

A COMPREHENSIVE PROCESS OF CARE COORDINATION: A SKIN CANCER APPLICATION

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Abstract

The Care Coordination improvement represents a challenge for the effectiveness and the quality of care delivery. Impacts of the care coordination can be seen on the care assess, patients benefits and healthcare costs. In order to better understand the care coordination process and its actual support within a hospital, a skin cancer care coordination process was identified. Several analyses have been done: process modelling, identifying information/data exchange and actors participating in this process. Herein, the study gathered the clinical route of 132 patient data, and care providers interviews i.e. the dermatologists. The aim of this study is to identify the difficulties and the needs in this process in order to provide to care givers different support tools. At the end we discuss the challenge to define adapted care coordination approach for a given context.

Keywords: Design methods, Communication, Process modelling, Patient-centered, Care coordination

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1 INTRODUCTION

Care Coordination (CC) is a challenge for the effectiveness and the quality of care delivery. Care coordination is defined through: 1) the numerous and the multidisciplinary participants, 2) the participant's interdependence to carry out disparate activities in patient's care, 3) the participant need for adequate knowledge about their own role or roles of the others, and available resources to carry out these activities, 4) the information exchange to manage the activities and resources, 5) the aim of the care coordination is to facilitate the care delivery (McDonald et al., 2007). Poor coordination of care has negative consequences for patients and contributes to increase medical costs. CC is described as an organizational tool to improve the effectiveness and the efficiency of healthcare system (Raak et al., 2005) and an appropriate CC stands on patient's needs.

In France, the public policies are concerned to improve the quality of care and to reduce the public expenditures (Bruyère et al., 2008). Several studies displayed the association of CC improvement and the increase of patient outcomes, for example the decrease of emergency hospitalization or the hospitalization duration (Peikes et al., 2009). Improving CC is a challenge, especially in chronic illness and in the elderly population (Wolff et al., 2002). One of the possible enhancements is to look at the CC process and propose different models that take into account difficulties and challenge that exist in present healthcare system as the Geisinger model developed in USA. The setting up of this model enabled a decrease of 20% of hospital admission and 7% of medical savings (Paulus et al., 2008).

This paper describes a model of CC to improve the comprehension of the participants, their disciplines and their interactions. This model will enable the better identification of resources needs, information and knowledge to propose an optimized care delivery process.

First, the patient workflow process is modeled and his variability analyzed. In order to understand different sides of the CC process in terms of actor interdependence and information sharing we developed a Responsible, Approver, Consulted, Informed (RACI) model (Singprasong and Eldabi, 2013). In the end, through different interviews with practitioners the analysis of dysfunctions is performed using a Design Structure Matrix (DSM). The aim of this work is to understand the CC process and its existing difficulties to identify a new care organization to solve the problem previously described.

2 STATE OF ART

The care coordination impact on the healthcare system was widely studied in the literature especially the patient's outcomes benefits or the reduction of healthcare cost. Different models of the care delivery are discussed with the objective to provide the effectiveness of CC. Table 1 references main models in care delivery that we have found. Approaches were classified according to the defined aim of the CC process: disease centered, patient centered, case management and coordination network.

Table 1. Literature analysis of the different approaches delivery

Approaches		Description	References
Disease-centered		It is the traditional model for the care delivery. The physicians focus only on medical aspects for the disease management.	(Green et al., 2002)
Patient-centered	Chronic conditions	The understanding of global patient's aspects have been included in the care delivery. It improves the patient health outcomes.	(Bergeson SC and Dean JD, 2006; Little et al., 2001; Stewart, 1995)
	Patient centered medical home	This model involves to strengthen primary care through a reorganization of existing practices.	(Meyers et al., 2010; Rich et al., 2012)
	Navigator patient	The CC is insured by a Navigator, who helps patients through a social network (information needs, emotional support)	(Carroll et al., 2010)
Case management		To carry out of the complex cases to take the global need of patient: care and social need. The intervention of a care manager to coordinate the patient is often required.	(Addington-Hall et al., 1992; Lambert, 2014; Unützer et al., 2002)
Health network		A multidisciplinary groups of caregiver promotes the care access, CC and continuity. The general practitioner plays a key role in the coordination activities and follow-up.	(DGOS, 2012; Ghadi et al., 2011; Lambert, 2014)

The patient-centered approach is often defined in the American literature as a global approach, in which the social, psychological and medical aspects are included in the care delivery. Stewart *et al.* (1995) showed that this new relationship between patient and physician improve the patient health outcomes. The Patient Centered Medical Home (PCMH) model is largely used in chronic illness and polypathologic patients. This model requests resources to coordinate the care activities, as a general practitioner or coordination nurse. Moreover, the remuneration system needs to be adapted to include to the coordination management (Meyers *et al.*, 2010). The use of communication and information technologies allows to support the coordination activities facilitating information exchange and communication between the caregivers; for example the use of the electronic medical records (MacPhail *et al.*, 2009; O'Malley and Cunningham, 2009). In the United States, the new legal framework in the healthcare system promotes the design of innovative healthcare systems and payment models. The Geisinger Health System (GHS) is based on the improvement of care coordination and chronic care optimization with regard to an integrated model and the use of electronic health records. The design process of this model is based on the patient-centered model and an innovative architecture design (Paulus *et al.*, 2008).

In France, the improvement of care coordination is considered as a path to insure the care quality and reduce the healthcare cost; the march 4th 2002 law of the public health code was designed to promote the care coordination through the setting up of coordination networks. The public healthcare organizations were set up as health networks, in particular for the chronic illness and the elderly patients (Ghadi *et al.*, 2011). The aim of this approach is to improve the care assess, the care coordination and the multidisciplinary of care delivery between hospital and primary care structures. In terms, the general practitioner plays a key role in the organization, follow up and care coordination of the patient. To be effective and sustainable, health networks must be supported by an adapted information system, remuneration system and multidisciplinary infrastructures, as local health center. These changes represent application difficulties (DGOS, 2012). In France, the CC is considered to be a key issue for the change of healthcare system and many studies deal with the CC between the hospital and the town for the continuous of care in the chronic pathologies (Brunn and Chevreur, 2013; Glonti *et al.*, 2014).

The care delivery at hospital is interdisciplinary: for example the cancer management needs the intervention of several specialities into the hospital. The improvement of CC between different disciplines within an hospital is crucial to maintain a good communication between the caregivers and insure the care quality and improve the patient benefits. Very few studies were evidence based (upon actual patient data) and were looking at actors' interactions and adequate supports (Dykes *et al.*, 2014). In order to address these issues, we intend to analyze the needs of one CC process (skin cancer) and to identify its difficulties. This work aims to understand and describe the actual needs and to suggest if necessary CC models to increase one hospital outcomes.

3 METHODOLOGY : RESEARCH DESIGN

The analysis of CC process and its dysfunctions in skin cancer process was chosen. Skin cancer occurs with an incidence of 20% among people of 65 years old or more. In France, 80 to 90 000 skin cancers are diagnosed and treated with a surgical procedure every year. At the hospital, the skin cancer management includes the intervention of various departments or caregivers. Designing an effective care organization based its improvement may improve the care quality and reduce the healthcare cost. To understand the CC process, we modeled the existing process i.e the patient management route within the hospital for a skin cancer management. Several data sources were considered:

- Interview with dermatologist, a specialist in skin cancer management: Two face to face interviews, each during average 30 minutes, a mail exchange including the process model for its validation,
- Data gathering using data from the "Agenda" software, the planning software, enabled the inclusion of 132 patients over a 3 months period in 2013 after their first consultation for a skin cancer management.

We performed many interviews to get quantitative inputs for our process modeling. Then, process modeled and its options were analyzed to determine:

- The main care process and its main activities? The duration of the care process?

Then, we added supplementary interviews to identify resources and their interdependence to understand:

- CC management? The coordination problems? The possibilities of CC process organization to increase its efficiency and to solve these problems?

This case study analysis is used to understand the need in the care coordination in view to establish guidelines for designing a new care organization.

3.1 Skin cancer CC process

The process modelling methods are helpful to understand the work process. These methods are very well used in various fields (Jun et al., 2009). The existing process of skin cancer management model is based on Structured Analysis and Design Technique (SADT) activity diagram with the Bizagi software (Ross, 1985). The Figures 1 and 2 details the sequence of activities underwent by a patient with a skin cancer in the hospital with a skin cancer. The process is cut up in two parts: the first part represented in Figure 1, describes the first steps of the process, from the dermatologic appointment to the surgery, the second one considers after the dermatologic appointment. In the second part, three options are possible: the patient is biopsied, a medical treatment is prescribed, or an announcement consultation is organized. The surgery decision is made during the announcement consultation. The surgeon and the dermatologist decide together if the patient requires surgery or not.

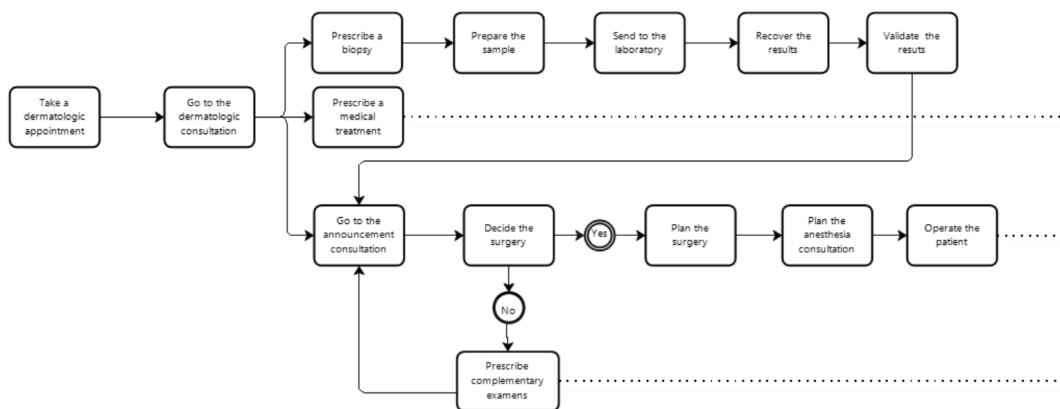


Figure 1. Representation of skin cancer management process at the hospital: from the dermatologic appointment to the surgery

The second part represents the last steps of the process, from the surgery to the patient follow-up. Finally, after the first steps, we identified two options for the patient: 1/ the patient follows a medical treatment 2/ the patient is operated. In the first case, the follow-up of the patient is organized within the dermatology department. In the second option, the patient is monitored in plastic surgery and in dermatology department.

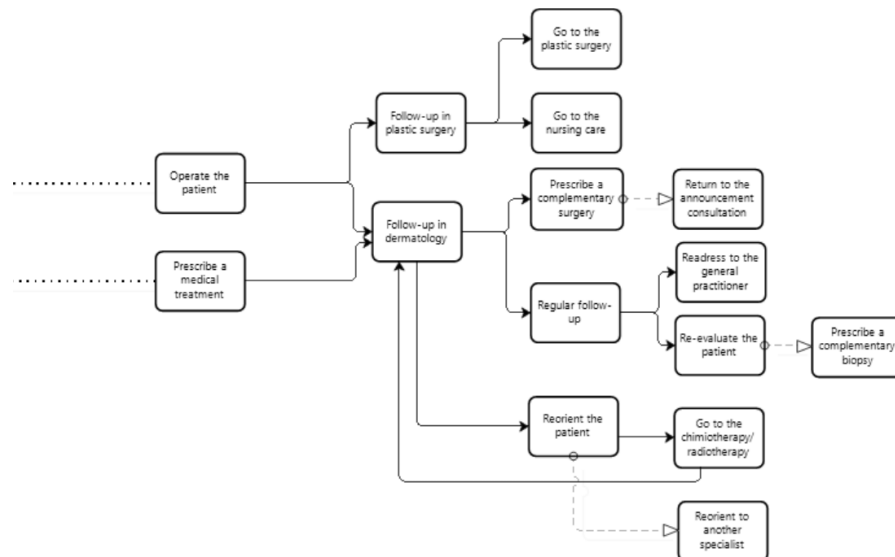


Figure 2. Representation of skin cancer management process at the hospital: from the surgery to the patient follow-up

3.2 The process analysis

The existing process is analyzed based upon data collection for 132 patients during a three months period. This sample is composed of 43% of women and 57% of men with an average age of 73 years. There are 3 types of skin cancers: the basal cell carcinoma (BCC) which is the most frequent and the serious less; the squamous cell carcinoma (SCC) which may be metastatic; the melanoma (M) which is the most serious.

First, we want to know how the patients enter in this process: 38% of the patients came from the hospital dermatologic follow-up, 53% of the patients from the general practitioner, 3% from the dermatologic emergency department and 6% from another department of the hospital. The analysis of the process displays that 93% of the patients go to the dermatologic consultation before the announcement consultation.

To understand the process, a preliminary analysis of the duration was done including the potential variability in the CC process. Then after debriefing with the dermatologist, the analysis was focused on an analysis regarding the type of pathologies, to identify if different CC processes were required per pathology to increase an integrated process.

Table 2. Period between the main steps of the process

Period of process	Mean Average (days)
Period between the first and the last consultation	175
Period between the first dermatologic consultation and the announcement consultation	23
Period between the announcement consultation and the surgery	27
Period between the surgery and the plastic surgery follow-up	49
Period between the surgery and the dermatologic follow-up	12

Table 2 highlights the duration variability between the process activities. The average duration of the global process is 175 days with a minimum duration of 0 day, when the patient is coming once, and the maximum duration of 539 days, when the patient comes for a melanoma management and needs a long follow-up. In all situations, the second part of the process is longer than the first part, 125 days versus 50 days. After the surgery, the follow-up of the patient is the most important part of process and with the main activities located in the dermatologic department.

The variability of the process can considerably influence its quality. As the BCC is the most frequent cancer and its management not an emergency, we compared the BCC patient process with the others. The M and SCC tumors are more serious and the management of these tumors is emergency to avoid

the metastasis. Variables were compared and tested using khi-deux test, $p < 0.05$ indicated statistical significance, all tests were two-tailed. Our analysis highlighted the following significant results:

- The surgery decision occurs immediately for the BCC patients (40/43 versus 52/88),
- The complementary surgery is more frequent in the non BCC patients (45/86 versus 8/43),
- The complementary exams are more frequent in the non BCC patients (34/84 versus 3/43).

These preliminary results display that the process is different according to the pathology.

Further analysis may determine if these process need to be managed according the pathology profile.

3.3 Care coordination analysis

To characterize the care coordination in the existing process, we then identified the resources of each activity of the process. Caregivers of the dermatologic department and the plastic surgery department were interviewed. These two departments of Henri Mondor hospital are involved in the skin cancer management. We used semi-structured interviews to identify: who are the actors of the process and with whom they interact? What is the information exchanged? What are the information supports? What are the coordination problems? The 8 main actors' interviews have been reported for each activities (Table 3):

- The actor number column represents the number of people which take part in the activity proceedings,
- The actor category number column represents the different categories of trade which take part in the activities,
- The supports column refers to the information support types which is using to achieve each activity or to exchange information,
- The issues column represents the interview answer when we ask how facilitate this activity achievement.

Table 3. Extracts of interview responses

Activities	Actor number	Actor category	Supports	Issues
First steps				
Take an appointment in dermatologic consultation	5	4	mail/ letter/ agenda/ phone/ claim form/ipop	"We have to solve the lack of appointment and slot -> automatic voice dictation"
Go to the dermatologic consultation	6	4	phone/ mediweb/ word document	"It is difficult to join the reception", "A nurse should be allocated to the consultation"
Recover the results	2	2	mediweb/ gilda/ agenda/ paper	"It's too long, too complicated, need to look at several supports"
Go to the announcement consultation	3	3	paper/ patient records	"We need have a specific place, and dedicated time to plan the consultation"
Plan the surgery	6	5	agenda/ phone/ claim form/ prescription	"We should move plastic surgery secretaries"
Plan the anesthesia consultation	1	1	schedule	"The patients should to go to the reception with his paper for the planning"
Operate the patient	2	2	check list/ operatory record/ mediweb	
Last steps				
Follow up in plastic surgery	2	2	actipidos/ histological record/mediweb	
Prescribe a complementary surgery	2	2	schedule/ipop	
Follow-up in dermatology	5	4	agenda/ arkados/ mail	" We send the letter to each patient manually", "We confirm the patient appointment on two different softwares"

The data gathered in this table underline the interdisciplinary of the skin cancer process and also that:

- Various actors perform the same tasks as take an appointment in dermatology, go to the dermatologic consultation, plan the surgery, and follow-up in dermatology,
- Various information supports, therefore complicating the communication and coordination process.

To focus on this particular point, we developed an actor-activity matrix, called RACI matrix (Table 4), and we classified the actors as:

- Responsible: the person who does the work to achieve a task,
- Approver: the person who is accountable for the task advancement,
- Consulted: the person who provides the information,
- Informed: the person who is informed about the progress.

The aim of this analysis is to determine the roles and responsibilities of each actor involved in the care process and to understand what resources organization is.

Table 4. RACI matrix extracts

D =dermatologist, A =welcome officer, I =nurse, S = secretary, C= plastic surgeon										
Activity/actor	D1	D2	A1	A2	I1	I2	S1	S2	C1	
First steps										
Take an appointment in dermatologic consultation	C		R	R			R	R	I	
Go to the dermatologic consultation	R/A				I	I	R		R	
Prescribe a biopsy	R						R		I/C	
Send to the laboratory					R	I/R				
Recover the results	I				R		R			
Validate the results	C	R/A								
Prescribe a medical treatment	R								C	
Go to the announcement consultation	R/A				R/C	R/C/I	I			
Prescribe complementary exams	R/A								R	
Plan the surgery	R		R	R	R	R	I		R	
Plan the anesthesia consultation									I	
Operate the patient					R				R/A	
Last steps										
Follow up in plastic surgery							R		R	
Go the nursing consultation					R					
Prescribe a complementary surgery	R								R	
Follow up in dermatology	R		R	R	R	R	R			
Regular follow-up	R									
Readdress to the general practitioner	R						C			

This matrix provides a vision of the different actors in this process and confirms that several persons can be in charge of the same tasks. This analysis underlines the difficulties, as caregivers need to be coordinated to avoid the replication or the oversights of the activities. An information system is needed to the information exchange between the actors. The multiplication of resources and information supports causes error in the communication and coordination process. The consequences are the increase of the waste time and the duration of the process (Ash et al., 2004).

The interviews and the RACI model enabled us to identify the actors, their roles and interdependencies in the care process. This work reveals that the CC process is a complex system composed by several interdependent actors. For further analysis, the DSM approach can be used to (Eppinger and Browning, 2012):

- The understanding of the system architecture through an easiest visualization to the recognition of the system dysfunctions,
- The improvement of the process through to mathematical models.

The DSM is an innovative tool for system analysis as it can provide a compact representation of the system organization. The Figure 3 is a DSM which representing the interactions between actors and supports.

Actor/ Support	mail	letter	oral	agenda software	phone	claim form	mediweb software (SW)	paper prescription	ipop SW	gilda SW	biopsy coupon	biopsy report	biopsy case	patient records	schedule operator Block	check list	operator record	acipidos SW	exam application	ambados SW	contact list	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
Dermatologist1	D1	x	x	x	x			x	x			x	x		x				x	x		
Dermatologist 2	D2			x		x						x										
Welcome officer 1	A1	x		x	x	x																
Welcome officer 2	A2	x		x	x	x																
Nurse 1	I1	x			x				x		x	x	x									
Nurse 2	I2				x						x	x	x									x
Secretary 1	S1		x	x	x	x		x	x									x			x	x
Secretary 2	S2	x	x	x	x	x		x														
Plastic surgeon 1	C1							x		x												

Figure 3. DSM model : actor-support interactions

In the care process in skin cancer management, 21 different supports were referenced, while the 8 different actors/users are represented in the first column. Crosses marked the support is used by an actor. We identified that an actor used between 3 and 11 different supports to the achieving of all activities of this process. The use of this several supports that he information is fragmented during the care process, that causes an unstructured information flow. It is an obstacle to the communication between the actors and the efficacy of care delivery, and by definition an obstacle to the improvement of CC. In light of these observations, it could be interesting to work about a collaborative system which enable more effective exchange of the information between actors to improve the care coordination.

3.4 Discussion

This work reveals that the healthcare system needs to redesign his organization to improve his effectiveness and quality of care. The improvement of care coordination is one way to increase the quality of care and reduce the health cost (Institute of Medicine (U.S.) and Committee on Quality of Health Care in America, 2001). The main problems that are highlighted here are in the information exchange and the resources organization. The literature analysis allows to compare the different care organization models in function of the patients profiles application, the resources organization and the impact on the care coordination, the more adequate model to improve the care coordination seems be the patient-centered model. The care quality and the cost reduce are the two criteria which are measured for the care coordination assessment (Bodenheimer, 2008). Based on these criteria, the process analysis could be useful to measure the effectiveness of the care process and the impact of a new organization on care process and on care coordination. Using the engineering methods to redesign of healthcare organization is a challenge, for example the cost impact would be difficult to measure with the cost engineering methods, due to a different cost structure in the healthcare system. The engineering methods may be adapted to be applied in the healthcare delivery and used by caregivers and administrators to improve the care process performance (America and (US), 2007).

4 CONCLUSION

The improvement of CC would be a way to insure the care quality and reduce the healthcare cost. In this work, we presented the CC process analysis in skin cancer at hospital. The understanding of this CC process highlights that it is a complex system. In fact, the number and the multidisciplinary of the actors, the information flow and the multiplication of information supports express the need of an efficient organization around the improvement of CC. This study allows to characterize the care process in skin cancer application to understand existing difficulties. The analysis has also underlined the difficulty of having clearly identified roles in the coordination process and the use of 21 supports in the process. It is an important work to report the hospital system situation and identify the origin of the difficulties in the care coordination. However, the analysis should be extended in several departments to determine if the information exchange and the resources organization are common

difficulties at hospital. Future research will address possible strategies that can contribute to increased efficiency and medical professional support in this process. Further studies have also to be conducted with regard to different CC processes within a hospital. The aim would be to establish a common framework which would allow to design a new organization of the care system.

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