*Building Continents of Knowledge in Oceans of Data: The Future of Co-Created eHealth*
*A. Ugon et al. (Eds.)*

*doi:10.3233/978-1-61499-852-5-526*

# Pros and Cons of Clinical Pathway Software Management: A Qualitative Study

M.F. AARNOUTSE[a], S. BRINKKEMPER[a], M. DE MUL[b], M. ASKARI[a,b1]
[a] *Department of Information and Computing Sciences, Utrecht University, Utrecht*
[b] *Erasmus School of Health Policy & Management, Erasmus University, Rotterdam*

**Abstract.** In this study we aimed to assess the perceived effectiveness of clinical pathway management software for healthcare professionals. A case study on the clinical pathway management software program Check-It was performed in three departments at an academic medical center. Four months after the implementation of the software, interviews were held with healthcare professionals who work with the system. The interview questions were posed in a semi-structured interview format and the participant were asked about the perceived positive or negative effects of Check-It, and whether they thought the software is effective for them. The interviews were recorded and transcribed based on grounded theory, using different coding techniques. Our results showed fewer overlooked tasks, pre-filled orders and letters, better overview, and increased protocol insight as positive aspects of using the software. Being not flexible enough was experienced as a negative aspect.

**Keywords.** clinical pathway, critical pathway, integrated care pathway, Hospital Information System, clinical pathway software.

## 1. Introduction

Many initiatives have been introduced in the past decades to improve the clinical effectiveness of care processes, and clinical pathways is one of them [1,2]. A clinical pathway — also known as an integrated care pathway, care map or a variety of other different terms — is a methodology for the mutual decision making and organization of care for a well-defined group of patients, during a well-defined period. They detail essential steps in the care of patients with a specific clinical problem and describe the patient's expected clinical course [3]. This methodology represents a path that a patient can undertake if his/her conditions are associated with a routinely series of interventions. At each step of the path, healthcare professionals can decide whether the patient must keep following the initial pathway, exit it, or begin a new one.

Clinical pathway management increases in popularity and is known to lead to several benefits in the hospital environment, including the improvement of clinical effectiveness, patient care, and a decreased financial pressure [4-9]. These clinical pathways can be either paper-based or software-based.

Hospitals often still choose to work with paper-based clinical pathways due to the entailed high investments costs of the software [10-13]. Nevertheless, previous studies have shown that for hospitals which do use clinical pathway management (CPM) software they can lead to economic benefits and increased patient satisfaction [13,16].

[1] Corresponding author: Postal address P.O. Box 1738/ 3000 DR Rotterdam, The Netherlands. E-mail: askari@eshpm.eur.nl.

In spite of efforts toward the measurements of the benefits of the CPM, no attempts have been made to study the effectiveness of CPM software from the point of view of healthcare professionals. The objective of our study was therefore to investigate the pros and cons of CPM from the health care professional perspective.

## 2. Method

### *2.1. Setting and Data Collection*

We performed a qualitative study to determine the perceived effectiveness of the CPM in a large academic hospital in Utrecht, the Netherlands. Since 2011 the hospital has been using a commercial Hospital Information System (HIS) (EZIS, ChipSoft, Amsterdam, the Netherlands). This HIS runs on the Microsoft Windows platform and includes a home-grown order management system called Check-It. The objectives of Check-It were defined by the hospital as follows:

1) To improve protocol-based working.
2) To improve the monitoring of this protocol-based working.
3) To ease administrative workload.
4) To reach a more efficient workflow, among others by reducing consultation preparation time.

All orders are entered directly into the computer by physicians or nurses this system was piloted in six departments, of which three departments have participated in our study (Table 1).

The healthcare professionals participating in this study have different functions throughout the hospital. The three distinct groups are: physicians & medical specialists; nurses & paramedics; and (medical) support personnel (such as administrative personnel).

Interviews were held with all healthcare professionals who work with Check-It. The interview questions were posed in a semi-structured interview format and the participants were asked about the positive or negative effects of Check-It four months after experiencing the software. The interviews were audio recorded.

### *2.2. Analyses*

Demographic data was calculated using percentages. The interviews were transcribed based on grounded theory principals and steps. Open coding was used to identify names and categorize phenomena in the text. After labeling all the relevant chunks of data, we used axial coding to relate the codes, and the labeled categories to each other. In the final phase, all created categories were reviewed to choose an adequate wording.

## 3. Results

### *3.1. Characteristics of Respondents*

In total 30 (96.77%) healthcare professionals participated in de study out of 31 participants who used Check-IT. From the 30 participants in the three departments, 45%

were male. 37% (11/30) were physicians and 30% (9/30) were nurses and paramedics. 33% (10/30) were medical support staff.

**Table 1.** Overview participating departments

| Department | Focus clinical pathway | # of participants per department | # of healthcare professionals who used Check-IT per department | Percentage of participants in the 'physicians and medical specialists' group per department |
|---|---|---|---|---|
| Pediatric pulmonology | Children with Cystic fibrosis | 6 | 6 | 83% |
| Dermatology and allergy | Atopic dermatitis | 9 | 9 | 33% |
| Ophthalmology | Uveitis | 15 | 16 | 20% |

### *3.2. Pros and Cons of CPM Software*

Table 2 shows the combined result of the positive and negative statements the healthcare professionals mentioned in the interviews. The percentages in the columns indicate how many healthcare professionals of the total amount of healthcare professionals (for that department) have mentioned a particular statement. The statements that were mentioned by two or more participants are listed in the table.

**Table 2.** Interview results per department and in total

| Positive/ Negative? | Statement | PP (%) | D&A (%) | O (%) | Total (%) |
|---|---|---|---|---|---|
| + | Less forgotten tasks | 16.7(1/6) | 33.3(3/9) | 33.3(5/15) | 30.0(9/30) |
| + | Pre filled orders and letters | 50.0(3/6) | 33.3(3/9) | 13.3(2/15) | 26.7(8/30) |
| + | Better overview | - | - | 40.0(6/15) | 20.0(6/30) |
| + | Increased protocol insight | 16.7(1/6) | 11.1(1/9) | 20.0(3/15) | 16.7(5/30) |
| + | Increased efficiency | 66.7(4/6) | - | - | 13.3(4/30) |
| + | Improved protocol-based working | 66.7(4/6) | - | - | 13.3(4/30) |
| + | Decreased cognitive workload | 33.3(2/6) | - | - | 6.7(2/30) |
| - | Not flexible enough | 16.7(1/6) | 44.4(4/9) | 6.7(1/15) | 20.0 (6/30) |
| - | Difficult when not following the protocol | 16.7(1/6) | - | 20.0(3/15) | 13.3(4/30) |
| - | Lack of use | - | 44.4(4/9) | - | 13.3(4/30) |
| - | Inadequate clinical pathway | - | - | 26.7(4/15) | 13.3(4/30) |
| - | High learning curve | 50.0(3/6) | - | - | 10.0 (3/6) |
| - | More work | - | - | 20.0(3/15) | 10.0(3/30) |
| - | Lots of clicks | - | - | 13.3(2/15) | 6.7(2/30) |

PP = Pediatric pulmonology, D&A = Dermatology and allergy, O = Ophthalmology

The departments of ophthalmology and pediatric pulmonology mention more positive statements than negative ones (respectively a positive/negative ratio of 16/13 and 17/7). For dermatology and allergy this is the other way around (8/10).

In addition to what is reported in table 2, other aspects such as "Not aligned with other programs", "Lack of usability" are also mentioned as negative aspects of CPM software, together with "Decreased orientation time", "More accurate administration", and "Increased patient care" as pros of CMS.

## 4. Discussion

In this study we investigated the perceived effectiveness of Clinical pathway management (CPM) software. Our findings show that CPM software has the opportunity to be effective for healthcare professionals working with such a system by reducing the amount of forgotten tasks, contribute to a more efficient workflow due to pre filled orders and letters, and creating a better overview of tasks for the entire department which increases the understanding between healthcare professional functions. However, for some respondents the software was not flexible enough. A distinctive difference between dermatology and allergy and the other two departments was the number of mentions of the 'lack of use' and the 'inflexibility of the program'. In the interviews it became clear that the healthcare professionals of dermatology and allergy perceived using Check-It as not flexible enough due to the nature of their clinical pathway. As one of the participants stated: "The clinical pathway is based on an average patient, only the average patient doesn't exist in our department".

Based on the results of our study, the first two objectives of Check-it that were defined by the hospital were reached. However, there is room to improve the usability of the software, for a more efficient workflow and a decreased administrative workload.

Several studies prove that there are reasons why healthcare organizations could better move away from paper-based clinical pathways. Li et al. [11] proved that paper-based clinical pathways are challenging for knowledge sharing, and bring burdensome paper work which causes inefficiency and a lack of accuracy in care processes. In addition Du, Jiang, Diao, Ye, and Yao [14] state that paper-based clinical pathways have a limited capacity of data recording and collection, and lack support for monitoring and handling variations. Our results showed that clinical pathway management software has the opportunity to deliver better information, and it made the information available for the different healthcare professionals as it was also the case in the study by Sermeus et al. [15].

To the best of our knowledge, this is the first study in the Netherlands that evaluates the perceived effectiveness, and the pros and cons of CPM software. This case study is conducted in one academic hospital, evaluating one particular software program; therefore the generalizability of the results is limited. Investigating the pros and cons in other hospitals with other CPM systems would strengthen the value of these results. In addition, the repartition in health care professionals participating in our study was uneven, which could have influenced our results. Future studies are needed to investigate whether there is a difference between the effectiveness of the CPM systems among different groups of healthcare professionals.

Factors such as national culture, type of hospital, the composition of CPM system components, the amount of healthcare professionals using the system, and the length of use can have an influence on the perceived effectiveness of it. Future studies are needed to examine the effect of the mentioned factors.

## Acknowledgement

We would like to thank all the participants of this study as well as those who facilitated it. Specifically, prof. dr. Ronald Batenburg and Marieke Vissers.

## References


[1] H. Campbell, R. Hotchkiss, N. Bradshaw, M Porteous, Integrated care pathways *BMJ* **316(7125)** (1998), 133–7.

[2] M. Askari, R. Westerhof, S. Eslami, et. al., A combined disease management and process modeling approach for assessing and improving care processes: a fall management case-study, *Int J Med Inform* **82(10)** (2013), 1022-33.

[3] R.J. Offey, J.S. Richards, C.S. Remmert, et. al. An introduction to critical paths, *Qual Manag Healthc.* **1(1)** (1992), 45–54.

[4] P. Kent, Y. Chalmers, A decade on: has the use of integrated care pathways made a difference in Lanarkshire?, *J Nurs Manag* **14(7)** (2006), 508–20.

[5] D. Allen, From boundary concept to boundary object: the practice and politics of care pathway development, *Soc Sci Med* **69(3)** (2009), 354–61.

[6] J. Darer, P. Pronovost, E.B. Bass, Use and evaluation of critical pathways in hospitals, *Eff Clin Pract* **5(3)** (2002), 114–9.

[7] W. Li, K. Liu, H. Yang, C. Yu, Integrated clinical pathway management for medical quality improvement – based on a semiotically inspired systems architecture, *Eur J Inf Syst.* Nature Publishing Group **23(4)** (2013), 400–17.

[8] A. Atwal, K. Caldwell, Do multidisciplinary integrated care pathways improve interprofessional collaboration?, *Scand J Caring Sci* **16(4)** (2002), 360–7.

[9] S. Deneckere, M. Euwema, P. Van Herck, et al. Care pathways lead to better teamwork: Results of a systematic review, *Soc Sci Med* **75(2)** (2012), 264–8.

[10] K. Vanhaecht, M. Bollmann, K. Bower, et al. Prevalence and use of clinical pathways in 23 countries - an international survey by the European Pathway Association, *Int J Care Pathways* **10(1)** (2006), 28–34.

[11] S. Wakamiya, K.Yamauchi. A new approach to systematization of the management of paper-based clinical pathways, *Comput Methods Programs Biomed* **82(2)** (2006), 169–76.

[12] W. Zhang, K. Yamauchi, S. Mizuno, R. Zhang, D. Huang, Analysis of cost and assessment of computerized patient record systems in Japan based on questionnaire survey, *Informatics Heal Soc Care*. **29(3-4)** (2004), 229–38.

[13] M. Berg, Implementing information systems in health care organizations: myths and challenges, *Int J Med Inform* **64(2-3)** (2001), 143–56.

[14] G. Du, Z. Jiang, X. DiaoY. Ye, Y. Yao, Modelling, variation monitoring, analyzing, reasoning for intelligently reconfigurable Clinical Pathway, *IEEE/INFORMS International Conference on Service Operations, Logistics and Informatics* (2009), 85–90.

[15] W. Sermeus, A. Vleugels, K. Vanhaecht et al, *Onderzoek naar de toekomst van transmurale zorgpaden binnen Vlaanderen, Leuven* (2008).

[16] U. Ronellenfitsch, E. Rössner, J. Jakob, et. Al, Clinical Pathways in surgery: should we introduce them into clinical routine? A review articl, *Langenbecks Arch Surg* **393(4)** (2008), 449–57.