.

4.7 *Refreeze* Step

In order to refreeze the newly acquired documentation status after implementing the new documentation concept, we utilized a very dominant red signal within the surgery information system which clearly indicated missing/incomplete material documentation. We further established a to-do list integrated into the regular documentation workflow, which simplified the newly structured documentation. Additionally, individualized reports were created according to staff specifications using the newly documented material consumption data. Finally, the responsibility for the further maintenance of the sets was transferred to the nursing staff, on their request.

4.8 Documentation Statistics

During the b1 phase a total of 283 procedure-related sets were defined by the head nurses. Out of a total of approx. 44,000 medical materials from the hospital's material management system a subset of 3566 materials were identified as relevant materials usually consumed during surgeries. These were assigned to surgery type-related material sets and thus defined within the material catalog of the surgery information system. Produc-

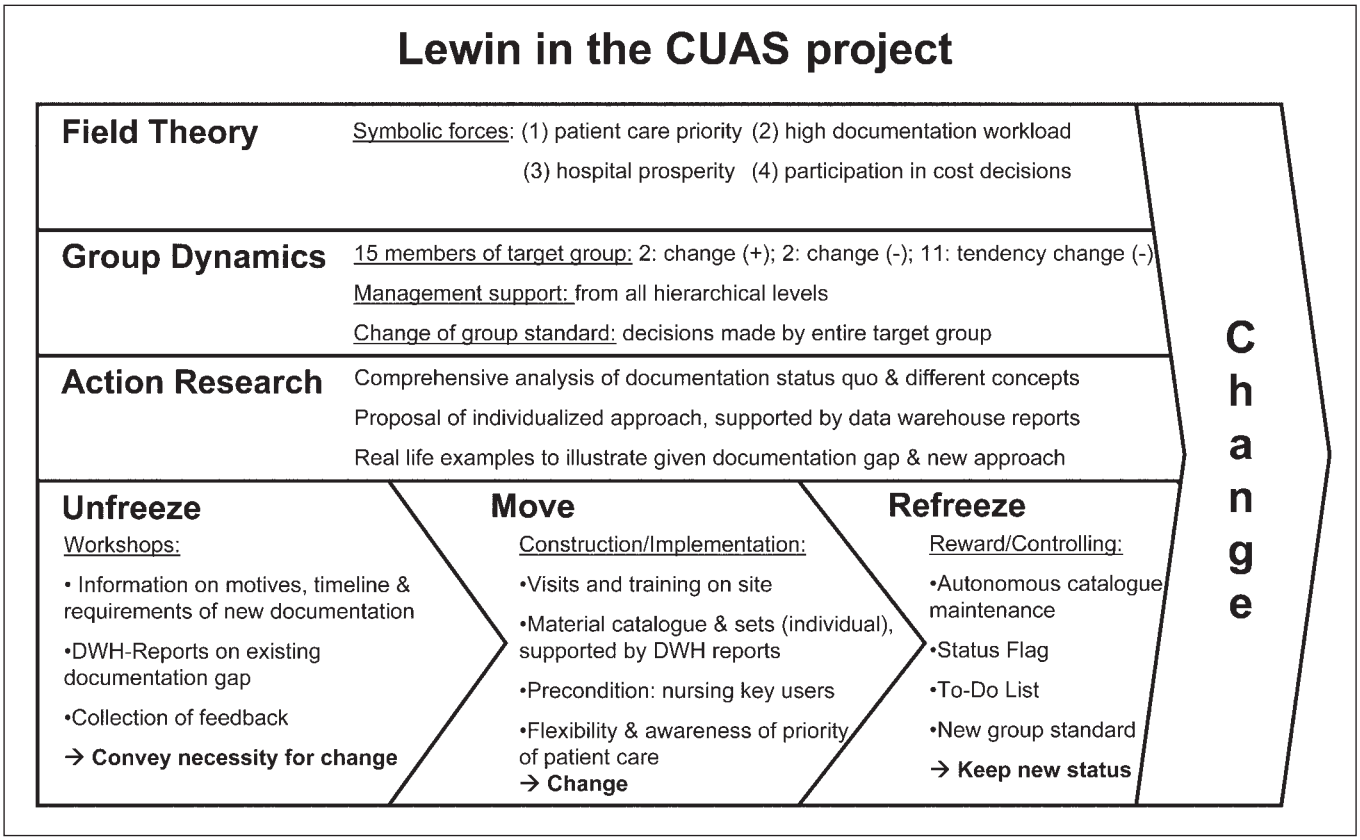

Fig. 4 Lewin´s change management model as it was applied to the CUAS project at Erlangen University Hospital

tive use of this catalog then started at time point b2.

▶Figure 2 illustrates the course of the project between January and September 2008. The top line depicts the total weekly number of surgical procedures performed (I). The steep decrease in calendar weeks 1, 12 and 18 correspond to German holiday periods, where reduced surgery programs are usually undertaken in order to disinfect some of the operating rooms. The second highest line (II) represents the number of "InEK"-relevant procedures (defined by our project team as those procedures which would normally consume materials (e.g. implants) that should be documented, according to the InEK guidelines). Line (V) is marked with filled black squares and, represents the number of InEK-relevant procedures for which valid material documentation is available. This line is zero until the first week after b2, when the new documentation approach was in effect. From week 33 on, this line rises and comes close to the subjectively defined total number of InEK-relevant procedures. Interestingly, lines IV (procedures in general for which structured material documentation from the predefined catalog is available) and III (procedures in general for which structured catalog-based as well as freetext material documentation is available) illustrate that after b2 the concept of the new catalog-based documentation, and its advantages regarding cost transparency and material consumption overview, became so obvious to nursing staff that many of them applied this approach to those procedures for which such a detailed documentation was not directly required within the CUAS project. The small difference between lines III and IV relates to the material documentation in those two surgical disciplines that were not yet able to define their respective material catalogs and therefore still document material consumption as freetext. Fortunately these are two disciplines that do not have large numbers of InEK-relevant procedures.

▶Figure 2 shows that the amount of InEK-relevant procedures for which structured material consumption data were recorded (V) reached a stable level of 64% of all InEK-relevant procedures within two weeks of b2.

This figure, along with the fact that this rate persisted over the next weeks, illustrates a high acceptance of the new approach among the surgery nursing staff. This was also affirmed by informal interviews conducted with all nursing team leaders after the *Refreeze* phase.

5. Discussion

Previous literature encouraged the application of Lewin's CM model to the healthcare sector [10, 17, 20], but to the authors' knowledge none of these projects have comprehensively applied all facets of the model. The results from this CUAS project showed that a project which was at risk of failure after five months could succeed by applying the complete Lewin CM model.

This approach enabled the introduction of a new documentation process in relatively short timeframe and allowed it to be maintained in a stable condition. The initial goal was to reach full material consumption documentation for all InEK-relevant procedures

(II). Within two weeks of activating the new documentation a stable level of 64% was achieved. Detailed analysis of the remaining gap showed that approximately half (18%) could be attributed to the two departments which were still in the *Move* phase due to understaffing. It was further realized that our subjective definition of "InEK-relevant" procedures was overly cautious and that this approach, taken in order to prevent any relevant documentation from being overlooked, resulted in too many procedures being defined as "InEK-relevant". In a later project phase, following direct application of the resulting documentation for the cost unit accounting system, this definition was adapted, so that a smaller number of procedures is actually counted as InEK-relevant than is illustrated by line II in ▶Figure 2. Thus, only a very small gap (<5%) finally remained, relating to materials not yet defined in the catalog or missing materials documentation. The overall percentage of procedures with valid material documentation data (IV) considerably exceeded expectations, peaking at 44%. Subsequent to the change project, and with the advantages of this new approach so apparent, the nursing staff were motivated to document additional procedures beyond the initial requirements. This is further evidenced by the fact that after the *Refreeze* phase the gap between required documentation and actual documentation began to close even more as nursing staff maintain the material catalog and the predefined material sets themselves and directly include newly procured materials within the material catalog of the nursing information system.

Our experience has shown that scheduling periodic workshops with all participants on current implementation status creates strong peer dynamics and provides motivation. In order to identify change-relevant forces, a hospital-related insight is required by the change management team, which should have experience in hospital environments [44]. The intensive support based on different IT components of this hospital information system, mainly the clinical data warehouse reports, proved to be essential for the CM implementation [45, 46], particularly in the action research phase.

Change awareness among the nurses was successfully established during the *Unfreeze* step. Understanding hospital-specific hierarchies and occupational groups was helpful in gaining commitment for our project on all organizational levels, including the medical, administrative and nursing directors.

The *Move* step was accomplished in a relatively short period of time despite given high concurrent workloads and limited computer literacy among some of the nurses. Key to this success was creating high motivation by strengthening the promoting forces and counteracting the opposing ones [12, 13]. Encouraging the nurses' active participation throughout the change process and the interdisciplinary composition of the project team strengthened the promoting forces. In addition, we facilitated the process by providing customized data warehouse reports on procedure profiles and the ordering patterns of materials. The opposing forces were addressed by lowering the perceived additional documentation workload through a flexible approach to individualized material set definitions, covering the varying requirement of different surgical disciplines. A further positive aspect was the CM team's flexibility in offering training sessions and support on site at short notice. The authentic willingness to consider the specific needs of each department and to adapt the implementation strategy accordingly gave our CM team credibility. The public health sector offers few opportunities for financial incentives. Therefore, we had to rely on improvements in the workflow or on empowerment for cost-related decisions through value-added data warehouse reports based on the documented data.

Thus, the data warehouse reports indicating the percentage of correctly documented procedures were an essential tool for the feedback meetings in the *Refreeze* phase. On the one hand they upheld the continuing peer motivation and on the other they implied an external controlling of the nurses' documentation behavior. The request by the nurses to take over responsibility of the future maintenance of the material sets signified both identification with the constructed material sets and acceptance of the routine status of the new documentation approach. Nonetheless, additional feedback meetings and informal interviews were conducted throughout the several phases of the change model in order to gain and keep an impression of the level of acceptance of the new concept. It is also important to note that while the process itself was refrozen, it still needed to offer enough flexibility in order to accommodate the changing materials, procedures and individual patients immanent in the health care sector.

The integration of the change management model into this project strategy is not believed to have required significant additional resources. The number of meetings would have been equal to a traditionally managed project. However, using this time to discover the underlying forces, to address individual concerns and to design flexible solutions proved to be essential CM-driven success factors for the project. Additional effort had to be invested into individualized data warehouse reports, but it delivered an immediate return by boosting staff motivation.

Based on the experiences of this change project, where all aspects of Lewin's CM model were applied: Field Theory, Group Dynamics and Action Research then pursued via the three steps *Unfreeze*, *Move* and *Refreeze* (▶Fig. 4), we have assessed the validity and applicability of this model for healthcare IT projects. The criteria defined at the outset for measuring the Lewin CM model's applicability to our hospital setting (acceptance of the new documentation approach, documentation completeness, long-term documentation quality) were fulfilled.

As one remaining limitation, our current CM project while being interdisciplinary across 15 surgical disciplines, only comprised one occupational group (nursing). Further research is required for projects which have to deal with changes that would affect more than one occupational group within a hospital (e.g. nursing, physicians and administrative staff), presumably resulting in more forces with an even higher potential for conflict. Thus, the relation between increased project complexity, diversity of participants and the possible increase in additional change management efforts would be another open question for future research.

Furthermore, specific hospital characteristics influence the respective steps of the change model and need to be taken into account. Forces identified in this project included both generic aspects (e.g. force 2: perceived high documentation workload) as well as healthcare-specific ones (e.g. force 1: priority of patient care over administrative work). The subsequent attribution of these forces to

change opponents and change promoters allowed a flexible solution to be designed that all nurses in charge would support [43].

Even though a successful process implementation was observed by switching from traditional project management to a structured CM approach, this paper does not provide a formal evaluation of the method in the healthcare IT context.

6. Conclusions

Organizational factors are increasingly recognized to be decisive in the successful or unsuccessful implementation of healthcare IT projects [4–10, 17]. Based on our project experiences, we consider Kurt Lewin's change management approach applicable to the healthcare IT sector without a substantial requirement for additional resources. However, specific hospital characteristics need to be taken into account. Healthcare IT infrastructure (e.g. data analysis tools) can itself provide essential support throughout the CM lifecycle. The application of established CM methods should be encouraged not only for large IT system implementation projects but also for smaller process modifications as described here.

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