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Digital Follow-Up Application for Cancer Patients – Value Mechanisms Regarding Health Professionals’ Work

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Abstract. This study examined the value mechanisms of a digital cancer follow-up application (CFUA). Value is defined as the health outcomes achieved per resources used. The focus was on how the digital health intervention (DHI) affects the professionals’ work. The research was conducted through interviews of healthcare professionals in the empirical context of gynecological cancer clinic at a university hospital in Finland. The identified key mechanisms were improved coordination and optimized care level. The CFUA improves coordination through reducing time restrictions of work, as the professionals have more chances to time their contacts and plan their work. The CFUA helps in optimizing care level, as the application can effectively filter patients to either nurses or physicians according to symptoms. Coordination mechanism is closely connected to other healthcare value mechanisms, such as reducing waste and supply management. This study increases understanding of DHI value potential recognition, and how value can be actualized.

Keywords. Telemedicine, Cancer Care, Value-Based Healthcare

1. Introduction

Introducing new digital health interventions (DHIs) requires that their cost-effectiveness, their value, is proven. Implementing DHIs with demonstrated value improves the economic sustainability of the healthcare system and benefits all parties, including patients, payers, providers and suppliers [1]. Porter defines value as the patient health outcomes relative to the costs of care for the patient [1].

Cancer care DHIs have been a subject for academic research. It has been found that digital interventions can through certain mechanisms help cancer patients to cope better with the disease and symptoms [2]. Patient-reported-outcome follow-up has been shown to improve cancer patients’ survival and quality of life [3,4]. According to [5], telemedicine in cancer care can reduce the travel costs for patients and thus improve total value. Web-based outcome surveillance was found to be a cost-efficient way of monitoring and can reduce the follow-up costs for the insurance-provider [6]. It has been stated that also the staff viewpoint should be considered in digital services in cancer care [7]. Thus, when analyzing an intervention’s potential for improving value-based healthcare, it is important to examine the personnel perspective, where a

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significant part of the costs are incurred. Therefore, this research took intervention's impact on healthcare professionals' work as the focus and aimed to find the mechanisms that cause changes in their behavior and affect costs.

The studied DHI is a modular digital cancer follow-up application (CFUA) called Kaiku Health. This study focuses on the use of CFUA for gynecological cancer patients. The context of the CFUA case is the gynecology unit of a tertiary hospital in Finland. In the unit, all types of gynecological cancers are treated. CFUA is used both during treatments and in monitoring after treatments. The people using CFUA include patients, specialist physicians and nurses, some of which work with patients during cancer treatments, and some with patients in monitoring after treatments. All specialist physicians are specialized in gynaecology, and their tasks include diagnosis and treatment of gynecological cancer patients. Most of the patients are over 65 years old. The patients use CFUA to report their health status and symptoms by filling symptoms and quality of life questionnaires and can contact healthcare personnel through CFUA with chat messages. The message feature also allows sharing files, such as medical certificates. When a member of the personnel logs in, CFUA shows the patient cases that have new information that should be handled. Healthcare professionals react to the contacts either through CFUA or in acute situations by phone (Figure 1).

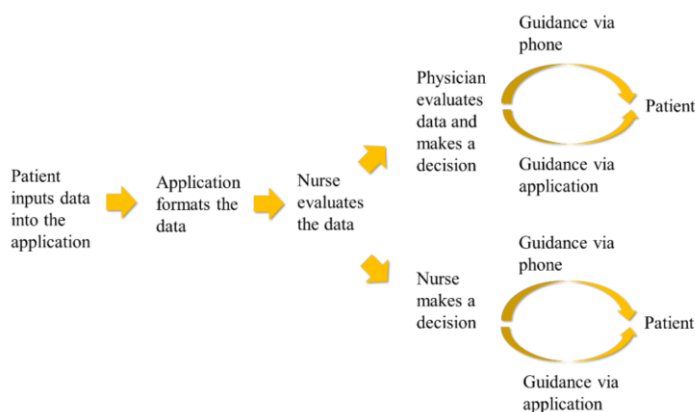


Figure 1. Typical data flows in the use of CFUA.

The application works with mobile devices and desktop devices. CFUA is offered as a separate installation for every customer clinic [7]. In WHO's (2018) classification of digital health interventions, CFUA can be described as a telemedicine intervention including e.g. consultations between remote client and healthcare provider, and remote health monitoring [8]. CFUA also possesses features of personal health tracking interventions, as it allows self-monitoring of health in form of symptom data.

The objective of this study was to identify and analyze the mechanisms through which CFUA creates value in cancer care from the healthcare professionals' perspective in the context of tertiary gynecological cancer clinic. The research problem was approached using the CIMO logic, describing the context, intervention and outcomes to analyze the mechanisms [9,10]. CFUA's CIMO-configuration and the changes were examined. We posed the following research question: How does a digital follow-up application change the work of healthcare professionals and which value mechanisms are activated through these changes?

2. Data and Methods

This research was conducted as a single case study. The unit of analysis was the work of a healthcare professional, which comprises tasks, actions and work processes, as processes can be complemented with other units of analysis, especially when they are not always clearly manifested [11]. The data was collected through semi-structured interviews with eight members of the clinic’s healthcare professionals (N=8). Four informants were specialist physicians and four informants were registered nurses. Three of the nurses worked with patients during the cancer treatments and one nurse worked with patients after the treatments (Table 1). The interview data was transcribed verbatim, and sorted into categories.

Table 1. List of informants.

ID	Role in Organization and Cancer Treatments
Nurse 1	Works with patients in active treatment
Nurse 2	Works with patients in diagnostics and monitoring
Nurse 3	Works with patients in active treatment
Nurse 4	Works with patients in active treatment
Physician 1	Specialist, diagnostics and treatment of gynaecological cancers
Physician 2	Specialist, diagnostics and treatment of gynaecological cancers
Physician 3	Specialist, diagnostics and treatment of gynaecological cancers
Physician 4	Specialist, diagnostics and treatment of gynaecological cancers

The data collected from the interviews was analyzed qualitatively, using the Grounded Theory methodology. From the data, core categories were formed that described the relevant themes summarizing the data set [12].

3. Results

The identified value mechanisms were improved coordination, right care delivery level and timing, reduction of waste, demand/supply-management, control information and health co-creation through symptom-based care (Table 2). Especially the mechanism of coordination comprises sub-mechanisms, such as reduced variation and is connected to other mechanisms.

Having more accurate and exact data about the patient enables optimizing the care level. CFUA provides data about the patients’ symptoms, which is used to decide whether a physician or nurse should handle the case. Nurses first read the non-urgent CFUA contacts, and only forward them to the physicians if necessary. This allows a more efficient care level, as doctors only handle more challenging cases fitting their skills.

Variation in tasks hinders productivity, as mental preparation and adaptation are needed when changing between tasks. The health professionals argued that they are able to follow their schedules better with CFUA, as the unpredictable phone calls do not interrupt and interfere with their current work. CFUA allows scheduling the day into sub-parts where the focus stays on a certain type of task for a longer period of time. Reduced time dependency allows the professionals to perform tasks with more efficient scheduling. The coordination mechanism of CFUA is primarily connected to organizing patient care and delivery of services in a timely manner. Instead of facilitating the organization of cancer care in a system level between teams and providers, CFUA is a tool for coordinating cancer care between the patient and specific nurses and physicians assigned to the patient.

Table 2. Value mechanisms of the CFUA.

Mechanism	Summary
Coordination	CFUA allows individual professionals to work more flexibly and plan their work better, reducing interruptions and improving productivity.
Right timing (for personnel)	With CFUA, the professionals have a time-window that allows them to choose a suitable time to handle a contact.
Care delivery level	CFUA allows optimizing care delivery to the lowest level by directing only the most challenging contacts to physicians.
Reduction in waste	As CFUA reduces interruptions in professionals' work, they need to spend less time.
Control information	CFUA provides more complete information, such as time series of symptoms, to professionals. This information helps professionals to decide what they should do next, thus improving coordination of care.
Demand/supply management	By relieving the time restriction of communication, CFUA allows scheduling the supply, the answers to contacts, more flexibly.
Symptom-based care	Patients contribute to their care by actively monitoring and reporting their health status. With reduced routine appointments, the professionals focus more on providing care for patients who report symptoms.

Improved control information can lead to a more optimal processing as the right decision can be made. The professionals using CFUA stated that the time-series of the patients' earlier symptoms help in comparing the situation with previous weeks, and thus evaluating if further actions are needed. Reducing waste "Muda" happens when improved coordination of work reduces non-value adding tasks. In addition to providing more data about patients, the CFUA can also provide more structure to monitoring processes. With CFUA, the processes can potentially be more standardized, if the contacts are more predictable. On the other hand, any lack of clarity in the procedures of CFUA use can cause waste.

In addition to the CFUA, the demand in the clinic is actualized through two channels: phone calls (scheduled and non-scheduled) and clinic visits. Although the timing of demand remains roughly the same, the channel of demand is connected to the timing of supply. In phone calls, the professionals must answer when a patient calls, whereas for CFUA contacts they have up to two days' time to answer. Supply can be planned in a more flexible way, while still retaining sufficient patient experience, as the patients are instructed not to use CFUA for urgent matters. The mechanism of demand/supply-management is related to the coordination mechanism. The ability to time supply with a larger degree of freedom allows better coordination of work, both in individual professional and organization levels. Similar to coordination, this mechanism is enabled by removing or reducing the time-restrictions of professionals' work.

Routine clinic visits can be economically inefficient when the personnel spends time examining patients that do not have any symptoms. With CFUA, the professionals mostly contact patients that have reported significant symptoms. Symptom-based care is connected to the co-creation of health. In co-creation of health, the patient contributes to maintaining or improving their state of health. The co-creation of health mechanism functions also through managing demand.

4. Discussion and Conclusions

This study identified several mechanisms through which CFUA increases value. The mechanisms were analyzed from the healthcare professionals' perspective, and most of the identified mechanisms create value by improving the productivity of the

professionals. The mechanisms affecting efficiency and productivity include both mechanisms improving individual professionals' efficiency in tasks, as well as mechanisms that allow more efficient allocation of tasks between professionals. The implementation and organizational practices seem to have a strong effect on the value creation of digital follow-up applications. The digital application should be an integral part of the professionals' work, with clear roles and procedures for using it. The primary source of value of digital application is the data output that creates or improves information. Incomplete movement of information in an organization deteriorates the value created. Key challenges that digital interventions could solve in healthcare are coordination and integration of fragmented knowledge. In the studied empirical context, CFUA has the potential to improve coordination in multiple ways.

The findings of this study contribute to the development of value-based healthcare and to the evaluation of digital health interventions. The study also has certain limitations. We did not interview the patients. Therefore, the value creation was analyzed focusing on costs rather than health outcomes. However, changes in professionals' work have effects on health outcomes, if the patient work changes. Patient outcomes also affect costs, as quick recovery incurs less costs than prolonged treatment. Furthermore, the actualization of the mechanisms as outcomes or costs was not measured. Nevertheless, this research has identified intermediate outcomes that could be used as measures for the value of digital interventions and for confirming the mechanisms in future research.

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