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GOVERNANCE IN HOSPITALS - THE CASE OF BUSINESS PROCESS ALIGNMENT

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ABSTRACT

Nowadays, health care organizations are situated in a highly competitive and selective market. They are forced to guarantee high quality and cost-efficient care. On the one hand, process management in health care is linked to the economical aspect, which means the reduction of time and cost efforts. On the other hand, it is also touched by the issue of governance of health care process according to the evidence medicine. The paper contributes to this second aspect. The research question is, how hospitals can be supported in building evidence based clinical processes. A method is presented, which is based on the two central instruments in this context, the Clinical Practice Guideline (CPG) that aggregates evident medical knowledge, and the Clinical Pathway (CP) that describes the clinic-specific processes for defined patient groups. The paper demonstrates the role and potential conceptual modeling for clinical process governance using CPG and CPs.

Keywords

Process Compliance, Governance, Process Management, Clinical Pathways

INTRODUCTION

The structural change in the European and in particular in the German health care system has intensified the implementation of interdisciplinary approaches in medical care. On the other hand, this trend is creating new competitive situations. A new challenge for health care provides is the demand to continuously adapt business information systems to the changing needs and/or potentials of medical evidence. An optimal medical treatment result must be accompanied by an economical use of resources. Within this context, Clinical Pathways (CPs) are discussed both in practice and research as an effective instrument for standardizing and channeling the performance of treatment (Rotter et al. 2008).

As another instrument Clinical Practice Guidelines (CPGs) were created, which act as a regulative regarding the enormous number of medical study results, i. e. the aggregation of medical knowledge into a compact form (AWMF & ÄZQ 2001). Both instruments are tools to standardize clinical knowledge, however on different levels: CPGs are established in general terms and are aimed at the entire medical community. CPs, however, address the staff of a specific medical provider such as a hospital. This means they are adapted to the organizational context (i. e. personnel, techniques, buildings etc.). Unlike CPGs, they are mandatory standards established by hospitals for hospitals.

The point at which the two concepts are beneficial linked to each other lies in the objective to systematically consider the current state of research – consolidated in CPGs – during the creation, maintenance and organizational implementation of CPs (Figure 1). With a targeted derivation of CPs from CPGs real evidence based CPs could emerge. As a side effect of this, evident CPs could in turn be converted into evidence-based IT workflows. If this derivation is not done systematically, conflicts between the path and guideline can arise, which must be identified and eliminated at an early stage (Bögel, Schlieter & Esswein 2011). In this context, (Ollenschläger et al. 2005) have discussed barriers to the implementation of CPGs into CPs: disorientation, a lack of practical relevance, missing availability and inappropriate form of publication of CPGs are just some of the identified elements.

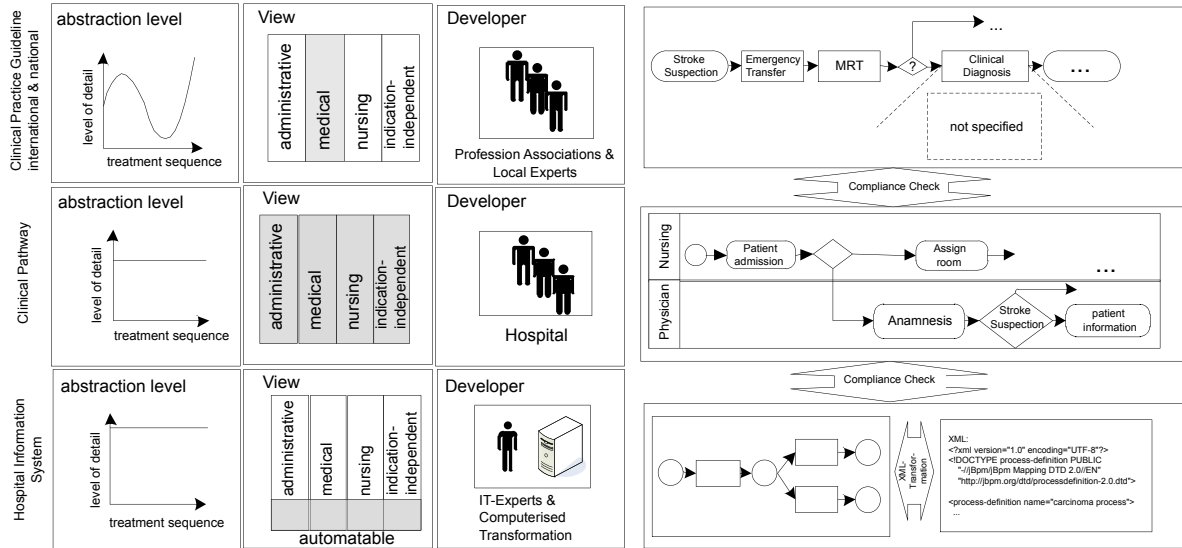


Figure 1: CPGs and CPs in their domain context

The aim of this paper is to counteract this trend. The adaptation task, i. e. the task of deriving specific CPs should be the intention of each CPG. In this work, this is archived through a methodical adaptation support integrated in a CPG. Hence, we reach CPG compliance during the creation process of CPs. With this goal we connect the following research question: how should a method be designed to permit a targeted derivation of CPs from CPGs.

RESEARCH METHOD

The research is related to the design-oriented branch of business informatics (March & Smith 1995; Hevner et al. 2004). The core idea is to create an artifact for resolving an unsolved or an economical as well as a qualitative improvement of an existing solution. The design science research is focused on the creation of useful artifacts in information system context (Offermann et al. 2011). This can be models, methods, implementation and their applications (Hevner et al. 2004). According to the philosophy of design science, artifacts are not the result of a sporadic development. Instead of that, they are planned and constructed systematically like it would be done in an engineering discipline (Winter 2008). Different procedures are published, how to create such artifacts methodically. According to (Peffer et al. 2007), a design science process ranges from problem-centered initiation over the goal-driven solution specification, the design of the artifact to the demonstration and publication of the result. Researchers are free in their way they organize the essential research steps. So, for example, it can be used a Case Study method to develop a research goal, or Prototyping method for the creation of the artifact, or Action Research to demonstrate and evaluate the artifact. In our research, we also use different methods for the different phases of the research process.

The paper is structured as follows: After the description of the research method is given, a short theoretical introduction into the foundations of methods in business informatics is presented. Afterwards, requirements for the method, which shall fill the gap between CPG and CP, are analyzed systematically. Subsequently, a method is presented for adaptation of CPG. The paper closes with a discussion and directions for further research.

THEORETICAL FOUNDATION

Methods in Business Information Science

Modeling methods have been established as a central instrument to support the design of information systems (IS). With the work of Brinkkemper about situational method engineering a different understanding of a method has prevailed: a method is seen as a complex composite of various method fragments (Brinkkemper 1996; Brinkkemper et al. 1999; Harmsen et al. 1994; Ralyté et al. 2004). Following this understanding, Tolvanen defines a method as a collection of well-defined techniques and rules (Tolvanen 1998). Rules define the order and the particular manner the techniques are used to achieve a given goal. A technique is understood as „...a well-defined sequence of elementary operations that more or less guarantees the achievement of certain outcomes if executed correctly.“ (Iivari et al. 1998).

Greiffenberg abstracted from the specific characteristics of a method. He described the systematic procedure the feature of guidance and the explication and tracking of a target type as the feature of the target orientation (Greiffenberg 2004). A

differentiation of methods may be possible regarding the characteristic of target orientation or the scope of the domain. One scope is for instance the conceptual modeling. According to the feature of target orientation, Weller distinguishes between the modeling method and the model-based method (Weller 2010). Modeling methods only provide instructions on how to create a correct, concrete model – most of them are of diagrammatic nature. A model-based method, however, includes not only the model itself as the main output of the method, but also the specification on how to use the model to solve a given problem. This idea follows from the principle of the abstraction-transformation-schema, i. e. by means of modeling a real world problem is transferred into a model space, where the problem-solving process begins. This is followed by the inverse transformation of the modeled solution into the real-world domain (Esswein 1993).

REQUIREMENTS ANALYSIS

To explore requirements, which are linked to an adequate solution of the adaptation problem, firstly, we focus on the goal to involve the estimations of CPG and CP end-user. Therefore, we want to refer to the investigation of (Juhrisch, Dietz, Schlieter 2012), who have carried out a survey with the scope to analyze the usage behavior of CPG and CP as well as suggestions for improvements in this field. The survey was conducted in a regional stroke network with physicians, who intensively used CPGs and CPs. The survey gives some interesting insights, which are taken to formulate empirical grounded requirements (Req.1.*).

(Juhrisch et al. 2012) have researched some questions about the respondents' expectations on CPs, that interestingly all answers in a long list were rated as high), starting from the quality assurance by an optimization of clinical processes and finishing with decreasing the number of re-hospitalizations, which was still averagely ranked as 4.5 on a scale from 1 ("don't agree") to 6 ("fully agree"). So the expectations on CPs are very high, which means that CPs nowadays have high importance in clinical management. The respondents rated negatively the documents, which should support the adaption of CPG. Explicitly named deficits were: The documents were too confusing or unclear so that they were not used and a personal contact was necessary; no systematic introduction into how to use and create CPs, and no support by tools for this. 54% of all respondents see a high potential for enhancing the methodological description, how to adapt the CPG to the local situation. Out of this need, we can formulate the requirement for a methodically support for CPG adaptation (Req. 1).

For a methodical support a formalization of CPGs will be useful. However, too much formalization is counterproductive. A semi-formal approach is therefore the best compromise to achieve a good formalization without restricting the textual freedom too much, to still be able to describe complex medical facts. With regards to the theoretical excursus of methods in business informatics, requirement 1 can be specified in detail. First, the way to code the textual CPG in semiformal form has to be described. This is also confirmed by the survey, in which the respondents were asked for their preference and problems with the actual use of certain ways of representation. A representation by a mixed form of text and diagrams is both by far highest ranked as expected to be useful as well as actually used. Semiformal models are always leave room for further textual annotations, so we come to the following requirement:

Requirement 1.1: The method has to include an adequate modeling language to model CPGs.

Furthermore, the survey results show that almost all respondents (81%) would like to enhance the available process library. This library could contain process templates for creating own CPs. Several other details like explanations on how to use the documents or an enhancement of diagrammatic descriptions and the availability of templates were rated neutrally. However, the need of methodical support implies the need for guidance of the method application.

Requirement 1.2: The method requires a description that guides the application of the method.

To define the responsibilities of single method steps, a role model has to be specified.

Requirement 1.3: The method requires a description of responsibilities for method application.

The high responds concerning the need of CPGs for CP development motivate a further aspect that has be considered, namely the reuse. Core of reuse considerations in science are on the one hand the suitable design of artifacts for reuse, and on the other hand the development of new artifacts with reuse. Thereby, cost and time efforts should be reduced (Fichman & Kemerer 2001; Sherif & Vinze 1999). Furthermore, reuse supports the dissemination of Best-Practice. In context of CPGs and CPs, reuse promises a better acceptance for CP adaptation; because the end-user (e. g. path developer) would be supported in creating CPs. CPGs have been built for a wide range of users. Every hospital with its numerous care units is a potential adopter. Thus, the cost of CPG preparation are less than saving that can be generated by guiding the CP adaptation. So we come to the following requirement:

Requirement 1.4: The method requires mechanism to describe reuse information. This reuse aspect must also be part of the procedure of the method.

In addition to these requirements, which could be found empirically, it is necessary to consider conceptually grounded requirements. This means requirements, which are the result of the characteristics of CPG and CP. For this investigation, we want to refer to the work of (H. Schlieter & Esswein 2010). They analyze both concepts in detail and describe issues of an adaptation process. These issues can be transferred to requirements that a prospective method deals with. In Table 1, the issues found by (H. Schlieter & Esswein 2010) are depicted in left column while the derived requirements are depicted on the right hand.

Issues of CPG Adaptation Process (Schlieter & Esswein 2010)	Derived Requirement
1. More than one CPG can be relevant for the CP development.	Req. 2.1: The method requires the involvement of several CPGs.
2. There are no structural standardization for CPGs.	Req. 2.2: The method must not assume a predefined structure.
3. There are no modeling languages standardized whether for CPGs nor for CPs.	Req. 2.3: The method has to be able to use different modeling languages for modeling of CPG and CP.
4. CPGs are more generally than CPs.	Req. 2.4: The method must allow to model different levels of abstraction.
5. CPs comprise more aspect than CPGs.	Req. 2.5: The method should allow the integration of other aspects when the CP is built.
6. CPGs are only partially aligned with the treatment process, whereas CPs describe the treatment process consistently in detail.	Req. 2.6: There is need of a mechanism, which transfers the fragmented recommendation of CPG into a continuous process.

Table 1: Summarization conceptually grounded requirements

Summarization of Requirements

In summary, the requirement analysis leads to ten main requirements. We grouped them regarding to their source, in empirical ground and theoretical grounded requirements (Table 2). The requirement analysis shows the need for a methodical adaptation of CPs with help of CPGs. Requirements 1.1 to 1.4 clarify in detail, what is meant by methodical support. By 2.1 to 2.6, requirements are defined which are linked to the conceptual characteristics of both concepts.

Requirements	
Empirical grounded	
Requirement 1.1	The method has to include an adequate modeling language to model CPGs
Requirement 1.2	The method requires a description that guides the application of the method.
Requirement 1.3	The method requires a description of responsibilities for method application.
Requirement 1.4	The method requires mechanism to describe reuse information. This reuse aspect must also be part of the procedure of the method.
Theoretical grounded	
Requirement 2.1	The method requires the involvement of several CPGs.
Requirement 2.2	The method must not assume a predefined structure.
Requirement 2.3	The method has to be able to use different modeling languages for modeling of CPG and CP.
Requirement 2.4	The method must allow to model different levels of abstraction.
Requirement 2.5	The method should allow the integration of other aspects when the CP is built.
Requirement 2.6	There is need of a mechanism, which transfers the fragmented recommendation of CPG into a continuous process.

Table 2: Summarization conceptually grounded requirements

Consequences for Methodical Support

Both parts of the survey demonstrate the usefulness of standardized guidelines — in the form of CPGs — for the creation of hospital-specific CPs. A high usefulness was demonstrated with respect to the medical content of the CPGs to ensure a high quality of medical treatments. When it comes to problems with the support, communication problems as well as too high efforts when implementing and executing CPs are ranked as highest.

To deal with the costly implementing processes, a higher formalization of CPGs are necessary, but even more clear guidelines on how to use CPGs to derive CPs are necessary. At present, the implementation and execution is mostly done manually due to the high complexity, and lacks clear guidelines for how exactly to derive CPs from CPGs as well as clear guidelines for the form of CPs.

Beside the human-centered, manual CP implementation, there is a plurality of approaches, which focus on a high formulization of CPG rules to transfer the non-formal rule-system of the CPG to the decision support systems (DSS) of the HIS. Such methods are for example ProForma, GLIF, GUIDE, or Prodigy (Peleg et al. 2003). The DSS supplements the CPs within a hospital. Therefore the HIS has to be able to interpret the formal language and to combine it with the specific state of the patient documented in electronic health records (EHR). The approach of that transformation of CPG into coded information (CI) structures is thus rather an extension of the paths than a methodology of a systematic transfer and organizational implementation. These approaches do not help to adapt CPGs more effectively to local structure. Thus, they are not suitable to deal with the addressed problem of building evidence-based pathways in a methodical way.

A further approach, which is actually less investigated, is the reference model-based approach. First experience with this approach are made by (Jacobs et al. 2007), who rebuild the treatment algorithm of a CPG with the help of an activity chart of UML. Thus process description was labeled as reference model of CPG. However, (Jacobs et al. 2007) do not considered requirement 2.1 to 2.6. Thus, this approach reflects more or less an idealistic state, which is not real; but the idea to use conceptual models enriched by reuse information seems a very promising approach, because on it would be possible to formalize CPG and leave room for textual notices as well as to integrate instruction for adaptation. This aspect is also poor considered in previous works. In the Conclusion of the related work, it seems the reference model-based approach has the highest potential impact to foster the development of evidence CP in the actual situation (Figure 1).

METHOD FOR ADAPTATION OF CLINICAL PRACTICE GUIDELINES

In the further course of this paper, an overview of the Method for Adaptation of Clinical Practice Guidelines (MAC) and the design rational shall be given. On the basis of the results of requirement analysis (cf. Requirement Analysis) and the theories of method (cf. Theoretical Foundations), we derive a framework that contain the essential fragments, which have to be developed, and their interrelationship.

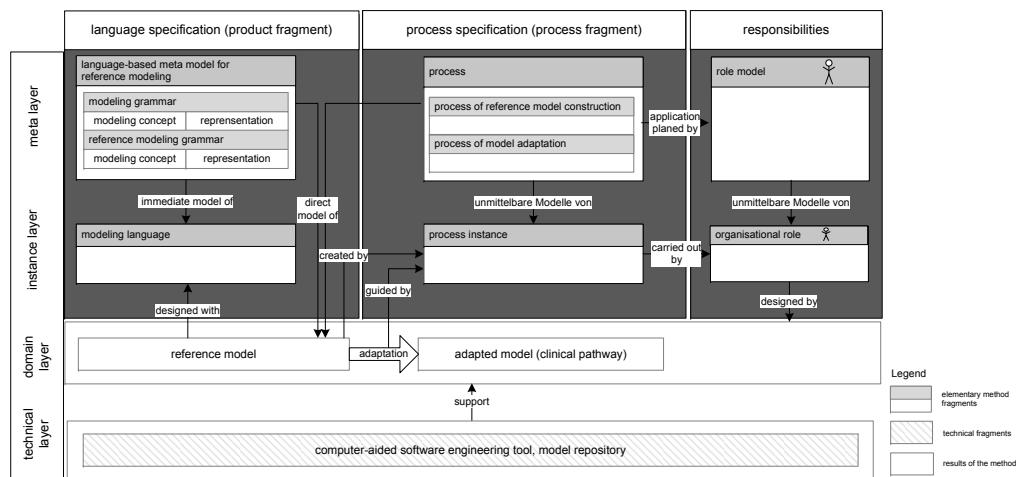


Figure 2: Fragments of the method

As depicted in Figure 2, it is composed of product fragment that contains the modeling language description (left-hand side), the description of method application (middle), and the responsibilities in role model (right-hand side). Emphasis of method presentation is on mechanisms and the role of diagrammatic descriptions in a model-based procedure as well as the implementation of techniques for model re-use. For demonstration, we use the example of breast cancer therapy and the concerning German CPGs.

In conceptual (information) modeling multiple perspectives are used to reduce complexity (Balzert 2009). In different views parts of the object system are narrowed in order to gain a better understanding of system components, structures and mechanism of action. The purpose of modeling is determining the characteristic properties of views (Darke & Shanks 1996; Frank 2002). The modeling of CPGs is limited mainly to the process-oriented aspects of medical treatment. This process is known as clinical algorithm describing a solution of a medical problem in a finite number of interrelated steps (Tuddenham 1968; Barak et al. 1992).

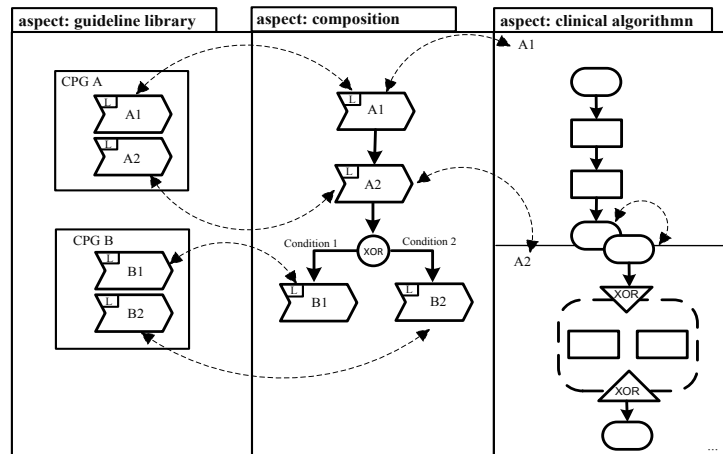


Figure 3: Aspects of the method

In order to meet the requirement 2.2 – support of the fragmentation of the recommendation of a CPG – the central view of a clinical algorithm is supplemented by the view of CPG library view and composition view (Figure 3). The composition view, however, arises from the idea of component-oriented reference modeling. Within the CPG library view all relevant CPGs are included associated to the modeled guidelines fragments.

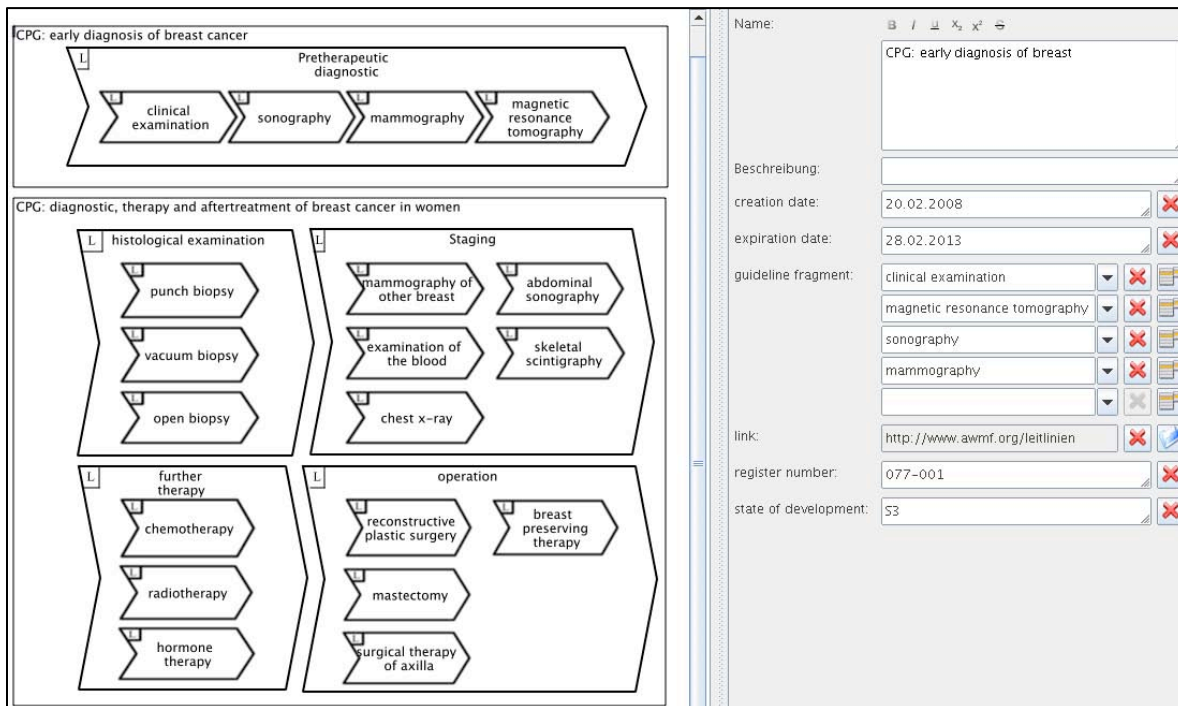


Figure 4: Example of guideline library for therapy of breast cancer

Any CPG in the CPG library view is symbolized by a rectangle, whereas guideline fragments are represented by a broad arrow. To model the membership of a fragment, i. e. its association to a CPG, guideline fragments are embedded in the

rectangle symbol of the guideline. For an example of a CPG library see Figure 4. Every CPG and fragment in this diagram is additionally information linked, such as development state, creation dated or expiration date (right-hand side, Figure 4). The CPG fragments, which are loosely recorded within the CPG library, can be modeled in accordance to their possible combinations using the Composition View. The internal implementation of the components is in turn mapped into the view of the clinical algorithm. According to table 3 each viewpoint is assigned to a presentation type.

Aspect / View	Purpose	Presentation
CPG Library	<ul style="list-style-type: none"> - Acquisition of CPG fragments - Allocation of CPG fragments to the different CPGs - Definition of criteria for inclusion and exclusion 	Guideline diagram
Composition	<ul style="list-style-type: none"> - Declaration of meaningful combination variants between CPG fragments - Definition of selection criteria - Integration of CPG fragments of different guidelines 	Composition diagram
Clinical algorithm	<ul style="list-style-type: none"> - Detailed description of a care process, starting from a patient's condition 	Process diagram

Table 3: Aspects and their purpose

The process model of this method provides the following major activities:

- Structuring the content of existing guidelines within the CGP Library
- Specification of CPG fragments regarding their compatibility within the composition view
- Adaptation of clinical algorithm using re-use recommendations
- Combination of adapted algorithms to a single pathway

We make use of the reference element to include text passages of a CPG into a CPG fragment in the CPG library. The same applies for the models of the clinical algorithms. In addition, inclusion and exclusion criteria can be specified. Inclusion criteria for the clinical examination cover, for instance, the existence of a positive finding discovered by touch or ultrasound examination.

The combination variants of CPG fragments are following from the composition view. Hence, the composition view reflects the dependencies between CPG fragments. As a composition we define a sensibly coordinated linkage of reference model components (RMC), i. e. loosely coupled model components with an application potential that is not fully known at design time (vom Brocke 2003). Similar approaches are being pursued with the propagated reference process building blocks (RPB) for the design of business process models or certain techniques like aggregation (Lang 1997; Becker, Delfmann & Knackstedt 2004). The basic idea is inherent in each of the approaches: organization-specific process models are designed by selecting and coupling of freely combinable sealed process parts. The merging of each RMC must consider certain constraints, e. g. the possible correspondences of RMCs.

The coupling of fragments may be specified similarly to the basal connector types: sequentially, parallelly (AND operator), with limited selection (OR operator) or with an exclusive selection (exclusive-or operator) (Lang 1997). The sequential order of fragments is represented by a simple directed edge. Conditional or mutually parallel combinations are displayed using the fragment connector. The language is supplemented by the concept of free connectivity (AND-region, Figure 5). It is used, if no fixed flow rules are specified in the CPG.

In Figure 5 the composition diagram for the supply of breast cancer is shown. On the left sides diagnostic fragments are listed in sequential order, whereas on the right side therapeutic fragments are shown, which are often part of a region element. For example, it is shown that the mammography follows on from the clinical examination. It continues with the breast sonography together with the magnetic resonance tomography represented in a free connectivity element that is annotated with an AND connector. This indicates that both clinical diagnostics ought to be included into the CP and may be the next step of the mammography. It would be followed by a histopathological examination (biopsy) to support the clinical findings – performed as punch, vaccum or as an open biopsy. The latter is mandatory for the CP. Considering the vaccum and punch biopsy at least one fragment must be included in the CP (OR+). The further steps of breast cancer care are similar to that.

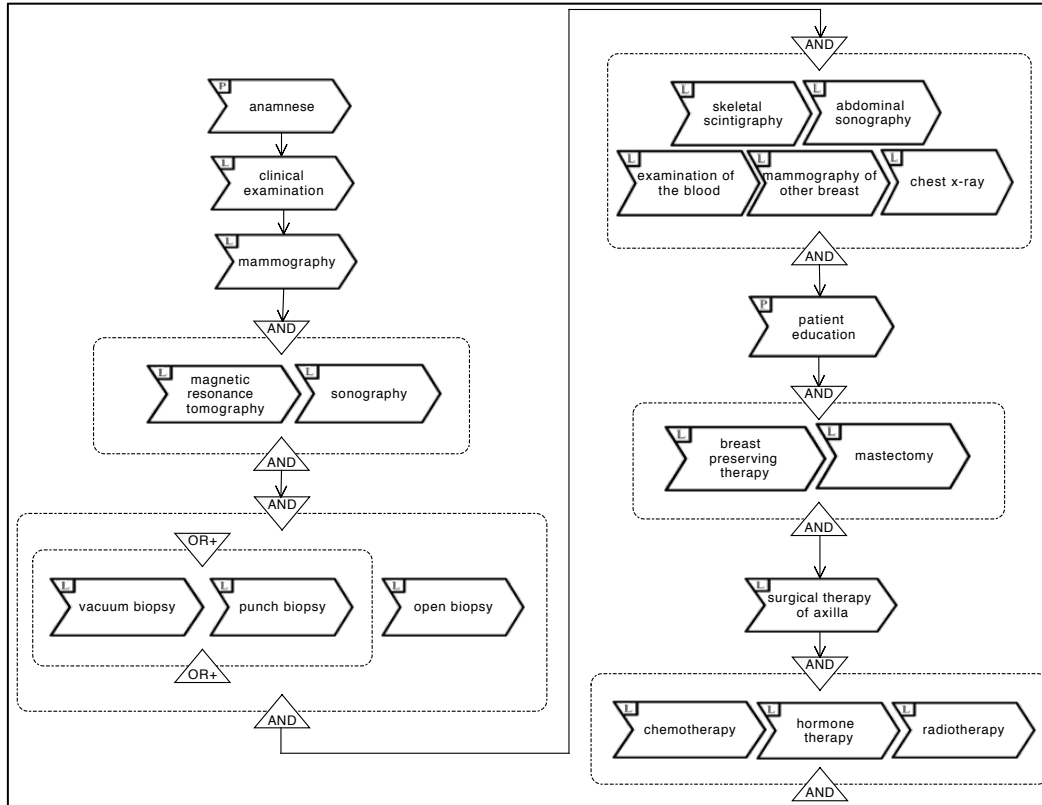


Figure 5: Example of composition diagram for therapy of breast cancer

If a CPG describes treatments that are alternatives to each other and/or depend on certain structural characteristics of the hospital they can be added using the complex fragment connector. At the end of the modeling of the composition diagram, we add CP fragments as placeholders that will be replaced by detailed descriptions during the path design activities. The CP fragment “anamnesis”, for example, will precede the CPG fragment within Figure 5. The anamnesis is already mentioned in the guideline, but remains unspecified. All three views are interrelated over integrative model concepts (dashed arrows, Figure 4). The inner perspective of the CPG fragments is again represented in the view of the clinical algorithm.

To assist the model creator during the adaptation of a CP we integrate techniques for reuse in form of recommendations into the clinical algorithms (see Req. 1.4). In conceptual modeling, reference models are an interesting approach since they provide so-called construction techniques. These can be used to represent instructions and rules for reuse. Reference models provide concepts to identify generic model elements and/or model parts and they describe the construction techniques on how to adapt them to local conditions (Delfmann 2006; Schlieter & Esswein 2011). The selected construction techniques determine the degree of freedom for the adaptation of the reference model. Thus, the creator of the reference model must conceive all forms of adaptation already at design time of the configuration. The introduced construction techniques must pay particular attention to the comprehensibility of their notation for the physicians. Otherwise they prevent the access of the domain experts to the model world. The approach is based on the concepts of the reference model annotation (recommendation for a group of elements) and the reference model region (aggregation of model elements) (Schlieter & Esswein 2011).

The designation of the adaptation note is established via a formal expression. It is the central part of the labeling of the reference model annotation (Schlieter & Esswein 2011). The expression starts with the kind of adaptation technique. Depending on the chosen technique this is followed by further structuring information to visualize related configuration alternatives or information, whether an extension or shortening of the selected model section is recommended. This is, e. g., the case for the concept of specialization. Thus, with the aid of a „[-]“-symbol models can be – hospital-specifically – reduced and extended with a „[+]“-symbol. The dichotomy into the “adaptation type” and the “adaptation note” allow a specification of the type of adaptation to a formal expression. On the other hand, an explanation is given with the help the note element that is providing additional information in textual form.

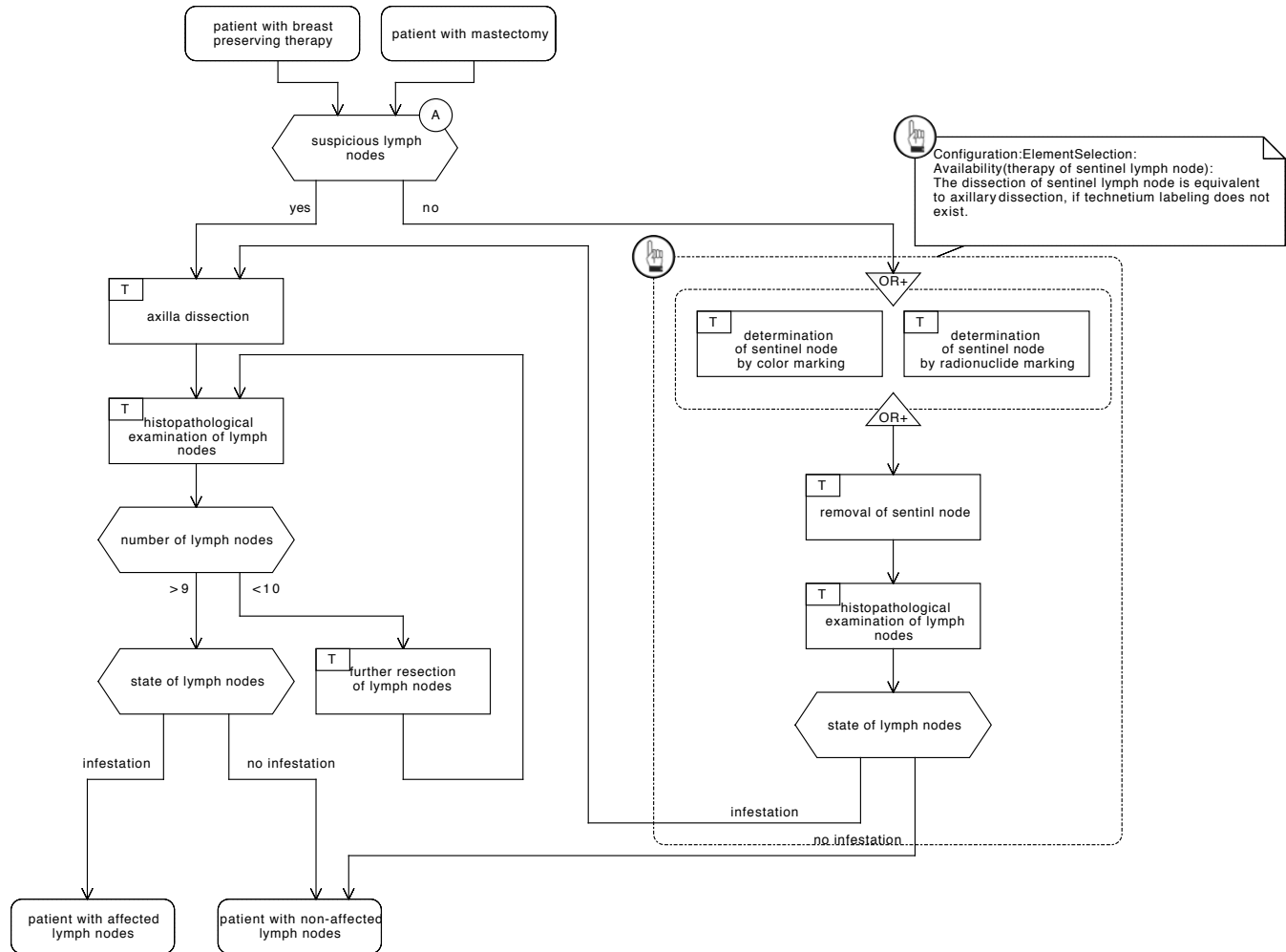


Figure 6: Algorithm for surgical therapy of axilla

The mechanism of aggregation and the configuration type “model type selection” are not included in the perspective of clinical algorithm. The composition of individual CPG fragments is subjected to the composition view and thus omitted due to granularity demands. To be still flexible in adapting to the target language we recommend the use of model migration approaches. Figure 6 outlines the way a construction technique could be integrated into a clinical algorithm. A region is shown which is grouping the associated element. Furthermore, by the annotation of a formal expression it is described how this algorithm can be implemented depending on the technetium labeling method for sentinel lymph nodes. In the existent reference model research a mechanism to explicitly express unwanted forms of adaptation has yet not been considered. This mechanism could, for example, mean that outdated treatment methods could be labeled as obsolete in GPGs (AWMF & ÄZQ 2001). Analogies are found within the pattern research, where such negative examples are referred to as anti-pattern. This basic principle is to be transferred to MAC. Therefore, the concept of “prohibition notice” has been introduced into the method and is used for grouping of model elements. A stop sign icon emphasizes this group. Associated reference model annotations provide textual information for design of the grouped elements. They are also used to formulate conditions or constraints for an adaptation that represent an improper application.

Prohibition information can be incorporated in various ways into clinical algorithms. In the case of a conditional prohibition note, they can be integrated directly into the control flow of the clinical algorithm. These algorithm could be adapted if the condition is not fulfilled. An absolute prohibition means that the incorporation of model elements into the target model depends on the scope of the ban. If the prohibition is of considerable extent, a supplemental presentation should be included in the clinical algorithm and is referenced using an annotation element. A small ban can be directly integrated into the correct clinical algorithm. It is modeled at the level of the corresponding model element; without embedding it into the control flow.

DISCUSSION AND FURTHER RESEARCH

The central research question of the paper was, how medical knowledge of CPGs can be used methodically to adapt CPs. This leads to the sub-questions, how CPG can be coded and structured by semi-formal models, and how can the adaptation of this information models supported. Therefore, we give an insight into a multi-perspective modeling approach – the so-called MAC method. The different views of the modeling approach help to structure the CPG in the first step, and to define possible adaptation result in the second step. In the third step, the clinical algorithm can be specified including adaptation hints described in a formal adaptation term. The presented method extends the modeling language grammar by reference model concepts, which allow a purpose-based modeling of re-use recommendations. Moreover, the possibility to use different types of construction techniques allows utilization of re-use recommendation depending on the rigorousness of a recommendation.

The economic relevance of the work results from the qualitative improvement of the treatment due to governance of CP by CPG. So, the method fosters the development of evidence-based clinical pathways. Savings are made because re-use support of the end-user. This reduces the creation time of CPs and the efforts that have to be made for an individual evidence investigation. Initial interviews with physicians confirm a positive trend in terms of cost savings. At first, these effects have to be analyzed in future research by a case study (Yin 2003). Afterwards, a broader empirical investigation can be carried out. From the scientific viewpoint, this topic provides a further use case to investigate empirically the usefulness of reference model. Until now, there is done only little work done analyzing this. The boundaries of the presented method are set by the quality of the underlying CPGs. The method only extends existing guidelines. If a CPG only consists of structural advises or does not deal with the algorithm of treatment, it will be impossible to model them. Therefore, the medical associations are responsible for definition of quality standards and the compliance with them.

The method may be carried over to other application areas. For example, in case of health care network, we often see big hospitals that are in partnership with small regional hospitals for different indications, such as stroke, diabetes or cancer. The method would help to define rules for treatment within the network and it would support the regional hospitals to create their own CP in compliance with the rules of the network. However, they have enough space to adapt them in consideration of the structural conditions of the clinics. The care plans of health insurance are another example for application of the method. These care plans can be extended by the guideline models, which defines the minimal process quality a physicians have to guarantee being a partner of the plan. Transferring the basic paradigm of the approach to the field of virtual organization has to be analyzed in the future. It may help to build normative models to govern agile defined business processes. In addition to the transfer of the whole method, single method fragment can be integrated in other methods, such as the reference modeling concepts. Further research should be done on the field of flexible care flows, where different CPs have to be integrated to one treatment. This is e. g. necessary to treat multimorbid patients with more than on diagnosis.

We want to finish the presentation of the method for clinical process governance by an outlook on the further directions, which semi-formal approaches will have in clinical area. With the help of the method, it is possible to build up a knowledge base for all medical process knowledge that contains CPG content as well as basic medical knowledge. Thus, this knowledge base will replace a lot of manual investigation of physicians. Furthermore the treasure of medical knowledge would be accessible for everyone.

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