A toolbox for the development and implementation of value based care pathways

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A toolbox for the development and implementation of Value Based Care Pathways

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Abstract—In this paper, we present a method for the development and implementation of Value Based Care Pathways. The method is based on an integration of three existing care pathway development methods, the concepts of the Value Based Healthcare paradigm, and practical knowledge obtained from interviews with experts in care pathway development in practice. This paper furthermore presents an interactive toolbox that facilitates the use of the method in practice and an expert evaluation of the toolbox.

Keywords—value based healthcare, care pathways, business process identification

I. INTRODUCTION

The healthcare domain is currently facing many challenges. Costs are rising and budgets are cut while delivering high(er) quality of care is more important than ever. The aging population puts the system even more under pressure by increasing prevalence of chronic diseases that require complex care that is coordinated over various care providers, crossing the functional borders of areas of specialties and organizations. Solutions proposed to cope with these challenges are amongst others the reengineering of care processes, the effective use of information technologies and the coordination of care across patient-conditions, services and locations over time [1].

Since the 1980s, care pathways are used to reorganize clinical processes into process-based care structures with the goal to increase efficiency and improve quality of care through the standardization, optimization and monitoring of the care process [2], [3]. Mostly these pathways are developed from a very functional perspective, only involving the diagnosis and/or treatment process of one department. They do not coordinate care over the full cycle of care that involves various care providers.

Besides the adoption of care pathways, healthcare organizations are also increasingly embracing the Value Based Healthcare paradigm, as introduced by Porter and Lee [4]. The paradigm stresses on the need for the healthcare system to change from a fragmented system into a patient-centered coordinated care delivery for each particular medical condition in order to stop the rising healthcare costs and start increasing quality. For each condition, care providers must have the common goal to achieve the best outcomes at the lowest costs, i.e. the highest value for patients. The Value Based Healthcare paradigm, however, does not yet comprise any practical implementation methods.

To overcome the abovementioned gaps, this paper proposes a practical toolbox for the development and implementation of Value Based Care Pathways (VBCP). Towards that end, the proposed toolbox:

1. integrates existing care pathway development methods and extends their scope to a cross-departmental or even cross-organizational perspective,
2. translates and operationalizes the strategic concepts of Value Based Healthcare to the more practical level, and integrates them into the method,
3. enriches the method built on the first two steps with practical experience, tools, and techniques for each step.

The resulting toolbox is based on the findings from literature and complemented with outcomes of interviews with experts from the theoretical, practical and managerial field. The utility of the resulting toolbox is evaluated by experts.

The remainder of this paper is structured as follows: first the theoretical background is discussed, encompassing an introduction to value based healthcare, value based care pathways and existing methods to develop care pathways. Then the research methodology is discussed and the toolbox is presented. The paper is concluded with an evaluation and conclusions.

II. BACKGROUND

Although many definitions exist, a care pathway – also known as a clinical pathway or a care map [5] – is often defined as an intervention for the mutual decision making and organization of care for a well-defined group of patients during a well-defined period [6]. A care pathway can be considered as a description of the patient care process, which models patient’s progress from admission through investigation to diagnosis, treatment and finally discharge or referral [7]. The aim of a care pathway is to enhance the quality of care by reducing variability in clinical practice, and optimizing the use of resources, thereby improving patient
outcomes, promoting patient safety, and increasing patient satisfaction [8], [9].

Care pathways are a popular means to increase care quality and patient satisfaction through standardization of the healthcare process [6]. They can be seen as an application of process thinking to the improvement of patient healthcare [10]. Several methods exist to develop and implement care pathways [3], [7], [9], [11], [12]. They are also used in continuous improvement efforts in healthcare such as described by [13]. Current research investigates also approaches and methods to assess the level of maturity of care pathways in healthcare organization and to identify aspects for improvement [14], [15]. Although these works provide much needed foundation for the development, use, and improvement of care pathways, they do not emphasize on taking the patient-centric view by particularly focusing on the value generated for the patient.

Another development in the management of healthcare is the Value Based Healthcare paradigm. The goal of Value Based Healthcare is to improve healthcare by focusing on achieving the highest value for patients; from a financial perspective, as well as from a health status perspective and a patient and employee perspective. Value in this context is defined as “health outcomes achieved that matter to patients relative to the cost of achieving those outcomes” [4]. For determining the outcomes for a patient, the full care chain is considered, involving several healthcare providers and crossing organizational borders.

To enable the organization of care around patient value, this paper proposes to combine the Value Based Healthcare theory with care pathway development methods into Value Based Care Pathways. Based on earlier definitions for regular care pathways in e.g. [4], [5], [16]–[18] we define a Value Based Care Pathway (VBCP) as “a description of the organization of the full set of activities of the multidisciplinary team performed over the cycle of care for a group of patients with a particular medical condition based on evidence based medicine (EBM) guidelines with the goal to achieve the highest value for patients”.

Fig. 1. Porter’s outcome measures hierarchy [16]

Porter [16] defined and ordered outcomes for patients in a three-tier hierarchy, comprising “Health status achieved or retained”; “Process of recovery”, and “Sustainability of health” (see Fig. 1). Furthermore, measurement of value should incorporate all services or activities that collectively determine the results. This way providers are collectively accountable for the value. To measure the costs to achieve these outcomes, it is important to measure them around the patient [16]. The goal of cost measurement is to establish the total costs per full cycle of care. However, a concrete and complete method to translate this paradigm to practice is still missing.

III. METHODOLOGY

The methodology used for the development of the VBCP toolbox followed a design science approach [19], [20]. Fig. 2 illustrates the research procedure followed with respect to the core phases of the design science research [20].

In the first phase, available literature on the development and implementation of care pathways and on Value Based Healthcare was studied to obtain the current state of the art on methods and tools in both areas. Findings from the different areas were compared and integrating leading to a theoretical framework (version 0).

Subsequently, nine experts in different sub-domains of healthcare were interviewed to complement the theoretical framework from the literature with knowledge from practice:

- Two experts in healthcare research, who have developed theories on value based care pathways. They provided insight into these theories, and helped to create a strong conceptual basis for the proposed value based care pathways development method.
- Four experts, who have applied the theoretical aspects of value based care pathways in practice. They signaled issues that are encountered in practice, and indicated key features that need to be incorporated in the toolbox to enhance its usefulness and usability in practice.
- Three experts, who were holding management positions in healthcare institutions. Although these experts do not use value based care pathways in their daily work, they have a strong background on organizational change management and are concerned with the development or implementation of value based care pathways from the strategic and governance perspective.
The results of the interviews were coded, compared and integrated into an initial version of the toolbox, version 1. This version of the toolbox was then validated through a walkthrough with two experts: a project leader transmural care, and a medical manager. A developer of the toolbox showed and explained the toolbox step by step to these experts and asked for feedback. The comments of the experts led to a refined version of the toolbox, version 2. Finally, the toolbox was applied in a practical case - the development of a VBCP for the thoracic pain treatment process in a Dutch regional hospital - and its utility was evaluated through structured interviews with three experts (Section V), different than the ones that provided input to the development of the toolbox. Their feedback was used to improve and finalize the toolbox (version 3).

Because of space limitation, this paper reports only on the main steps: the theoretical framework (version 0), the final version of the toolbox (version 3) and the evaluation through the structured interviews with experts, as is indicated in bold shapes in Fig. 2.

IV. THE VALUE BASED CARE PATHWAY (VBCP) TOOLBOX

In this section, the toolbox for VBCPs is presented. The aim of the toolbox is to give project leaders who are concerned with the development and implementation of value based care pathways a stepwise handhold in order to reach their goal. First, the conceptual basis of the toolbox in terms of the integration of methods from theory and practical guidelines is explained, followed by the final version of the toolbox and the presentation of an interactive representation of this toolbox.

A. Version 0: Theoretical framework

The VBCP toolbox builds on and integrates several complementary research results found in the literature. Through a systematic literature review, we found a number of methods that support the development of care pathways [3], [9], [11], [12]. We selected the 7-phase method by Vanhaecht et al. [3] as a foundation for our VBCP toolbox, since it provided the most elaborate guidelines. The method describes seven phases that a care pathway development effort goes through. These phases are adopted in our framework and extended with a preliminary phase (0) to cover the strategic decision making of the healthcare organization in adopting the Value Based Healthcare paradigm (see also Fig. 3):

(0) **Preliminary phase**, in which the healthcare organization makes a strategic decision to adopt the Value Based Healthcare paradigm. This phase does not need to be repeated for every VBCP effort, once the Value Based Healthcare paradigm becomes a part of the organization’s strategy and culture.

(1) **Screening**, in which the medical domain is determined and a project-owner is appointed.

(2) **Project planning**, in which the scope is further narrowed down to a specific medical condition within the area of practice. In addition, the project teams are composed, support is gathered, and a project plan is developed.

(3) **Diagnosis and goal setting**, in which the current care processes are analyzed in order to establish the patient outcome measures and to get a view on the activities that take place over the full cycle of care and their contribution to patient outcomes.

(4) **Development**, in which the VBCP (defining the sequence and timing of care activities) is developed (based on the results from phase 3). Cost calculations are made to determine the costs to deliver certain patient outcomes.

(5) **Implementation**, in which the VBCP is tested and evaluated through a pilot. When the outcome is positive, the VBCP is implemented in daily practice. Otherwise, if adjustments can be made based on the available information, the process goes back to Phase 4, or if additional information is required, it goes back to Phase 3.

(6) **Evaluation**, in which post-implementation outcomes are evaluated every year.

(7) **Continuous follow-up**, in which the areas for improvement are identified based on the annual evaluation. Furthermore, in this phase awareness for compliance to the VBCP and a culture that encourages continuous improvement is established.

The original 7-phase method by Vanhaecht et al. furthermore describes per phase what goals the phase should achieve, which methods can be used in each phase to achieve the objectives, and how each phase is evaluated. These elements of the description were adopted. The other methods for care pathway development that we found in literature [9], [12]...
more generally describe how care pathways should be created and only state a goal of each of their steps with little explanation. They were used as a validation and extension of the structure adopted from Vanhaecht et al. Based on [12], for example, the goal to select an important area of practice was added to phase 1. And, based on [9], the goal to evaluate time estimates was added to phase 6. In order to include the Value-Based Healthcare view in the toolbox, the literature on this paradigm [4], [16], [21] was reviewed and used to extend each phase in our framework with specific value based goals. The resulting theoretical framework can be found in Table I and includes a reference to the sources for each phase/goal.

This table shows that the framework by Vanhaecht et al. was extended with specific value based goals. For instance, in phase 4, the development of a care delivery value chain (instead of the focus on a single department) and the determination of patient outcome measures were added, and the goals of phase 6 were extended with the evaluation of cost estimates.

B. Version 3: final version of the toolbox

The theoretical framework was further expanded to describe the content of each phase in detail. To structure the additional information, the elements needed for a good healthcare process (re)design project as identified by Vanwersch et al. [13] were used: aim, actors, input, output, techniques and tools. This led to the following descriptive elements for each phase:

- The Goal section describes what the aim of the phase is and what needs to be achieved before going to the next phase (cf. the goals element in Vanhaecht et al’s method).
Phase 3: Diagnosis and goal setting

**Goals:** This phase has two goals:
1. Review and analyze the current care process from four perspectives: (i) the own team and organization, (ii) patient and family, (iii) available medical evidence and legislation, (iv) external partners.
2. Define patient outcome measures for the medical condition and review, if available, the current scores for these outcome measures.

**Techniques:**
1. The techniques that can be used in order to reach goal 1 are:
   - Own team and organization. In order to get a view on the current activities taking place in the care process, involved care providers and bottlenecks, the following techniques can be used: dossier analysis, process mapping, bottleneck analysis, document analysis, surveying of team members, focus groups, questionnaires, simulation, discipline-task matrix, value stream maps, failure mode and effect analysis. The analysis of the care process helps during the identification of relevant outcome dimensions and can be used for linking particular outcome dimensions to specific processes from which they arise.
   - View of patient and family. In order to determine which outcomes are important and relevant to patients, interviews or focus groups with patients and their families or with patient representatives from patient associations or patient advisory councils, can be held. Other techniques are a walk-through or shadowing of a particular patient.
   - Available medical evidence and legislation. A document analysis of (national and international) EBM-guidelines and standards, evidence based key interventions, benchmark outcome measures (e.g. ICHOM) and legislation is carried out. To study best practices, it is also interesting to interview or visit other national or international care organizations to discover how they have organized their care processes.
   - External partners. Besides the participation in the working group, interviews or questionnaires are held with first, second or third line care providers, such as GP’s, home-care givers, a quality coordinator, etc. about the coordination and cooperation.
2. The techniques that can be used in order to reach goal 2 are:
   - To determine the group of relevant patient outcomes, the following principles can be considered in determining the group of relevant patient outcomes: [1] Outcomes should include the health circumstances most relevant to patients; [2] they should cover both near-term and longer-term health, addressing a period long enough to encompass the ultimate results of care; [3] outcomes should cover the full range of services and providers that jointly determine the patients’ results; and [4] outcome measurement should include sufficient measurement of risk factors or initial conditions to allow for risk adjustment.”
   - In order to structure the outcome measures, the 3-tier hierarchy of outcome measures (see Fig. 1) is used. At least one outcome measure should be chosen on each tier. Risk adjustment should take into account the relevant initial conditions, such as stage of the disease, patient compliance with treatments.
   - The criteria for the set of outcome measures are: importance to the patient, validity (based on EBM, literature), reliability and feasibility of data collection, comparability, variability (variable enough to require focus and improvement, and justify costs of measurement), frequency
   - Furthermore, it is important to have an overview of the coherence of outcome measures. To achieve that an overview of the complementariness and tradeoffs between outcomes needs to be made. The benefit is that it shows explicitly that improving on one outcome will affect others. For example, to achieve more complete recovery a heavier treatment may be required or a higher risk of complications may be present.

**Actors:** The actors involved in this phase are:
- Core team and the Work group. The Core team and Work group (potentially divided into subgroups) gather and structure the information. The Core Team will analyze the information and define the outcome measures. Moreover, the Core Team will present the set of outcome measures to the Work Group, which will provide feedback. The Core Team processes the feedback and proposes an improved set of outcome measures to the Work Group (and other stakeholders). This can be repeated until consensus is reached.
- Patient, family and patient associations are involved by means of the interviews, focus groups or questionnaires in order to provide information.
- 1st, 2nd, 3rd line care providing partners which are not part of the Work Group, are involved via interviews or questionnaires.

**Input:** The input required to start this phase is an agreement on the project planning and project structure as developed in the previous phase, which results in a desire to actually start analyzing the current care processes and defining outcome measures. During this phase input is gathered from interviews, focus groups, questionnaires, documents, legislation, standards and protocols. In addition, the (clinical) expertise of Core Team and Work Group members is used as input for the analysis done during this phase.

**Output:**
- Own team and organization: current bottlenecks, view on minimal necessary resources to organize pathway qualitatively, general overview of care activities and involved care providers.
- Vision of patient and family: patient expectations, patient preferences, important pillars for good care from a patient perspective.
- Available evidence and legislation: overview of the latest available (international) standards and already developed sets of outcome measures.
- External partners: Objective evaluation of current organization of the care process.

**Tools:** The tool used to present the set of outcome measures follows the format of the outcome hierarchy of Porter (2010).
TABLE III: Detailed description of Phase 4: Development from the VBCP method using six core elements: goals, techniques, actors, input, output, tools.

**Phase 4: Development**

<table>
<thead>
<tr>
<th>Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make an overview of the activities that take place over the full cycle of care and develop the process map of the VBCP to show in which order tasks are performed, by who and how much time they take.</td>
</tr>
<tr>
<td>2. Estimate the costs and capacity of resources and use it to calculate the capacity cost rate and calculate the total cost per care cycle.</td>
</tr>
<tr>
<td>3. Analyze the impact of the new care process on other care processes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Techniques:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. As care activities are interdependent and value is created by the combined efforts of all of them, an overview of all activities that take place over the full cycle of care needs to be made. The overview of the activities gives insight in the relation between care activities and patient outcomes. Next, the activities need to be translated into a process map, which gives the sequence and timing of the processes and shows possible alternative routes. Based on the process map it can be determined when and how to measure outcomes, for example by sending questionnaires (PROMs) to patients before, during and after the care process. To have consistency in the modeling language and process models through the hospital, it is advised to use one language (e.g. BPMN4CP) to visualize the VBCP.</td>
</tr>
<tr>
<td>2. Time-Driven Activity Based Costing method may be used to determine the costs for the full cycle of care [22].</td>
</tr>
<tr>
<td>3. When the process map with the future-state of the care process is made, a Change Impact Analysis has to be done to analyze the potential consequences for other care processes and he risks associated with the change. If the impact is perceived large, adjustments need to be made to one of the processes. If the impact is only limited, results of the Change Impact Analysis need to be communicated prior to the pilot and implementation phase.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Core Team develops the VBCP and calculates the costs of the full cycle of care. When a design is ready, the Core Team will present it to the Work Group, who will provide feedback on the design. After the feedback session, the Core Team will come with an improved design. This improved design – feedback loop will be repeated until consensus is found on the design of the VBCPs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The input needed for this phase is the information gathered in phase 3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The output of this phase is the process map of the VBCP (including the elements of care, the sequence of events and the expected patient progress) and the results of the impact analysis.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tools:</th>
</tr>
</thead>
<tbody>
<tr>
<td>For the process mapping several languages and programs can be used, for example if an extension of BPMN for care pathways is chosen (such as BPMN4CP). MicroSoft Visio provides a template in which this can be modeled [23]–[25]. For the calculation of the costs for the full cycle of care the Time-Driven Activity Based Costing method can be used [22]. The Change Impact Analysis is used to analyze the consequences of the new care pathway.</td>
</tr>
</tbody>
</table>

Each of these sub sections was detailed with content mainly based on interviews with nine experts in the field of healthcare management, care pathway development and value based healthcare (see Section 3 Methodology).

In TABLE II, a summary of such a detailed elaboration of all elements of Phase 3: diagnosis and goal setting is given. In this phase, the current care process is analyzed from different perspectives (general goal) and the outcomes relevant to patients are determined (value based goal). One of the additions identified through the expert interviews is in the output: the definition and review of patient outcome measures in the current situation, before developing the care pathway. Another addition based on the expert interviews is the possibility to learn from other care organizations, mentioned under the techniques – available evidence element. Similarly, TABLE III contains an elaboration of Phase 4: development, the phase in which the VBCP is developed. One of the extensions to this phase, that was done based on the interviews, is the identification of tools to model the VBCP, e.g. BPMN4CP. Another addition is the description of the roles the various stakeholders play in the design effort, as is described under the actors element in Phase 5.

A complete description of the VBCP method outlined above can be found in [26]. Finally, the method was implemented in an interactive toolbox in the form of a Prezi presentation in order to increase the ease of use, allowing a user to navigate from the high-level lifecycle view to the detailed explanation and to browse through it in various orders, following the sequential line of reasoning but also allowing to go back to an earlier phase. The interactive toolbox is available via http://tinyurl.com/VBCPtoolbox and includes, in addition to the method presented above, an overview of barriers and facilitators that can hinder or help the implementation of a VBCP.

**V. EVALUATION**

The general utility of the toolbox was evaluated through structured interviews with three experts from practice. All three experts work for a healthcare institution in the Netherlands and are occupied with and have extensive experience in care pathway development in their organization:

- The first expert is a cardiologist and medical manager in a Dutch regional hospital. (1)
- The second expert is Managing Consultant Integrated Health Solutions at a Dutch healthcare consultancy company. (2)
- The third expert is head of Business Information Management in the Heart and Vascular Center in a Dutch academic hospital. (3)

During the structured interviews, the participants were asked to fill out a questionnaire to express their view on the utility of the toolbox. Through this survey, we aimed at eliciting practitioners’ view on the usefulness of the toolbox and its ease of use as a tool to develop and implement value-based care pathways. The questionnaire was built based on the Technology Acceptance Model (TAM) [27] and the Method Evaluation Model (MEM) [28]. TAM, and its derivatives such as MEM, are the most commonly referred theories that
TABLE IV: evaluation questionnaire for the toolbox (Questions marked with * are in neg. form and the results are reversed in the table.)

<table>
<thead>
<tr>
<th>Perceived ease of use</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I found the procedure for applying the method complex and difficult to follow *</td>
<td>◊</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>4. Overall, I found the method difficult to use *</td>
<td>⊘</td>
<td>◊</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>6. I found the method easy to learn</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>9. I think it is difficult to apply the method *</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>11. I found the phases of the method clear and easy to understand</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>14. I am not confident that I am now competent to apply this method in practice *</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perceived usefulness</th>
<th>Strongly Agree*</th>
<th>Agree*</th>
<th>Neutral</th>
<th>Disagree*</th>
<th>Strongly Disagree*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I believe that this method would reduce the effort required to develop and implement Value Based Care Pathways</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>3. Value Based Care Pathways represented using this method would be more difficult to understand *</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>5. This method would make it easier for users to verify whether Value Based Care Pathways are correct</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>7. Overall, I found the method to be useful</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>8. Using this method would make it more difficult to maintain Value Based Care Pathways *</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>12. Overall, I think this method does not provide an effective solution to the problem of developing and implementing Value Based Care Pathways *</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>13. Using this method would make it easier to communicate Value Based Care Pathways to involved stakeholders</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>15. Overall, I think this method is an improvement to the standard method to develop and implement care pathways</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intent to use</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. I would definitely not use this method to develop and implement Value Based Care Pathways *</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
</tr>
<tr>
<td>16. I intend to use this method in preference to the standard Care Pathways Model if I have to work with Value Based Care Pathways in the future</td>
<td>⊘</td>
<td>⊘</td>
<td>⊘</td>
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Predict and explain the acceptance and use of design artefacts. It has been used as a theoretical basis for many empirical studies in the information systems field, including the acceptance of IS methods and models [28]. TABLE IV shows the answers of the experts on each of the questions asked. Since this evaluation only included the views of three experts it is not possible to apply any meaningful statistics to the results, but the table clearly shows the positive tendency towards ease of use and perceived usefulness. For two of the three experts, the intention to use was also high. The third expert was a bit more skeptical about his actual intention to use the toolbox since he believed that the care pathways in his organization are well-designed already and that the focus for further development and improvement should be on including the measurement of outcomes only.

VI. CONCLUSION

In this paper, the rigorous and systematic design of a toolbox to develop and implement Value Based Care Pathways (VBCP) was presented. The toolbox describes eight phases that a VBCP effort goes through: from the moment an organization starts thinking strategically about adopting the Value Based Healthcare paradigm, until the VBCP is steadily embedded in the operations. For each phase, the goals, techniques, actors, input, output and tools are described. The toolbox integrates existing methods for care pathway development and is extended with the cross-organizational perspective and focus on costs and patient outcome proposed by Value Based Healthcare. Furthermore, to increase the applicability and usefulness it includes practical information, guidelines and tools drawn from experience, that were derived from interviews with nine experts, leading to a comprehensive and practical framework positively evaluated by structured interviews amongst three experts.

The proposed VBCP toolbox is an initiative to operationalize the Value-Based Healthcare paradigm in practice. It enhances traditional care pathway development methods by shifting the focus from one department to the cross-organizational value chain and from traditional KPI’s as throughput time and utilization to patient outcomes. It includes detailed information, actionable guidelines, and tools to apply the value-based concepts in practice. Nevertheless, the toolbox is not complete yet, and can be extended with theories, models and practical information.

Our study has limitations mainly in relation to the research methods applied in developing and evaluating the VBCP toolbox. We have worked in close collaboration with a number of healthcare specialists and experts in the healthcare domain; yet this number can be considered limited. For future
work, we plan to further enrich each phase in the framework with tools and techniques from the BPM domain as described by e.g. [29], [30], as well as from the knowledge management domain (e.g. value network analysis [31]). As a starting point, an initial mapping of the project cycles in these BPM approaches is provided in TABLE V. Furthermore, we plan to refine the toolbox through practical applications and evaluations from which we may identify gaps and missing information. We aim to develop a practical toolbox that will be used by healthcare professionals themselves.

TABLE V: Mapping of VBCP to BPM lifecycle [29] and Kettinger [30]

<table>
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<tr>
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<tbody>
<tr>
<td>0) Preliminary phase</td>
<td>Process identification</td>
<td>S1: Envision</td>
</tr>
<tr>
<td>2) Project planning</td>
<td>Process discovery</td>
<td>S2: Initiate</td>
</tr>
<tr>
<td>3) Diagnosis &amp; goal setting</td>
<td>Process analysis</td>
<td>S3: Diagnose</td>
</tr>
<tr>
<td>4) Development</td>
<td>Process (re)design</td>
<td>S4: Redesign</td>
</tr>
<tr>
<td>5) Implementation</td>
<td>Process implementation</td>
<td>S5: Reconstruct</td>
</tr>
<tr>
<td>6) Evaluation</td>
<td>Process monitoring and controlling</td>
<td>S6: Evaluate</td>
</tr>
<tr>
<td>7) Cont. follow-up</td>
<td>Process monitoring and controlling</td>
<td></td>
</tr>
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</table>