Managing Clinical Handover Processes for Cardiology Patients Using BPM

By

Amal Alghamdi

A thesis submitted to the
Faculty of Graduate and Postdoctoral Studies
in partial fulfillment of the requirements for the
MSc. degree in Electronic Business Technologies (e-technologies)

University of Ottawa

Winter/2015

Abstract

Health-care delivery involves clinical handover processes that occur at many levels of inpatient care. These processes are essential to an effective health-care system due to their role in achieving efficient communication, reducing transmission time, and lowering costs. Ensuring safe and effective handover requires the coordination of multiple care providers that work together to deliver patient care efficiently. Poor coordination during handover can have major effects on patient care, leading to loss of information and contributing to adverse events.

As health-care delivery evolves to become more patient-centered, handovers from short- to long-term care need to maintain a strong communication, which in turn will depend on the evolution of support systems for that communication.

Due to the wide range of care providers and patient needs, there has so far been a lack of research work on handover processes. This study aims to explore the clinical handover process for patients moving from a cardiology unit to home and community care settings, and how they are affected by varying degrees of communication. It relies on literature review and a case study conducted at Montfort Hospital, Ontario, to identify and analyze the major factors involved in this type of handover, and to form suggestions about how this process could be improved.

This thesis analyzes process scenarios arising in the case study, modeling them using business process management (BPM) tools and techniques to identify

problems and formulate solutions. A model of the existing process is created and analyzed using business process management notation (BPMN), and is then subjected to analysis, the results of which identify several communication issues with a potential to cause delays and information loss.

The findings highlight the importance of collaboration among care providers, and indicate the potential uses of BPM methodology to choreograph that collaboration. The study ultimately shows how improvements to collaboration and information exchange can increase the communication effectiveness in handover processes and reduce the probability of adverse patient events.

To Amer & Salwa…

"My Lord, have mercy upon them as they brought me up [when I was] small" (Qur'an: 17:24)

Acknowledgments

First, I would like to thank my supervisor Dr. Sarah Ben Amor for her continued support, motivation and patience. Your guidance helped me through my research and writing of this thesis. It has been such a great pleasure to work with you, your kindness and dedication to your work is a genuine inspiration. Thank you so much for everything.

I would like to thank Dr. Liam Payton for his advice and guidance and for the great opportunities he has provided for me during my studies.

I also would like to express my gratitude to Dr. Morad Benyoucef and Dr. Craig Kuziemsky for the valuable advice giving to me during my research.

To my family, words are often inadequate to convey how valuable your help and support was to me. For being the source of my strength and happiness; for sharing my dreams, I say thank you.

I would like to thank my friends and cousins who I could never have done this without. You've been my rock and joy. For standing by me during the difficult times, thank you.

I would like to thank Montfort Hospital for the opportunity to conduct my research.

Finally, I acknowledge the financial support from The Ministry of Higher Education (King Abdullah Scholarships Program)- Saudi Arabia, the IBM Center for Business Analytics and Performance (CBAP)- University of Ottawa.

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1. Introduction

The health-care industry is well known for being host to large and complex systems that present numerous barriers to care delivery. Due to this, there is an acute and urgent need to improve health-care systems to deal with decreasing resources, higher costs, and increased complexity of patient health issues.

Reacting and responding effectively to patient needs at any time and place are among the most important functions of health care. Changes in the health-care context can contribute to ineffective delivery of the full potential benefits of care to patients (Liu, 2010), with such changes including variation in public health-care needs, longer lifespans, increasing rates of chronic disease, and development of new medical technologies.

This thesis intends to focus on handover processes as an important part of efficient health-care delivery, to investigate how improved communication plays an important role in such processes, and to determine how that communication could be improved to the benefit of patients. In particular, this thesis investigates handover processes in patients' movement from a cardiology unit to a home and community care setting.

1.1 Managing clinical handover processes for cardiology patients using business process management (BPM)

The heart of this thesis is a case study that was conducted at Montfort Hospital in Ottawa, Ontario. The principal investigator carried out interviews with cardiology

care providers and home and community care specialists, observing the current state of the handover process between both settings. The study aimed to focus on the patient's journey from the moment they are discharged from cardiology care in the hospital until they reach a home and community care facility.

The following section contains a breakdown of the research problem, the study's objectives, and the expected outcome of the work.

1.2 Problem statement

Health-care systems have greatly improved due to rapid technological development in the twentieth and twenty-first centuries. (Australian Commission on Safety and Quality in Health Care, 2008; Nolte & McKee, 2008) Advancements in managerial techniques have also improved health-care provision, and today, tools and techniques from business process management (BPM) are widely used to improve the quality of health-care systems.

Continued increase in the prevalence of chronic illnesses, and a proliferation of patient care methods to deliver, will sustain the current trend toward home-based care. Long-term care (LTC) involves diverse health-care environments and engages interdisciplinary teams to work with patients and their families to deliver extended care that best manages their conditions.

Establishment of strong communication between care providers when handing over patients to an LTC service is essential to the delivery of high-quality care. Most importantly, it requires collaboration between multiple care providers, including health-care professionals and allied health workers, who must work together to deliver the best care for their patient.

Information exchange occurs at many levels of an organization. Health-care organizations that function twenty-four hours a day must pay strong attention to

the efficiency of communication and exchange of information, especially during shift changes. The effectiveness of such communication has a direct effect on the patient's safety, and the quality of work practices within the health-care setting (J. K. Johnson, Arora, Bacha, & Barach, 2011)

There are three basic elements that can affect patient flow in a health-care setting (Koo, Jang, Nielsen, & Kolker, 2010) :

1. number of patients
2. system capacity
3. the nature of patient flow

To create efficient patient flow, it is essential to manage these elements using a structured approach. In a review of relevant literature on clinical handover processes, (Gogan, Baxter, Boss, & Chircu, 2013; Haggerty et al., 2003; Manser & Foster, 2011; Petersen, Blackmer, McNeal, & Hill,2013) it became clear that the movement of patients with chronic conditions from cardiology care units to home and community care units had not yet been focused on sufficiently. Most research focused on studying handover processes within certain departments or units in the hospital but very few addressed these processes when occurring from hospital to home and community care units.

Many studies have identified the effects of communication in clinical handover processes on the quality of patient care (AMA, 2006; Belfrage, Chiminello, Cooper, & Douglas, 2009; Bost, Crilly, Wallis, Patterson, & Chaboyer, 2010) . Health-care organisations around the world have also pointed out the effects of miscommunication on the delivery of patient care (Australian Commission on Safety and Quality in Health Care, 2008; National Patient Safety Goals, 2008; WHO, 2007). That poor communication between care providers can be a precursor to loss of information and low quality patient care underlines the

importance of incorporating collaboration strategies into process improvement approaches. By understanding the main forms of communication in a typical handover scenario and identifying the major causes and negative effects of miscommunication, we will be able to formulate possible methods to avoid these issues and to demonstrate the communication in a collaboration model.

There is extensive literature on modeling and analysis of health care, representing great efforts to deal with industry challenges and introduce solutions. Most patient flow initiatives begin with process mapping in hospital departments. They then use a process such as simulation modeling or a business process-modeling tool to determine the most effective solution (Mahaffey, 2004). This study seeks to thoroughly understand clinical handover processes in their entirety (what they consist of and how they function) in a bid to develop deep and specific insights into the patient handover process from the cardiology care unit to home and community care facility.

1.3 Objectives of the Thesis

Business process management tools and techniques have been used to maintain the delivery of quality in health care (Helfert, 2009). Given the current movement towards using BPM methodologies in this setting, this work is motivated to investigate the problems of handover processes and help health-care organizations enhance the quality of their patient flow. To improve communication and reliability in these handover processes, this study will employ process modeling techniques.

As miscommunication is identified as a leading cause of low-quality patient care (Australian Commission on Safety and Quality in Health Care, 2008), this thesis seeks to identify *how* loss of information, delays, and low-quality patient care are caused by miscommunication. This is done by combining an understanding best

practices of communication in handover processes with the results gathered from the case study.

This study will contribute to the body of knowledge in the following ways. It will:

- Investigate processes in the clinical handover of patients from the cardiology unit to home and community care providers, when those patients leave the cardiology department at a hospital.
- Identify factors that affect information transfer during the handover process.
- Examine the dominant forms of communication and power relations among care providers from both units during the handover.
- Use BPM methodologies to identify potential improvements to the handover process and to highlight the collaboration required of involved care providers.

To elaborate further, the following section gives a breakdown of the study leading to the statement of the problem and the research questions.

1.3.1 Problem statement breakdown.

Observation.

Hospitals face numerous challenges in managing the flow of patients through their acute care settings (Haraden & Resar, 2004) Literature reviewed in modeling and analysis of health care demonstrates a great effort to deal with problems and introduce solutions.

Improving the reliability and consistency of patient handovers has become an international priority for the WHO, the Joint Commission, and the ACSQHC

(Australian Commission on Safety and Quality in Health Care, 2008; National Patient Safety Goals, 2008; WHO, 2007)

Communication problems, as well as issues around keeping patients' medical records, are among the major difficulties affecting clinical handover processes (Bomba & Prakash, 2005; J. K. Johnson et al., 2011) . Moreover, how to ensure an effective patient transfer from a hospital care provider to a home and community care setting has not been widely covered in recent literature (McBride, Beer, Mitzner, & Rogers, 2011) . This creates some urgency around the need to investigate how to improve communication in clinical handovers and patient transfers.

Thesis.

Home and community care providers experience significant sources of frustration and difficulty in handoff communication, as identified recently by McBride and others (McBride et al., 2011). For instance, certified nursing assistants (CNAs) faced barriers to communication within this context.

Enthymeme.

It is necessary to manage the clinical handover processes more effectively. BPM tools and techniques should be able to help guarantee patients' privacy and safety while increasing the level of communication between health-care practitioners who need to collaborate on an individual patient's care.

Problem statement.

To achieve effective management of clinical handover processes used during patient movement from cardiology to home and community care movements using BPM.

Objective.

Facilitate clinical handover with BPM as a patient moves from cardiology to home and community care units.

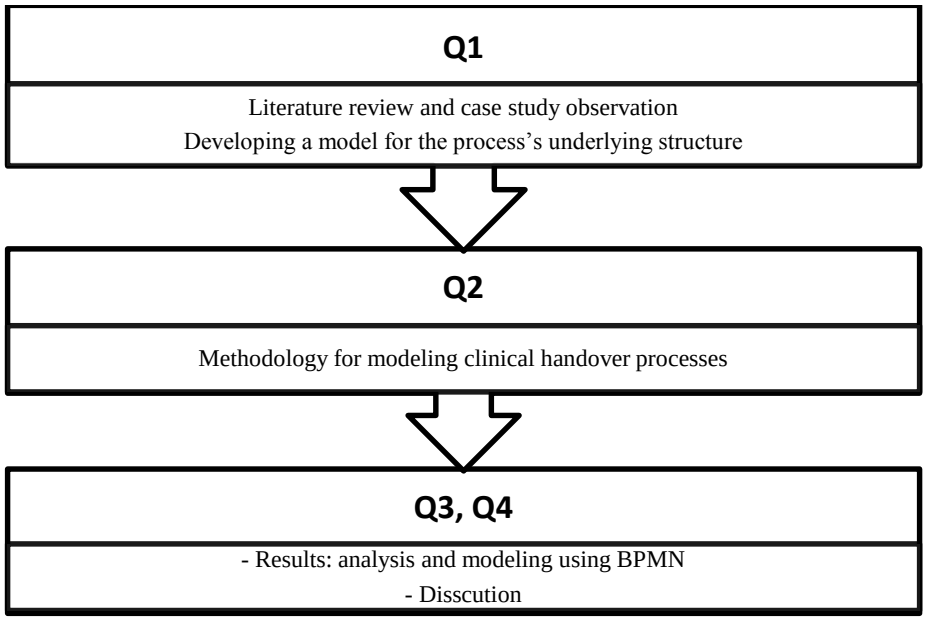
Research questions.

1. What is the handover process used when transferring patients from the cardiology unit to home and community care?
2. How can BPM methodologies be used to understand and model the continuity of care for patients in the context of the clinical handover process from cardiology to home and community care facilities?
3. What are the challenges associated with modeling this handover process?
4. How can BPM provide satisfactory solutions to problems in the handover process?

1.4 Thesis Organisation

Figure 1.1 gives a graphic representation of how the research questions map to the contributions of this work.

Figure 1.1 Thesis Contributions Matching Research Questions



2. Background and Literature Review

As the study setting is in cardiology unite and uses the practice of handover to LTC as a case study, literature on handover process and LTC services were reviewed. We present an overview of research on health care and health-care professionals. We clarify the meaning of "health care," and explain which health-care professionals are of particular interest for this thesis. We then narrow our focus within health care to clinical handover processes, and explain the most relevant issues and concerns on this subject. We also introduce a range of approaches to managing the impact of clinical handover that are mentioned in current literature. Later, we investigate the clinical relevance of handover, along with how communication and continuity of care is central in this type of health-care process, particularly in handovers to long-term care.

In section 2.3, we provide an overview of Business Process Management (BPM), Business Process Management and Notation (BPMN 2.0), and other tools and techniques used in this research. Finally, we relate the subject of clinical handover to past and current studies, highlighting gaps and problems related to our topic.

Since we have prior knowledge of problems in clinical handover, we seek through this case study to support our research with real-life scenarios and identify major issues with the clinical handover process. The case study at Montfort Hospital focuses on the clinical handover process in patients' movement from cardiology to home and community care settings, and this literature review will also devote attention to actors involved in the process.

This literature review was conducted using a variety of academic search engines, databases for journals, articles and theses. Major fields explored included management information systems and health-care systems. Search terms used

included “handover”, “clinical handover”, “health care”, “business process management”, “handover improvement”, “communication”, and “modeling languages”.

2.1 Defining “Healthcare” and “Health-care Professionals”

2.1.1 Health care.

According to the World Health Organization (WHO), health care involves activities directed towards maintaining and sustaining people’s health. The WHO defines “health” as a “state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. In the context of long-term care, health care is services provided to individuals or communities by health-service providers for the purpose of promoting, maintaining, monitoring or restoring health (WHO Centre for Health Development (Kobe, Japan), 2004) . Health-care systems involve health-care processes that help deliver patients services and care.

2.1.2 Health-care professionals.

Health-care professionals, as defined by the WHO in its classification of the health workforce (CITE), are people who study, advise, or provide preventive, curative, rehabilitative and promotional health services, based on an extensive body of theoretical and factual knowledge of the diagnosis and treatment of diseases and other health problems. Health-care professionals can also supervise other workers in the field.

The WHO also, in its classification of the health workforce, mapped different health-care workers to their occupations. Table 2.1 lists the main actors in this research and their occupations. Further detail is provided in Chapter 3.

Table 2.1 Occupation Groups and Definitions

Occupation group	Definition	Occupation name in this research
Specialist medical practitioners	Specialist medical doctors diagnose, treat and prevent illness, disease, injury and other physical and mental impairments using specialised testing, diagnostic, medical, surgical, physical and psychiatric techniques, through application of the principles and procedures of modern medicine. They plan, supervise and evaluate the implementation of care and treatment plans by other health-care providers. They specialise in certain disease categories, types of patient or methods of treatment, and may conduct medical education and research activities in their chosen areas of specialisation	Cardiologist

Nursing professionals	Nursing professionals provide treatment, support and care services for people who are in need of nursing care due to the effects of aging, injury, illness or other physical or mental impairment, or potential risks to health, according to the practice and standards of modern nursing. They assume responsibility for the planning and management of the care of patients, including the supervision of other health-care workers, working autonomously or in teams with medical doctors and others, in the practical application of preventive and curative measures in clinical and community settings.	Nurses (In this research, registered nurses [RNs] and head nurses are the focus).
Nursing associate professionals	Nursing associate professionals provide basic nursing and personal care for people in need of such care due to effects of aging, illness, injury, or other physical or mental impairment. They provide health advice to patients and families, monitor patients' conditions, and implement care, treatment and referral plans usually established by medical, nursing and other health professionals.	Assistant nurse

Community health workers	Community health workers provide health education, referral and follow-up, case management, and basic preventive health care and home visiting services to specific communities. They provide support and assistance to individuals and families in navigating the health and social services systems.	Community health worker. (E.g. CCAC care providers, community care providers.)

Source: WHO Centre for Health Development (Kobe, Japan), 2004.

2.2 Handover

2.2.1 Defining handover.

"Handover" is "the transmission of power from one person or a group of people to another" (Chambers, 2001). In the health-care context, the "transmission of power" involves physicians or health-care specialists transferring the patients to different stages of care. Another kind of transmission can occur between teams who are dealing with concurrent or continuing care activities (Scott, Ross, & Prytherch, 2012) . The term "clinical handover", on the other hand, tends to involve power transmission in the sense previously mentioned.

2.2.2 Clinical handover.

Research revealed a wealth of published literature on the term "clinical handover", though there is no universal agreement on what it refers to. The Australian Medical Association (AMA) defines clinical handover as "The transfer of professional responsibilities and accountability for some or all aspects of care for patient, or group of patients, to another person or professional group on a temporary or permanent basis" (AMA, 2006). But according to a more recent

study by the association in 2008, this definition is not universally accepted and may not correspond to the common understanding of the term (Australian Commission on Safety and Quality in Health Care, 2008) .

Why is this? First, a range of professionally used terms, in a range of medical settings, can be included in "clinical handover". "Hand-off", "shift report" and "patient transfer" can all convey the same meaning. Handovers are unavoidable in the health-care system, and can occur at shift changes; when transferring patients within and between hospitals; during admission, referral and discharge; or during a doctor's break (Manser & Foster, 2011) .

A range of studies have recognised the importance of patient handover, and many have launched initiatives for improvement. For example, the Australian Commission on Safety and Quality in Health Care (ACSQHC) has been appointed by the WHO to identify key aspects of patient safety and monitor outcomes in that area. Its studies revealed a considerable gap between policy and research in the area of clinical handover, and gave recommendations to prioritise clinical handover as the most important process in reducing adverse patient events (C. Jensen, 2010). Part of the ACSQHC's recommendations were for further research to be conducted in the area, including "research into the effectiveness of electronic records and tracking systems as well as the influence of work place cultural and clinical contexts on the content and accuracy of information contained in the handover" (C. Jensen, 2010).

A recent literature review demonstrated important limitations in the area of medical handover research (Scott et al., 2012). According to its authors, there is so far no evidence-based instrument for evaluating handover effectiveness. Although recent work has demonstrated tools and techniques to solve specific problems in the handover process (Bost, Crilly, Patterson, & Chaboyer, 2012;

Gerdtz, Liu, & Manias, 2012; Iedema et al., 2012) , no research so far employs BPM methodologies in an attempt to improve clinical handover from a unit of care to another one in the community.

The present work reviews the current state of research and improvement efforts in clinical handover, models the clinical handover process and identifies key areas for improving the communication process. In doing so, we will examine handover research that relates to and can contribute to the improvement of handover processes used in patient movement from cardiology to home and community care units. Where appropriate, examples of improvements made in other clinical handover settings will be used. The thesis's overall aim is to conduct an investigation of clinical handover from both theoretical and real case perspectives, focusing on its contribution to patient safety and the potential role BPM could play within this context. This led to the identification of two areas of focus, clinical handover and communication, and clinical handover and continuity of care.

2.2.3 Clinical handover and communication.

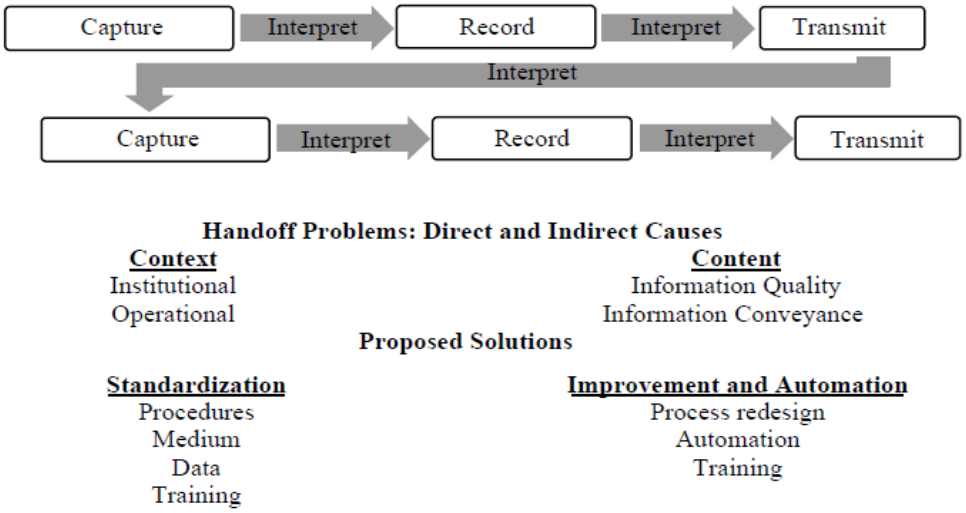
The development of standard procedures for communication in handover is one of the WHO's top five priorities for improving patient safety (Scott et al., 2012; WHO, 2007). Communication plays an important role during handover, and affects the ongoing process of exchanging medical information. Handover has been described as a routine "communication forum" where one or more care providers give details about the patient to one or more other care providers (Gerdtz et al., 2012).

Information handling.

A crucial factor in the communication process during patient handover is the effectiveness of information handling. Handover information is typically delivered as a combination of verbal and written elements (S. M. Jensen, Lippert, & Østergaard, 2013) . Communication behavior among care providers has rarely been studied in relation to patient handovers; most studies instead focus on the transfer of accurate and complete information (Manser, Foster, Flin, & Patey, 2013) .

Studies have looked at a range of different information handling mechanisms used during handovers. For instance, one study based its understanding of clinical handover on the concept of an information processing cycle (Gogan, Baxter, Boss, & Chircu, 2013b) . According to this study, clinical information is captured, recorded and transmitted during the provision of care by people using paper-based, automated or hybrid systems. Most handover problems can occur at any stage of this information processing cycle. Solutions to these problems can involve several approaches to process redesign, automation and standardisation (Arora, Johnson, Lovinger, Humphrey, & Meltzer, 2005; Gogan et al., 2013) .

Figure 2.1 Summary of Handover Problems and Solutions.



Source: Gogan et al., 2013.

From this study, we can see that effective communication plays an important role in information handling, and that clinical handover can be understood in the context of an information processing cycle.

Hand-off communication requires the coordinated effort of multiple care providers in multiple settings involved in the changeover of patient care (Amato-Vealey, Barba, & Vealey, 2008) . It has also been seen that handover occurs within a particular spatial environment, which has an impact on communication (Randell, Wilson, Woodward, & Galliers, 2011) . Communication methods used among health-care providers, despite the presence of advanced information technology, are frequently paper-based and/or rely on phones and fax machines, yet few studies have linked medication safety concerns with communication problems, signifying a lack of sufficient research on this topic (Gerdtz et al., 2012).

Communication during handoffs can be improved by using some of the most common tools and techniques applicable to this type of process. One of these tools for communication among care providers is SBAR (situation, background, assessment and recommendation) (Novak & Fairchild, 2012; Velji et al., 2008) . SBAR is a structured, focused way to set expectations of what will be communicated between care providers working within a team. It is very useful tool for framing conversations, especially those that require the clinicians' immediate attention (Amato-Vealey et al., 2008)

SBAR communication techniques consist of four components (Amato-Vealey et al., 2008):

- situation: stating the patient problem, identifying the clinician and the patient
- background: patient medical background
- assessment: evaluations and observations of the patient's current state.
- recommendation: suggestions for the continued care of the patient

Most studies concerning communication among care providers have focused on acute care settings and the nurse–physician relationship, and there is little work within the rehabilitation literature on the use of structured communication tools (Velji et al., 2008). Electronic SBAR gives staff a reliable and standard way to undertake patient handoff (Wentworth et al., 2012), and can significantly improve patient safety by helping to set expectations for what is to be communicated and how that communication will be handled (Velji et al., 2008). Structured communication plays a fundamental role in ensuring the accuracy of information exchanged during handover processes.

2.2.4 Clinical handover and continuity of care.

Continuity of care is an important aspect of the particular handover process that this research investigates in the case study. As a cardiac patient transitions to a rehabilitation unit in the community, family caregivers provide different types of support that will help them as they cross through long-term care systems. Continuity in this type of transition is important, as the process requires monitoring and follow-up. For example, patients might return to a hospital due to a range of complications in their condition, a need to follow up with care providers, or if questions about the patient's previous treatments arise (Haggerty et al., 2003)

2.2.5 Clinical handover and collaboration.

Since there is no standardised model for collaboration in health care, care providers engage with each other and work together in a variety of ways. This lack of standardisation can create challenges for care providers. As mentioned previously in discussion of clinical handover, effective communication plays an important role in delivering patient care. In particular, effective collaboration is essential to achieving successful communication between multidiscipline care providers working to transfer a patient to a LTC service outside the hospital.

Dictionary definitions have "collaboration" mean working jointly or together (Canadian Oxford Dictionary, Webster's New World Dictionary). In health-care contexts, collaboration may have more specific meanings depending on the disciplinary setting and type of operations concerned.

Wood & Gray found their study on collaboration on this definition: "Collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to that domain" (Wood & Gray,

1991) . They offer a summary of the core components of collaboration that, there and in a later study (Walter, 2005), are as follows:

- **stakeholders:** groups or organisations with an interest in the problem domain may have common or differing interests in the beginning; however these interests may evolve or be redefined as time and the life of the collaboration pass
- **autonomy:** stakeholders retain their autonomous, independent decision-making capabilities
- **interactive:** a process; change-oriented relationship; all participants take part in change
- **shared rules, norms and structure:** these can be implied in collaboration, but usually stakeholders explicitly agree to rules and norms that govern interactions, and there are evolving shared structures
- **action or decision:** participants in collaboration tend to act or decide, as collaboration is directed toward an objective
- **domain orientation:** participants orient processes, decisions, and actions toward issues relating to the problem that brought them together

Understanding collaboration as broken down into these components can provide a foundation for assessing the effectiveness of collaborative relationships between care providers in multiple settings. This will also narrow the study from collaboration as understood in broad organisational terminology, focusing it on collaboration as understood in relevant health-care terminology (Walter, 2005). Such an understanding of collaboration will also act as a foundation for assessing the collaboration relationships examined in this research.

2.2.6 Relevance of clinical handover in health care.

We do not here attempt to study or define the concept of clinical handover in its entirety. The goal of this research is not to examine handover in itself, but to consider how it affects health-care delivery, particularly in the context defined by the case study.

Effective execution of a clinical handover process can eliminate some of the most complex problems faced in health-care delivery. In an attempt to improve this execution, some of the initiatives examined during the literature review proposed standardisation for handover communication that is partially general and partially specific to medical settings (Manser & Foster, 2011) .

Problems involved in clinical handover occur in different medical settings. Studies have shown that ineffective transfer of information among participants in the handover process can lead to adverse patient events (Gerdtz et al., 2012). Communication is central to safe clinical handover management. Research on the complexities of handover has focused on the changing environment and on power relations in medical facilities (Manias & Street, 2000) along with problems facing nurses during multiple stages of patient care (Chaboyer, McMurray, & Wallis, 2010; Gerdtz et al., 2012; M. Johnson, Jefferies, & Nicholls, 2012; Tobiano, Chaboyer & McMurray, 2012) . Little to no work has yet been done that incorporates all aspects of health-care settings and yields results that can suit all types of handover. The present study intends to discover if business process management (BPM) techniques can offer such an inclusive result.

2.3 Business Process Management (BPM)

2.3.1 The BPM concept.

The history of business process management dates back to the 18th century. Adam Smith is one of the most prominent founding names in relation to this topic. His example of the pin factory in the 1776 work *An Inquiry into the Nature and Causes of the Wealth of Nations* is an early analysis of business process. Smith provided an elaborate description of how work can be divided in manufacturing a single pin, showing that a number of people can share the tasks involved in the manufacturing process. Here, he tried to bring out the importance of business process management in quality and time aspects of needle production (Gattnar, Ekinci & Detschew, 2011) , demonstrating that through division of labor in manufacturing processes, output can be increased. This concept allowed production to increase by almost twenty four thousand percent during the Industrial Revolution. Business process management is founded on the division of labor and other similar advancements (Jedd, 2007).

There are a number of differences that exist between business process management and business process reengineering (BPR). Whereas BPM deals with the improvement and implementation of business processes, BPR is concerned with particular techniques through which the various business processes are made more effective (Helfert, 2009). BPR is an aspect of BPM: it is the analysis of designs for workflows and organisational processes. On the other hand, business process management is concerned with *implementation* of business process reengineering among other analytical tools and techniques. If BPM were software or a program, BPR would be a method within the software or program (Vallabhaneni, 2008)

Business process management as a term has occasionally been misinterpreted and/or misused. This is common in literature from industry commentators and vendors that give a misleadingly narrow definition of BPM focused on technology, which has little to do with the impact of business process management on various business processes (Jeston & Nelis, 2008) . Other reasons for misusing this term can be that vendor identification of BPM with particular processes, software, or technology gives BPM an overly narrow sense that disempowers users by hiding its broader scoop and applicability. Were in fact, a successful BPM initiatives requires close collaboration between business operations and technologists, and ties all business process projects to core business initiatives(International Business, 2012)

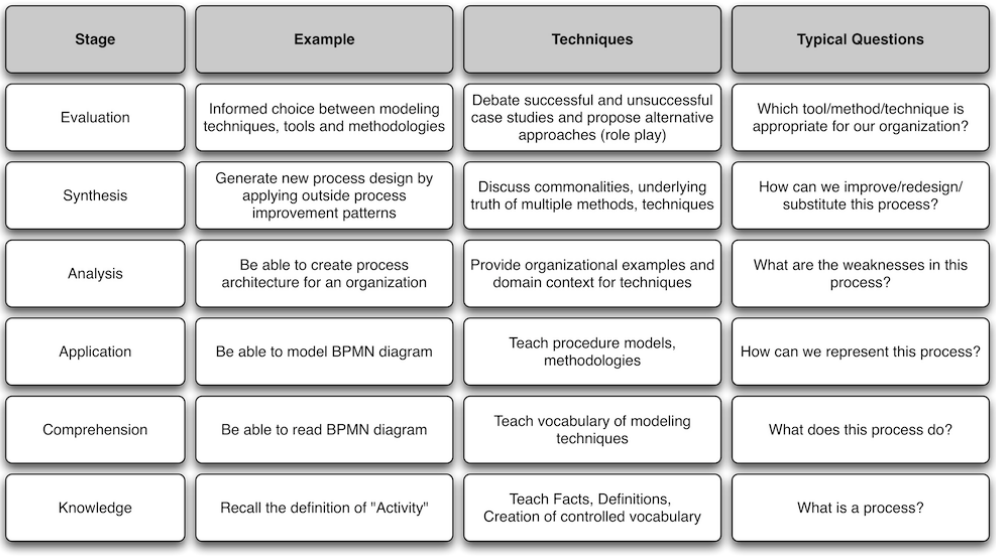
As an experiment, this study adopts BPM techniques to accomplish its goals and objectives, which include analysis, implementation and monitoring of the clinical handover process.

2.3.2 BPM tools and techniques.

Considering our target organisation as a set of organised and managed activities carried out to achieve concrete goals, we base the BPM skills required for this research on Bloom's taxonomy, first published in 1956 in volume 1 of *Taxonomy of Educational Objectives*. Although the taxonomy was designed for learning and educational objectives, we find it describes some of the necessary skills to develop, manage and analyze clinical handover processes.

Bloom's taxonomy (Figure 2.2) lists several BPM skills, and specifies to what extent they should be developed (Muehlen, 2011).

Figure 2.2 Bloom's Taxonomy



Stage	Example	Techniques	Typical Questions
Evaluation	Informed choice between modeling techniques, tools and methodologies	Debate successful and unsuccessful case studies and propose alternative approaches (role play)	Which tool/method/technique is appropriate for our organization?
Synthesis	Generate new process design by applying outside process improvement patterns	Discuss commonalities, underlying truth of multiple methods, techniques	How can we improve/redesign/ substitute this process?
Analysis	Be able to create process architecture for an organization	Provide organizational examples and domain context for techniques	What are the weaknesses in this process?
Application	Be able to model BPMN diagram	Teach procedure models, methodologies	How can we represent this process?
Comprehension	Be able to read BPMN diagram	Teach vocabulary of modeling techniques	What does this process do?
Knowledge	Recall the definition of "Activity"	Teach Facts, Definitions, Creation of controlled vocabulary	What is a process?

Source: Muehlen , 2011

This research requires the following skills (Muehlen, 2011)**:**

- **knowledge:** the ability to observe the process and recall information, and mastery of subject matter in terms of definitions and specifications
- **comprehension:** translating available knowledge about the process from data collected in the case study into a BPMN diagram, putting concepts into a new context and allowing us to predict consequences and infer the performance of the process from its design.
- **application:** using BPMN to model the previous process
- **analysis:** creating the reference model to analyze the process and identify gaps and weaknesses; analyzing interview transcripts from the case study at Montfort Hospital to locate problematic points that caused breaks in communication
- **synthesis:** propose improved solutions and use simulation to forecast the impact of the proposed changes on the organisation
- **evaluation:** evaluate the chosen approach to modeling the clinical handover process, and the proposed framework for change

2.3.3 Business process modeling.

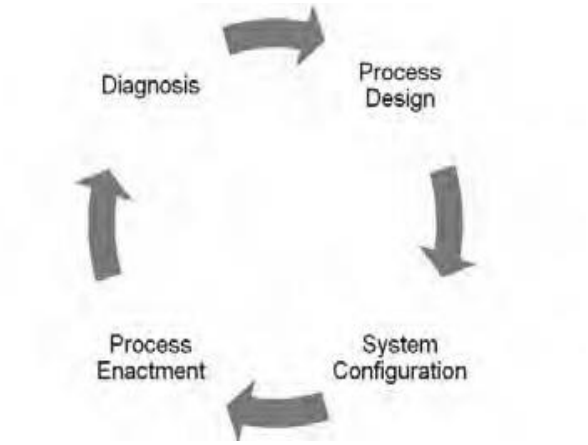
BPM presents a number of challenges that make it difficult and time-consuming to implement. Some common challenges include learning to understand modeling languages, software systems, and management standards. Modeling can be defined as a form of mapping that seeks to connect the modeling world with the modeled world. A modeling technique is a tool through which concepts, things, and constructs found in the modeled world are mapped to objects in a model (Mili et al., 2010). Difficulties with representing real-world objects in context are the main reason behind the development and implementation of modeling languages (Vallabhaneni, 2008). Although learning them can present challenges, modeling languages have been developed and are necessary to overcome difficulties with representing real-world objects within a model.

Business process modeling allows one to focus on an organisation's main process for analysis and integration. After identifying a main objective in the analysis stage, one progresses to building the model.

After explaining the terminology used, this research will move on to a modeling process based on Ko's approach (Ko, 2009). Ko's research demonstrated six stages of the modeling process, which align with van der Aalst's BPM life cycle (Figure 2.3) (Lee, Wah Lee& Ko, 2009) :

1. business needs
2. business goal definition
3. detailed business process diagram
4. translate diagrams to executable code
5. execution code
6. executable business processes

Figure 2.3 Van der Aalst's BPM Life Cycle



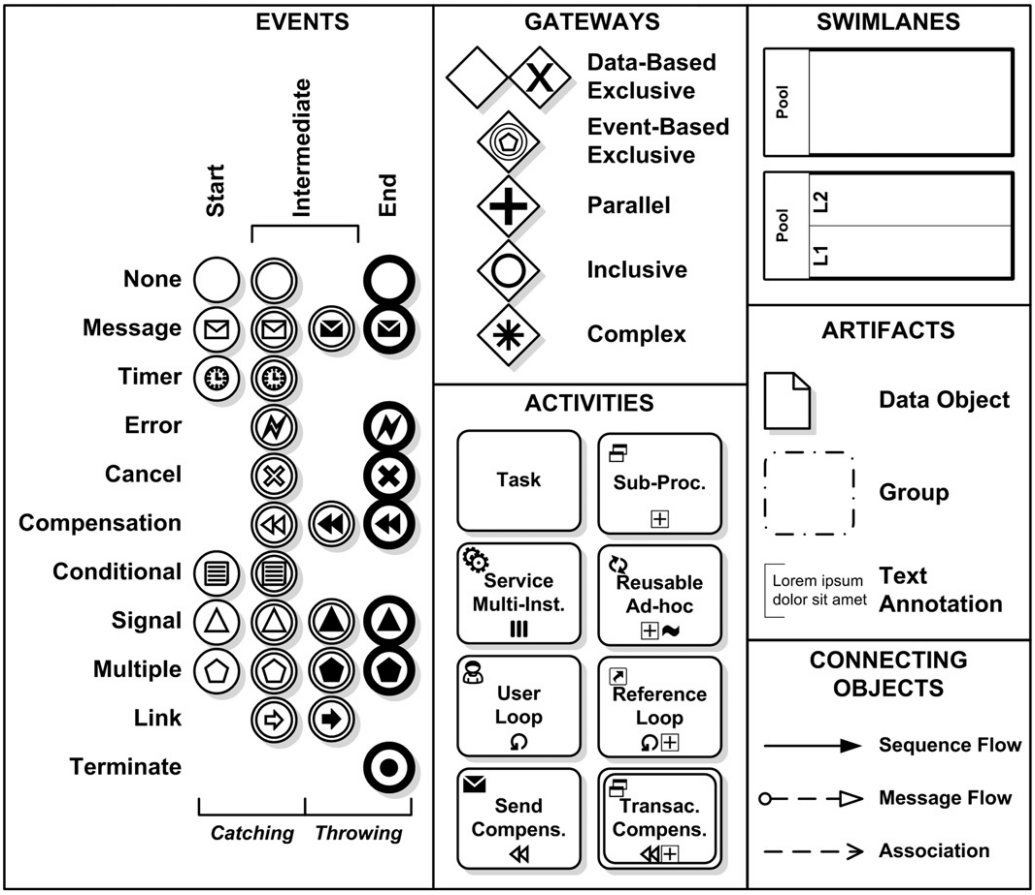
Differences between BPM and BPR.

2.3.4 Business process management notation (BPMN).

Business Process Management Initiatives (see bpmi.org) developed a standard Business Process Management Notation (BPMN), and released it to the public in May 2004 (Chinosi & Trombetta, 2012) . BPMN notation aims to be readily understandable by all entities involved in the process of drafting, analyzing, implementing and managing BPM projects.

The complete BPMN specification defines fifty constructs and attributes, grouped into four basic categories of elements: *flow objects, connecting objects, swimlanes and artifacts* (Figure 2.4 shows the categories along with examples)

Figure 2.4 BPMN Core Elements.



Uses of BPMN: processes (orchestration), choreographies and collaborations.

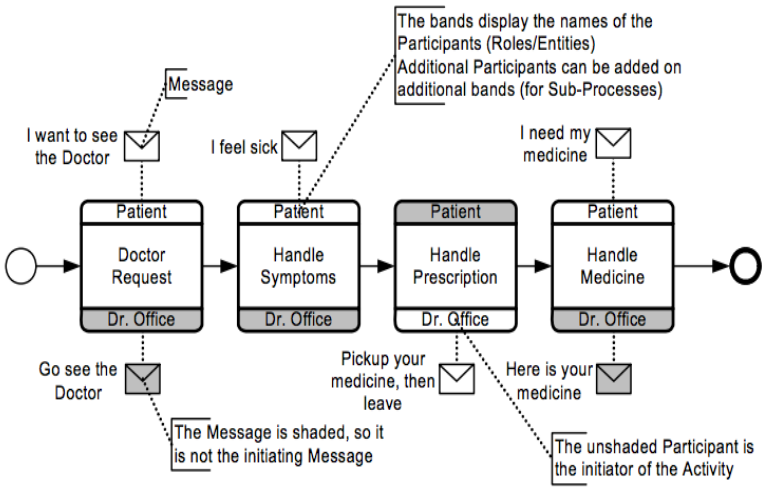
Collaboration is one of the characteristics of the process for handover to long-term care (LTC). This study collaborative process for the optimised handover model is formulated using service choreographies. Importantly for our purposes, BPMN 2.0 specifications extend the scope and capabilities of the BPMN 1.2 in many areas, including by extending the definition of human interaction and defining choreography modeling (Object Management Group, 2011).

An end-to-end BPMN model can include three basic types of sub-models (Object Management Group, 2011). Definitions of each, including their main distinguishing characteristics, follow:

- **Processes (Orchestration).** This includes two main types. First there are private (internal) business processes that belong to a specific organisation. This includes executable and non-executable processes. The second type of orchestration involves public processes, and shows only the main interactions (messages, activities) that take place to communicate between a private business process and another process or participant. Public processes can be modeled separately or within a *collaboration*.
- **Collaborations.** Collaborations can have a broader sense than processes. These depict the interactions between two or more entities, by containing usually two or more pools representing the participants. A collaboration model can show interactions between two or more public processes. Collaborations are different from public processes in that they are likely to have many more activities and details considered as connecting points between participants.
- **Choreographies.** The collaborative process in the optimised model is modeled using choreography. This choreography formalises the way participants coordinate their interactions and exchange information. Choreographies differ from normal processes in lacking a central controller, responsible entity or observer that controls the process flow. BPMN 2.0 offers a rich set of graphical notation for control flow constructs that includes the notion of interacting processes and distinguishes between sequence flow (within an organisation) and message flow (between organisations). This makes BPMN a good candidate for choreography modeling (Decker, Kopp, Leymann, Pfitzner, & Weske,

2008) , and suits the characteristics of many handover processes in health care. Figure 2.5 shows a sample choreography modeling using BPMN 2.0.

Figure 2.5 A Sample of Choreography Modeling in BPMN 2.0



Source: Object Management Group, 2011

2.4 Related Work and Gaps in Research

2.4.1 BPM in health care.

Application of business process management (BPM) has been driven by organisations' need to use holistic approaches that align organisational and information systems with clients' needs (Amir Afrasiabi Rad, Morad Benyoucef, & Craig E Kuziemsky, 2009) Desires for efficiency, effectiveness, flexibility and innovation have provided the motivation for current business process management applications, and several studies have sought to explore emerging themes in organisations' efforts to optimise their processes (Helfert, 2009, p. 937; Mili, Tremblay & Jaoude, 2010).

Literature reviews in these studies expose the complicated environment of business process management applications, and also reveal themes in discourse that revolve around the complexities of designing and implementing modeling languages, standards, software systems and architecture for BPM (Rad et al., 2009). When such literature reviews narrow their focus to the application of BPM in health-care environments, these themes are even more pronounced (Ko, Lee & Lee, 2009; Rad et al., 2009). A majority of research studies attempt to offer guidelines on the way forward.

2.4.2 Integrating BPM in health-care settings.

According to Ko et al. (2009), researchers and practitioners developed an interest in BPM to address challenges arising from the need for quick decision-making, fast transfer of information and adaptation to organisational changes, to meet increasing frequency of orders for goods and services, and the demand to shorten cycle times. Helfert (2009) and others also address these challenges, identifying what has necessitated the use of BPM in health-care settings.

According to Helfert (2009), governments have embraced BPM because of the need to slow the rise in health-care expenditure, enhance patient care and streamline workflows to improve efficiency and effectiveness.

Roberts (2011), in his analytical review of why simulation has been embraced in health-care delivery systems, explains what makes simulation attractive. Roberts notes that variability, complexity, assumptions, ease of use, what-if perspectives, acceptance, and appropriateness for Lean/Six Sigma are some of the qualities that make simulation appealing (p. 1406–7).

While simulations, integrated software systems, and modeling languages are becoming attractive in health-care settings (Roberts, 2011), they are not without their challenges and shortcomings. Benyoucef and others (2011) observe that

health-care delivery is becoming increasingly complex as multiple providers replace a single provider of patient care in collaborative platforms, but existent systems designs do not possess the capacity to support sophisticated, integrated and multifaceted care delivery.

2.4.3 Communication concerns in clinical handover.

As mentioned in the introduction to this thesis, clinical handover has attracted worldwide attention due to its impact on the patient care delivery. The ACSQHC has been appointed by the WHO to identify key aspects of patient safety and monitor outcomes. ACSQHC studies revealed that there is a considerable gap in policy and research around the area of clinical handover (C. Jensen, 2010), and gave a range of recommendations including prioritising clinical handover as one of the processes of most importance in reducing adverse patient events. Part of the ACSQHC's recommendations concerned the need for further research in the area, including "research into the effectiveness of electronic records and tracking systems as well as the influence of work place cultural and clinical contexts on the content and accuracy of information contained in the handover" (C. Jensen, 2010).

This thesis aims to obtain a clearer understanding of the multifaceted and dynamic medical handover process, exploring the factors that affect efficiency and effectiveness while investigating the potential impacts of BPM on medical handover. The insight that communication problems, as well as keeping patients medical records, are among the major issues affecting clinical handover processes (Bomba & Prakash, 2005; J. K. Johnson et al., 2011) is crucial to this project.

There is a clear need for better-structured clinical handover processes, and support from BPM, including in the area of IT systems, may be central to their effective and efficient execution.

2.4.4 Long-term care services.

Health-care services and modes of delivery have evolved to become more patient-centered. This is especially true of handover processes in delivering long-term care (LTC). The delivery of long-term health care requires high levels of communication. Support systems are also vital in order to enable the provision of supportive and effective communications. This thesis therefore aims to explore clinical handover processes in specific settings and contexts—patient movement from cardiology units to home and community care settings. It will examine and analyze what these handover processes entail, with a focus on communication occurring within them (McBride et al., 2011) .

A combination of literature review and case studies will identify and explore the major factors influencing the success of this type of handover processes as a basis for formulating ways to improve and enhance that process. The next section of the literature review looks at long-term care services, including what types of LTC exist and what concerns are relevant to them.

2.4.5 Types of long-term health-care services.

Long-term health-care services differ based on the range and level of medical, personal, and supportive services provided. Long-term health care is given to patients suffering from injuries, chronic illnesses, and cognitive, mental and physical disabilities, among other conditions.

Activities of daily living (ADLs) are LTC services provided by caregivers within nursing homes. ADLs are provided to patients in the form of physical and medical therapy to assist them in undertaking daily chores such as feeding, dressing, and bathing. ADLs are mainly provided for patients with impairments, the elderly, and patients within the pediatric department (Nolte & McKee, 2008) .

Instrumental activities of daily living (IADLs) in long-term care involve managing the patients' medication procedures and housework. This is a physical and drug therapy provided at nursing homes as part of LTC. Physical therapy is provided for patients with temporary or permanent disabilities. Elderly people and patients with disabilities need assistance while feeding, dressing, and undertaking physical movements. Caregivers must also ensure patients consume their medication on time.

In-home respite care, coupled with personal emergency response systems (PERS) provided by home caregivers, allows patients to access emergency services in a response center through fitted electronic devices (Ellenbecker, Samia, Cushman, & Alster, 2008) .

Home and community-based services (HCBS) long-term care is mainly provided to elderly and impaired patients who want to be independent. Federal Centers for Medicare and Medicaid Services approve this long-term care in the United States, allowing disabled and aging members of the community to access HCBS long-term.

Lastly, nursing homes provide LTC to patients suffering from chronic diseases and injuries. These illnesses often limit patients' ability to meet personal needs, due to inhibited independence. Patients are therefore admitted to a nursing home and 24-hour trained and experienced caregivers hired to look after them (Champlain CCAC, 2014)

2.4.6 Overview of Champlain Community Access Centre organisation.

The Champlain Community Access Center (CCAC) is a health organisation funded through the Champlain Local Health Integration Network (LHIN). And they provide a range of specialised care at home and in the community that includes: Physiotherapy, Nursing, Speech therapy, and Palliative Care…etc. They

work closely with people to make sure they make informed decisions about their care needs and plan (Champlain CCAC, 2014) .

Three strategic directions were developed to guide the Champlain organisation in delivering safe and high-quality long-term care (Champlain CCAC, 2014) . They include "person driven care", "engaged and proactive people", and "sustainable health care". The CCAC's Rapid Response Nursing Program (RRNP) is developed to assist patients and reduce readmissions as a result of miscommunications during handovers. Thus, the RRNP aims to reduce avoidable emergencies across the CCAC.

Patients with complex medical needs as well as the elderly, seniors, children and frail and disabled people all benefit from the RRNP. The CCAC ensures that its Client and Caregiver Advisory Council regulates caregivers' roles and responsibilities. Regular visits across home-based and nursing facilities identify health-care needs among the patients. Consequently, caregivers are guided in providing LTC to patients that enhances their physical, mental and functional capabilities (Nadine, 2013).

2.4.7 Handover processes to long-term health-care services.

Handover processes to long-term health care involve a caregiver passing on crucial information to another to support the patient in leading a safe, high-quality and comfortable life. However, this handover process is often marred by communication breakdowns leading to adverse events. Such events reported between 1995 and 2006 to the Joint Commission revealed that effective communication between caregivers is vital in ensuring patient safety.

To reduce communication issues among long-term health-care providers, it has been recommended that the following measures should be adopted (Michael & Tina, 2012). First, the handover process should not be marred by interruptions and

distractions. It should also be patient-oriented, clearly defining the patient's health-care expectations. Caregivers should create shared mental models inclusive of the patient's medical conditions and issues, knowledge of how to solve them and shared ideas on how the patient's clinical status can be improved. Caregivers should develop and identify shard understandings of the patient's health-care needs and wants. The resulting mental model should be a foundation in developing and implementing clinical measures that can be adopted to improve the patient's medical conditions.

Because communication between caregivers is the foundation for ongoing treatment after handover, caregivers should accept sole responsibility in ensuring that the handover process is clear, effective and efficient, and maintains the patient's safety. Taking sufficient time to conduct a handover process should avoid pressure to facilitate a caregivers' review, if handover was done satisfactorily (Tanja & Simon, 2011).

2.4.8 Ways of solving handover issues.

Health care should be affordable, accessible, standardised and of high quality(Amato-Vealey et al., 2008). However, patients may lack physical and mental strength to ensure that their own requirements are effectively and efficiently met. Caregivers are hired to provide LTC for patients residing at home or at a nursing facility. Patients must receive LTC services from multiple caregivers under a range of circumstances, particularly when transferred between nursing homes, from acute care to LTC, or from a nursing facility to a home-based program (Ellenbecker et al., 2008) .

Caregivers need to develop models and techniques to guarantee that patients are attended to safely. They should also ensure that patients' medical needs are clearly communicated to other caregivers that may be attending to the patient.

This can prevent or eliminate situations where caregivers make incorrect assumptions about a patient's medical needs and as a result administer the wrong treatments, causing adverse events and worsening a patient's condition. Clear communication enhances patient care and health-care service delivery, so caregivers must be articulate and lucid (Carol, Linda, Margaret & Kristine, 2010).

In chapter four a model of the as-is handover process was created and analyzed using BPMN2.0. This identified several challenges and issues in communication that could have potentially adverse effects, which were mainly to do with causing delays and loss of information. (Tanja & Simon, 2011).

First, health-care givers collaboration, the BPM methodology is a choreography applied to present various ways care providers can collaborate to improve the handover process and reduce adverse effects associated with miscommunication. The model developed revealed that more collaboration during the exchange of information could increase communication effectiveness and reduce the probability of adverse events affecting patients. Caregivers also need to conduct direct interviews to understand the patient's medical needs and wants (Benyoucef, Kuziemsky, Rad, & Elsabbahi, 2011)

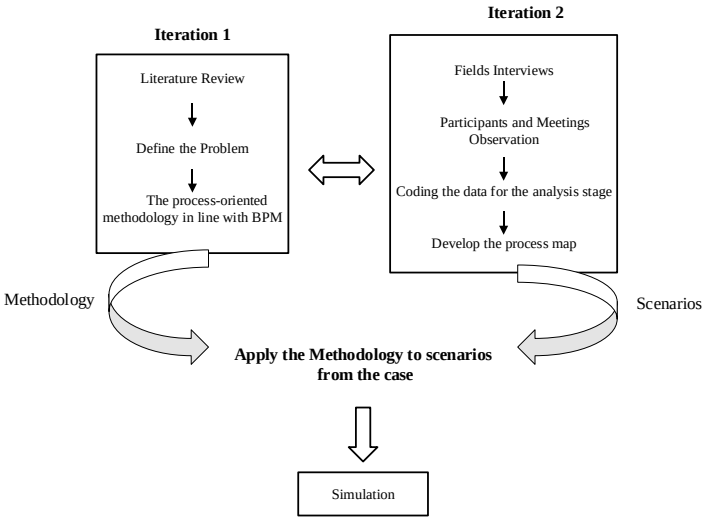
For example, one way to perform this is through interviews between collaborating caregivers that can be conducted to implement the Standardized Patient Handoff Program (SPHP). This is because the Standardized Patient Handoff Program (SPHP) has reduced miscommunication associated with ineffective and inefficient handover processes, and has reduced adverse issues associated with miscommunications by at least seventy percent, which makes a strong case for its adoption among caregivers looking to ensure they provide high quality long-term medical services without communication challenges during handover processes (Harris-Kojetin, Sengupta, Park-Lee & Valverde, 2013).

BPM discourse acknowledges that cultural changes can hinder caregivers from achieving and sustaining effective and standardised handoffs(International Business, 2012). This is mainly due to differing methodologies and languages applied in delivering long-term care. As human and business interactions between caregivers and patients should aim to achieve increased productivity and reduced operational costs, these issues need to be minimised. To do this, caregivers could apply high-level graphical modeling languages to choreograph their message sequences by linking handover sub-processes to business procedures. The Situation Background Assessment and Recommendation (SBAR) is one technique that can be used to eliminate shocks associated with cross-cultural communication (J. K. Johnson et al., 2011)

3. Thesis Methodology

This chapter introduces the present study's methodological aspects, which were developed through a process involving two iterations, one focusing on literature review and the other on a case study (Figure 3.1).

Figure 3.1 Research Methods and Techniques: Two Iterations



3.1 Iterations

3.1.1 Iteration 1: Problem definition.

Iteration 1, undertaken in Chapter 2, involves a literature review to build understanding of the range of existing theories and concepts relating to business process management in health care. BPM methodologies offer ways to address many issues in health-care handover. According to the literature, there are frequent problems in handover processes at many health-care centers. These often appear as issues with the continuity of information exchanged. To deal with this kind of challenge, iteration 1 involves choosing the appropriate BPM methodology to provide structure and formality to the process and coordinate the

involvement of multiple care providers. Methods associated with BPM such as choreographies and orchestrations can help put collaboration in place. This study will apply BPM methodologies to the scenario model to describe the collaboration between multiple care providers and minimise the communication issues identified.

3.1.2 Iteration 2: Detailed case study of handover process to LTC.

This present chapter describes the second iteration of the research, which will include capturing the process scenario, its environment, and the main entities involved.

3.2 Case Study

This thesis uses a case-study approach to investigate process flow, the environment in which it takes place, and the main interactions between the entities involved. According to Stake (Stake, 2005) , a qualitative case study facilitates a phenomenon within its context to gain insights on the phenomenon from different points of view. While the particular context of this case (handover from cardiology to home and community LTC) is important, the focus of this research is on miscommunication issues arising among care providers within that context.

The practice of handing over patients to LTC services in the community requires the cooperation of multiple care providers working in different settings. This case study focuses not only on the environment where that process takes place, but also looks closely at issues of miscommunication between interdisciplinary care providers trying to deliver the same service to the patient. Stake (2005) defines such studies as *instrumental case studies*, which are used to accomplish something other than understanding the case in question, and shift the focus to an

issue or problem. These contrast with *intrinsic case studies*, where the aim of the study is purely to understand the case in question. This present study is intentionally instrumental.

3.2.1 Handover as a case study for communication in LTC.

This thesis seeks to model the continuity of care for patients transferred to LTC services in the community. In so doing, it will take a close look at how interdisciplinary teams can work together in different settings to deliver LTC services. A specific best-case scenario for this process will be used to gain an understanding of how information loss and communication delays occur within this context.

The importance of communication among care providers in cardiology units and LTC, and the complexity of this area of care, have been discussed in Chapter 2 of this thesis. When a patient is transferred from a hospital to an LTC service in their community, inputs from care providers who have the knowledge required to complete this process must be coordinated and managed. That this handover practice involves a continuous exchange of information even when the patient is discharged makes it the ideal subject of a clear assessment of how communication takes place between care providers, and between care providers and patients' families.

Ineffective communication between care providers involved in these processes can result in adverse events. These can occur when patients move from hospital to an LTC service at home or in the community, or when several care providers are handling different aspects of the same patient's care. Such events can involve loss of information, delays with delivering the service and adverse drug events that will affect the patient and their family. For this reason, it is essential that clear,

consistent and organised communication between care providers occur within this transition.

This research will analyze the types of communication involved in the handover process. By building a model of a current scenario and undertaking a qualitative case study, it will identify areas where there are high risks of miscommunication. Understanding the patterns of communication involved in handover make it possible to diagram the necessary interactions between the care providers when delivering the optimised model of the process.

3.3 Study Design

This thesis uses a case study design involving one practice (handing over patients to LTC) within two care units: an in-patient cardiology unit and the CCAC office for further LTC services.

An embedded case study is one that contains more than one sub-unit of analysis (Yin, 2003). To collect the data that will help us to further build the as-is model of the process, it was determined all care providers involved in this specific process should be interviewed. In designing the data collection phase of this research, it was determined that the best method of identifying embedded units depends on the nature of the problem. Since the communication to be observed will mainly take place between the cardiology unit and CCAC, the most meaningful embedded units of analysis, in terms of communication strategies, are divided into two teams. The first team is that responsible for cardiac care in the cardiology unit, and the second consists of the care providers who are responsible for all the LTC aspects of the transition.

3.3.1 Data collection methods.

This study focuses mainly on the structure of the handover processes observed, and does not assess performance or execution of its different stages. The following qualitative methods were used to collect data in a way that will ensure its credibility and integrity.

Field interviews.

Purpose: To gain the care providers' perspectives on the process and the communication structure between the units.

Participants: Registered nurses, CCAC care providers, cardiologists, head nurse, social workers, PTs, OTs. All consented to participate in the field interviews.

Data-collection approaches: The author carried out semi-structured interviews in both wards. Participants were asked to sign a consent form, and agreed to audio recording of the interviews. Participants were asked to describe the process and to comment on the activities that happened during it.

Quantity of data: Twelve interviews.

Participant (field) observation.

Purpose: To gain a general understanding of the tools and techniques used to carry out the handover process, and to identify any patterns in the process.

Participants: Nurses, most of which were in charge at the time of the interviews.

Data-collection approaches: The author conducted the following observations: (1) 22 February 2013 at 10 a.m. [the RN working on the handover tool]; (2) 28 February 2013 at 9 a.m. (at the CCAC unit—observing data entry); (3) fully integrated clinic website and patient portal.

Quantity of data: Four pages of field notes.

Meeting observations.

Purpose: To gain a general understanding of nurses' communication methods during shift-change meetings, and to capture patterns of information exchange among participants.

Participants: Nurses attending the meeting.

Data collection approaches: The first author attended one nurses' meeting, and documented activities and conversations related to the handover process. Observations and conversations were recorded as field notes.

Quantity of data: Two pages of field notes.

3.3.2 Additional information.

Ethics approval.

Ethics approval was granted by the hospital's Ethics Research Committee for the period of 21 January 2013 to 21 January 2014.

Field interviews (semi-structured).

This research involved semi-structured interviews. This type of interviews is not demanding the participants to answer each question precisely, open and allows discussions and new ideas to be brought in during the interview. This interview method was chosen to gather insights from health-care professionals of diverse knowledge and backgrounds in a way that could be clearly understood and assessed. Questions for these interviews were prepared based on the identified research themes and problems. The main purpose of these interviews was to gain

a clear understanding of how the handover process flows, and to gather enough knowledge of its procedures and practices to build the model and identify problematic areas. In total, twelve interviews were conducted. For the interview questions please refer to Appendix B

3.3.3 Participants and setting.

Research setting.

Prior to commencing data collection, a consent form (in English or French) was given to participants to read and sign (Appendix A). Participants were recruited from the cardiology unit (4A) and CCAC office located in the fourth floor of Montfort Hospital. This 289-bed bilingual (French/English) hospital operates twenty-four hours a day with five cardiologists delivering consultation when needed. Patients requiring cardiac rehabilitation will be enrolled in either the short-term rehabilitation unit inside the hospital or to CCAC for longer-term care outside the hospital.

The short-term rehabilitation unit works with a maximum of twenty-one hospitalised patients confronting difficulties in regaining their former level of independence. Its aim is to equip and educate these patients to live safely in their environments after being discharged from the hospital. This type of rehabilitation is outside the range of this research.

Champlain Community Access Centre (CCAC) is a health-care organisation that delivers extended care to patients at home or in the community. Funded through the Champlain Local Health Integration Network (CLHIN), the CCAC facility involved in this study is one of fourteen CCACs in the province of Ontario. All providing care for over 54,000 clients annually, delivering over 2 million hours of health services. These services include nursing, personal care, physiotherapy,

occupational therapy, social work, speech-language pathology, nutritional therapy, and medical supplies and equipment. This case study focuses on the long-term care CCAC provides.

Recruiting.

Participants for this study were recruited mainly from the two settings mentioned above (the cardiology unit and CCAC office). Making potential participants aware of the study and then recruiting them involved multiple approaches.

1. **Introduction to the unit.** The cardiology unit's co-investigator at the hospital showed this researcher around and provided information on the unit's physical layout, sections, and so on, as well as introducing the researcher to different staff and care providers. At CCAC, the researcher was briefed about the office by other care providers, and introduced themselves to the care providers there. Once the researcher had been introduced to some of the staff members, efforts were made to recruit participants for the study while undertaking weekly visits to the hospital and informing staff about the research.
2. **Poster about the research (information sheet).** Before the recruiting process for interviews began, an information sheet (in English and French) advertising the research was posted around the cardiology unit to inform all staff involved in the process of handing over patients to LTC services about the project, and to ask them to contact the researcher if interested. Please refer to Appendix C for research poster.
3. **E-mailing.** E-mail was used to connect with staff when the researcher was given a possible candidate's contact information. Participants who did not have complete information about certain aspects of the handover process would sometimes provide the researcher with contact details of another potential participant who could bring helpful insights. Although it was not

initially intended to e-mail staff as an approach to recruiting participants, this approach was adopted particularly when it was difficult to reach specific staff members who were not available be seen in the unit.

An effort was made to recruit only care providers who were involved in the process of handing over patients to LTC services in the community (CCAC).

The case study's objective was to understand the handover process sufficiently to build the process model, and interviews were considered to be the most important source of information. The researcher determined when the number of interviews was sufficient to reach the desired level of understanding. In total, twelve interviews were conducted, two of them for validation purposes in order to showcase the developed model to the same participants. Interview participants were representative of the health-care team, which contains members from diverse health-care professions.

Table 3.1 Professions Involved in Interviews and Observations

Position	No. of individuals
Allied Health	
Champlain care coordinators	3
Physiotherapy aides	1
Speech-language pathologists	1
Social workers	2
Physicians	
Cardiologist	1
Family doctor	1
Nurses	
Head nurse (RN)	1
Registered nurse (RN)	1
Palliative care nurse	1

Due to the small number of health-care professionals involved in the process, the researcher conducted two participant observations. Details of these participants are not included in this thesis because of its potential to disclose their identity. Table 3.1 shows the number of participants involved in from each health-care profession. Recruitment materials and interview questions can be found in Appendix B and C.

3.4 Analysis

In total, fifty-five pages of interview data (ten transcripts) were transcribed. Two of the ten interviews were not transcribed, as the audio recording was sufficient to

analyze them for validation purposes only. The transcripts were coded to highlight problematic areas in the handover process and to understand its flow.

As mentioned earlier, the focus of this study is mainly on the structure of the handover processes. It does not involve any kind of assessment of the performance or the execution of that process's different stages.

The process under consideration is undertaken within the care unit for the considered chronic disease (cardiology). There are several possible methods to model and map the patient's handover processes. Choosing the proper technique or tool, in line with BPM strategies, first requires answers to the following questions (Ko, 2009):

1- **Who?** Identify the people involved in the process of handing over the patient from the care unit in charge of the chronic disease patients under study (cardiology) to CCAC.
2- **When?** When should the process of handover take place?
3- **Where?** Where should this process occur?
4- **How?** How are the main steps in this type of handover process conducted?
5- **What?** What needs to be handed over in terms of information? Are there any problems with the communication or management of the patient's records?

3.4.1 Process scenario.

BPM methodologies are used to understand and model the continuity of patient care in the context of the clinical handover process from cardiology to LTC facilities. The particular scenario chosen for analysis is transmission of cardiac patients suffering from dementia and mobility problems that will prevent them from communicating. In this case, a CCAC care provider at Montfort will provide the services of a nursing home to the patient in their community setting. The case

study focuses on transmission and communication of information among care providers in this scenario.

Figure 3.2 Clinical Handover of a Cardiac Patient from Cardiology to LTC

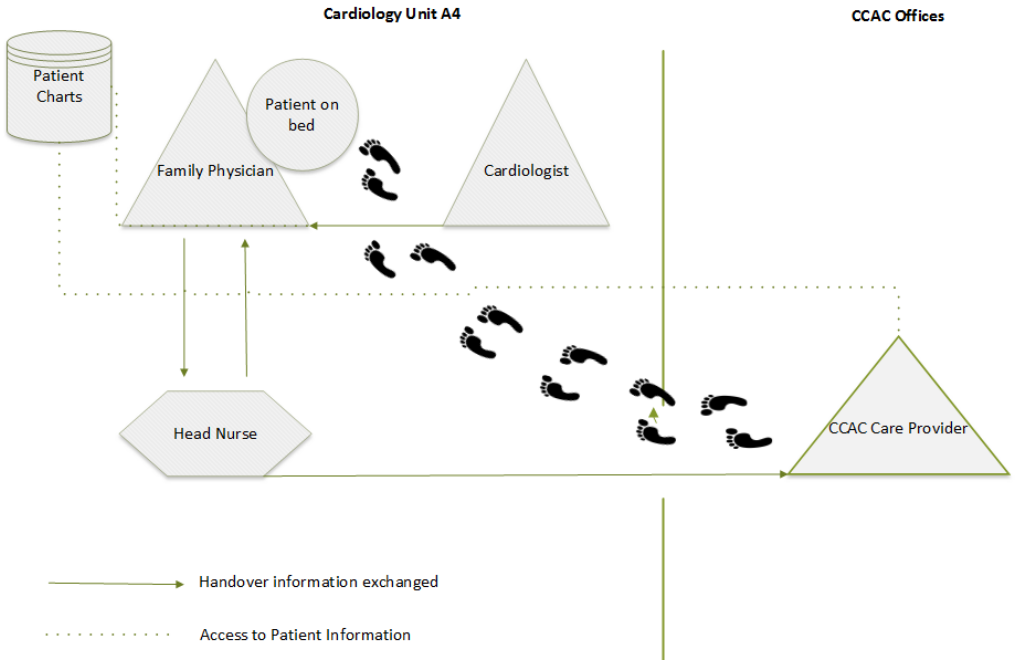


Figure 3.2 demonstrates the clinical handover process for this type of patient. The patient is suffering from dementia and a mobility problem that will prevent them from communicating with care providers and taking care of themselves after discharge. Patient information was given by the cardiologist to the patient's family doctor in the form of verbal handover instructions, which basically declare that the patient no longer requires cardiac care at the unit, and that they are ready to be discharged to LTC.

The family doctor will then write the CCAC referral and request that the nurse commences the discharge process. The nurse will usually complete the form and fax it to CCAC. In other scenarios, a doctor or social worker can also complete the referral. The CCAC care provider is notified of an incoming patient by a

telephone call from either the nurse assigned to the patient or the head nurse, as participant No. 2 describes:

> Well, there is the team leader, the doctors, the nurse from CCAC, and sometimes the nurse to the patient. But if you want things to move quick, it's better to go by the team leader, because she doesn't have any patients, and she can act, act, act, act. If you wait for the nurse at the—who's taking care of the patient, you know, assigned to the patient, it's complicated, because she has five other patients to take care of. (Participant No. 2)

After receiving the referral to CCAC, a CCAC care coordinator will visit the patient and complete the care assessment. Both the family doctor and CCAC care coordinator will have access to the patient's charts.

The second handover will occur outside the cardiology unit, inside the CCAC office where the patient will be handed over to their appropriate LTC service. The LTC service requested in the unit is in the form of a temporary nursing home in the patient's community. The CCAC coordinator will then consult the patient's family:

> So then on the referral they will write the diagnosis of the client, the services they think they will need. They fax that to us, and then we will go and meet the client and the family, assess their care needs, according to their eligibility criteria, and then we will provide them the care that they need, according to what is available. (Participant No. 3)

If the patient's family approves the LTC service, another handover will take place, this time to the nursing home care providers in the patient's community. In addition, the CCAC care providers can go into the hospital file and get more information on the patient, including their admission diagnosis and any

interventions that were made. This information can be shared, with the patient's consent, to the nursing home care providers when required. This handover to nursing home care providers is outside the range of this research and was not modeled in the process map.

3.4.2 Entities involved in the process.

Table 3.2 shows a breakdown of the main entities involved in the handover process, along with the activities each must carry out. Some details about the participants were also explained in the research literature review.

Table 3.2 Main Entities Involved in the Handover Process

Entity	Responsibilities and roles
Cardiologist	**Responsibilities:** The cardiologist in this process is one of five providing cardiology consultation services in Montfort Hospital. These services cover two areas: inpatient services and consultations for patients admitted to the hospital. They are also involved with the outpatient clinic, post-hospital follow-up visits, and seeing other patients from family doctors' offices. **Activities:** Providing consultations for cardiac patients referred by a family doctor. Cardiologists provide consultations with the family doctor when the patient's cardiac condition is no longer a primary one and they are ready to proceed to an LTC service. Usually, the cardiologist will perform this consultation through a phone call to the family doctor, in a form of a verbal handover.

Family doctor (FD)	**Responsibilities:** The FD works as a hospitalist in Montfort, which means taking care of medical inpatients at the hospital. When the patient's cardiac problem becomes secondary but they are unable to go home due to other problems (dementia, mobility issues, etc.), responsibility for the patient is transferred from cardiology to family medicine. **Roles:** The FD will assist with discharge planning, rehabilitation services, home care services and outpatient follow-up. They will receive a phone call (verbal handover) to commence moving the patient to LTC. At this point, the doctor will have access to all the chart notes. The chart is continuous and does not start anew when the patient is assigned to the FD. In addition, the FD has access to all the electronic charts from the hospital.
CCAC care provider	**Responsibilities:** The CCAC care provider coordinates in-home health-care, support, and rehabilitation for patients in the hospital or in the community. **Roles:** The CCAC care provider receives the patient referral by fax. This includes an indication of the services the client requires upon being discharged from hospital. The referral includes the discharge date and the services required. The CCAC care provider then visits the patient and potentially their family, and reviews their hospital chart with their

	permission. This takes place in the hospital. The CCAC care provider's initial meeting with the client occurs in the cardiology unit, usually at their bedside. The chart review also occurs here, where the chart is located. After completing the interviewing and assessment, the care provider returns to the CCAC office to perform data entry and order required services with reference to eligibility criteria and what is available.
Registered nurses (RNs) (cardiology unit)	**Responsibilities:** RNs are able to independently meet the nursing care needs of patients whose needs are not well defined or recognised, or are changing regularly. **Roles:** RNs complete the LTC referral initiated by the family doctor. They assist the patient in selecting the appropriate LTC service, treatment or care provider. The nurse will call the assigned CCAC care provider to come for further assessment and consultation on the patient condition. Later the RN will fax the referral to CCAC.
Patient's family	**Role:** The main role of the patient's family in this process is to make the final decision in selecting the LTC service.

Community care providers	**Responsibilities:** Providers including nursing homes, community support services and residential care facilities have varying responsibilities. **Roles:** In this particular process, the community care providers are nursing homes in the patient's community. The CCAC care provider will arrange for admission to these long-term care nursing home.

4. Results

In this chapter, we present results in the form of clarifications of communication structure of the handover process to LTC services in the community. We also present insights into communication patterns that we derived from the case study. From analysis of the as-is model developed based on data collected from care providers, we arrive at an understanding of communication patterns observed in the process and the difficulties inherent in them.

4.1 Communication in the Handover Process

The overall practice of handovers to LTC services with CCAC is described in Chapter 3. Cardiac patients will be transferred to a LTC service in their community based on the instructions from their cardiologist and assigned family physician. When the patient's cardiac problem is no longer a primary one, they can be transferred to LTC service if required. Within this scenario, multiple interactions will take place to reach the overall goal of delivering LTC service to the patient. These interactions will be, for example, between family doctors and cardiologists, family doctors and nurses, and nurses and CCAC care providers.

Care providers will communicate and interact in different ways to achieve the same purpose—delivering patient care. Within the patient's journey through care, a number of key, independent phases must be completed.

In interviews, we asked participants questions about how the handover process will take place, who exactly are the participants in most case scenarios, and how handover contexts are designed to eliminate potential issues affecting the patient transfer.

The following section reviews how the handover process occurs in the unit studied by presenting high-level maps, and uses simulation to identify complexities and deficiencies in communication about care provision in this interdisciplinary process.

4.1.1 Overview of communication structure.

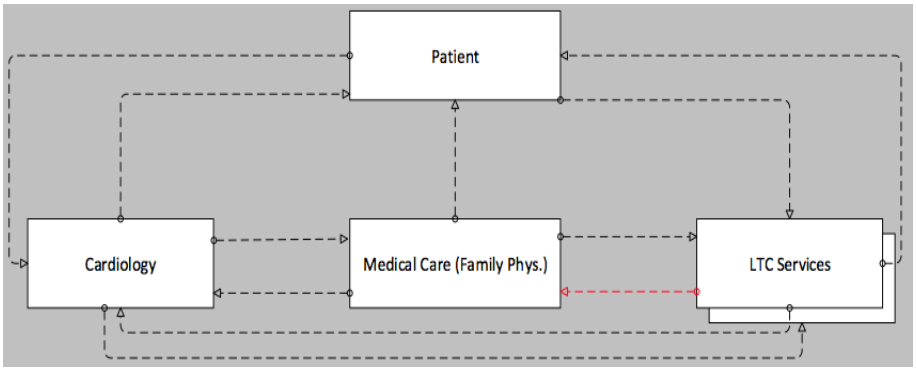
Figure 4.1 is a structural view that illustrates the process scenario used throughout this research, which was also detailed in Chapter 3. In some cases, several LTC services are involved, covering a part of the patient's overall journey through care: e.g. nursing care, an emergency care system, etc.

The pools (rectangles) in this figure represent the types of participants involved. Only one patient, cardiologist, and family physician, are involved in each process instance (Decker, Kopp, Leymann, Pfitzner, & Weske, 2008) , along with LTC services. The overlapping pools for LTC services indicate that more than one LTC service could be provided to each patient.

Dashed arrows indicate message flow between participants of each type, indicating which participants may potentially communicate with or send a message to others. Communication from the LTC service to the family physician, highlighted in red, occurs when the patient is returned to hospital due to health complications.

This very high-level view of the process identifies the participant types and interactions involved in one process instance. It also captures all the possible communication that will take place for that instance.

Figure 4.1 High-level Structural Diagram of the Handover Process



4.1.2 Understanding handover processes.

To understand the handover process as precisely as possible, we conducted interviews and asked questions about information sharing between the care providers involved, and about the main stages of the handover process. Based on the data collected, we focused our attention on understanding the specific mechanisms involved in the handover to LTC (the scenario in Chapter 3). In this part of the research, we go a step further to understand the handover process on the basis of our case study and relevant literature.

Based on the data collected, information sharing among individuals generally relied on verbal and written communication. Which of these is used depends on the nature of the patient service and how urgently it is needed. Nurses mostly communicate by phone to achieve urgent tasks in to the handover process. However, written communication is used for patient referrals. Here is one nurse describing how direct verbal communication is the best choice for urgent matters:

> Phone, phone, phone, phone. Talk directly to the person; you say what you want. Because when you talk to the person, she knows you, you know her sometimes, and she knows you're gonna go with this, she trusts you. And I think electronic is not the best. And I don't think… Meetings are good, too,

> when we talk in meetings, but it's face-to-face people—that's the best way to communicate. (Participant 2)

Verbal communication.

Verbal information sharing was the most common communication method for several participants. Availability of colleagues with which to share information was a key point participants raised in relation to this method. The availability of a head nurse plays an important role in speeding up the handover process, according to one participant:

> Well, there is the team leader, the doctors, the nurse from CCAC, and sometimes the nurse to the patient. But if you want things to move quick, it's better to go by the team leader, because she doesn't have any patients, and she can act, act, act, act. If you wait for the nurse at the … who's taking care of the patient, you know, assigned to the patient, it's complicated, because she has five other patients to take care of. (Participant 2)

Most of the allied health practitioners and physicians in the cardiac unit are available Monday–Friday during the day shift. In most cases, the nurse assigned to the patient and the head nurse initiate any verbal communication.

Written communication.

Care providers' reliance on written materials as sources of information varies at different stages of the handover process. First, in communication from cardiology to the family doctor and through to the CCAC care facility, patient referrals and patient charts are the most-used written communication tools. The nurse at the cardiology unit will eventually fax the referral to CCAC after all the family doctor and cardiologist have completed all patient information.

Family doctors have access to patient chart notes as this chart is continuous—it does not start fresh when the patient arrives in the family doctor's care. Long-term care providers, on the other hand, get only photocopies of those elements of the patient chart that are relevant to their needs and concerns in LTC.

Family physicians do not usually use other sources of information, be they external or internal, to fill in medical forms in the patient's chart. Instead, they rely mostly on whatever medical history is already present in the chart. The family physician then reviews the chart to generate a list of the patient's conditions and most pressing medical issues.

Interviews revealed that experienced care providers like the family physician believed that information exchanged in the patient chart is enough for cardiac-care staff to establish an understanding of the patient's cardiac condition, but that LTC staff might not be able to establish a good sense of the patient's cardiac needs from the excerpts they receive:

> I'm not sure that I would get a sense that this patient, for example, is easily agitated and wanders, or that this patient needs help being fed, or any of those kinds of very important bits of information. I also think that they don't do a good job establishing between the fact that the patient, you know, had a hysterectomy in 1962 and has COPD today. I don't think it's a good form, I think that's the major weakness. But you would have to—again, I'm not part of the other end of the care, so I don't know how—maybe the team at the nursing home end feels that it's a reasonable enough amount of information. (Participant 9)

Inability to create a shared understanding of patient information does not result from a care provider's inability or lack of skills, but reflects the lack of a standardised approach to the information-sharing process, and of well-defined

documentation that takes into account the different background knowledge of care providers on both sides of the communication. Documentation complexity increases errors and information loss, and eventually creates delays in delivering patient care, as one participant's observations show:

> Well, it's a badly designed chart, that's a problem. I'm sorry, the form is very badly designed. The medical report form doesn't make a lot of sense. It's not very clear; it doesn't interface well with the system that we have here. The questions on it are not good, so it's very hard to know what exactly they're aiming for. (Participant 9)

The likelihood that care providers are likely to encounter adverse events during patient care calls for multiple recommendations.

First, communication processes should be standardised to improve the patient quality of care by ensuring that patient information is complete and correct and minimising confusion. Handover standardisation addresses goals of the World Health Organization and the Joint Commission. Part of these agencies' recommendations on handover communication was to use a standardised approach: between staff, on change of shift, and between different patient care units involved in the course of the patient transfer. Suggested elements in this standardised approach include provision of information about patient status, medication, treatment plans, etc., and about any significant change of status. It is also suggested that verbal or written exchanges be limited to that information which is necessary to fulfilling patient needs and ensuring their safety.

4.1.3 Potential for error and communication issues.

During handover, information is exchanged between care providers within the same cardiology unit, and also with those external to the organisation such as CCAC.

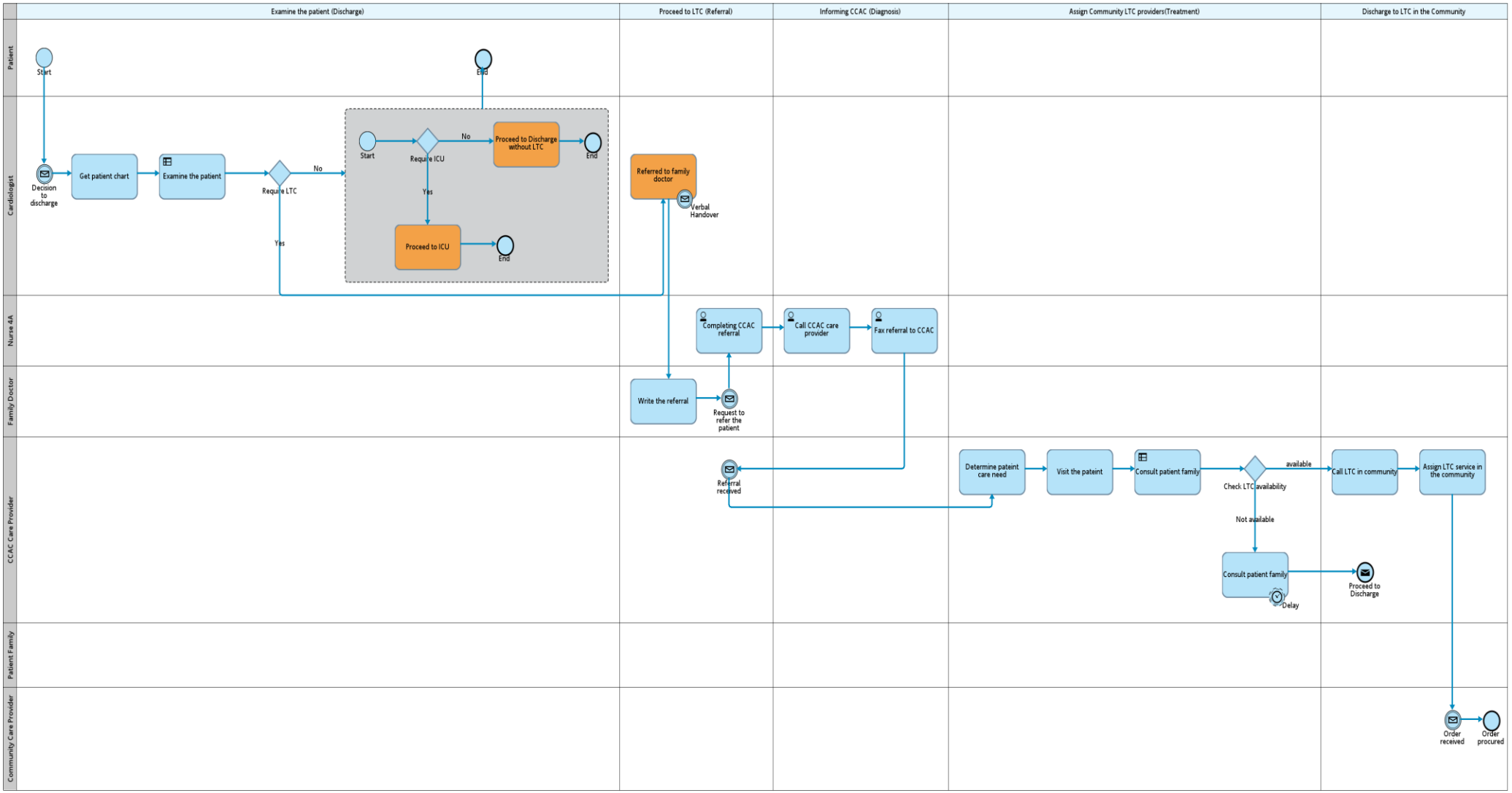
The process model shown in Figure 4.2 illustrates how some conditions and events pose potential difficulties in completing some of the basic steps in the handover. It also clearly indicates the importance of efficient communication among care providers, which can save time and minimise errors that put patient safety at risk.

Communication structures in the handover process can easily be represented by graphical elements in the BPMN process model. These elements not only allowed easy development of a process model that most business analysts would find familiar: they also demonstrate communication dynamics between the care providers involved.

For example, one of the basic categories of notation element is the flow object that presents *events* and *gateways*. A circle represents an event: something that happens during the course of the process. Events not only affect the flow of the process but also the flow of communication. They have a cause (trigger) or an effect (results), and divide into three types based on when they affect the flow: start, intermediate, and end.

In contrast, gateways are represented by a diamond shape, showing divergence and convergence (meeting) of the sequence flow. They also show how and where communication may break down (See Figure 2.4, “BPMN core elements”, for more information).

Figure 4.2: As-is Model of the Handover Process



(Detailed view and breakthrough of the model in part 4.2.1.3 in Page 70)

Each step and activity in the process of handover to LTC is represented by rounded-corner rectangles joined by connecting objects such as sequence flow. We used the concept of *swimlanes* (*lanes* in particular) to organise activities into separate graphical categories and illustrate the different functional abilities or responsibilities of each participant. The *sequence flow* may cross the boundaries of lanes within a pool, and shows the order in which activities will be performed during the process. Sequence flow can also be used to show the flow of communication between participants in this process.

As our interviews focused on collecting data about communication between care providers, we aimed to build a model that could not only represent the process structure but also the communication that takes place within it.

4.2 Modelling the Handover Process

Modelling the handover process and analysing its main activities creates a foundation for studying the nature of the communication involved. Developing an in-depth understanding of the handover, process, by mapping all the key activities and their information dynamics, helps us understand the communication structure of each step in the process, and to see how each structure increases or diminishes the process's effectiveness. The method is intended to reveal communication issues that affect the process.

Poor understanding of communication issues involved in the handover process can have several consequences. One is that health-care professionals will fail to identify communication issues and the proper way to solve them when they arise. Mapping the handover process can help pinpoint communication issues and identify where they took place and who was involved.

A model of the process as it is (the *as-is model*) will show how information sharing currently takes place. *How* do the care providers involved in the process choose to share information, and *under what conditions* do they share it? Is there any information loss or misunderstanding? Whether information is received *when* needed is also an important factor .

Developing an in-depth understating of the process by mapping its key activities and their information dynamics requires access to care providers' knowledge of the steps involved in

communication. For each activity, we documented a successful and unsuccessful execution of the communication process in place. A *successful* communication is defined as one that occurs without any of the problems that might arise, while an *unsuccessful* execution demonstrates issues that care providers identify as problems with the process, or which are shown in the activity's output.

The as-is model of the handover process in Figure 4.2 was created using information obtained in the cardiology–LTC case study. It maps the key activities involved in that process, and documents communication issues at each step. Such a model is important to developing understanding of how well-structured communication in the process could decrease adverse events such as delays and information loss.

4.2.1 The handover process model.

This section explains each part of the as-is model for the handover process, along with the process of creating it using Blueworks Live (Blueworks). In section 4.2.1.3, we divide the model into three main parts and discuss each activity, condition, and event therein; we also outline each part's relation to the concerns about communication during the process. Where possible, we present quotes from care providers that informed development of the process model, and explain how each part of that model reflects necessary elements in achieving the overall goal of effective communication.

Process improvement ideally begins with developing an understanding of how a process currently works. During this effort, it is helpful to depict the process using a widely adopted graphical notation like BPMN, which can be easily understood by others and can save time and minimise confusion. Our model of the as-is process is built using BPMN for this reason.

In the existing process, care providers use a range of communication methods to gather and transmit information during handover. By constructing the model, we analyse a standard handover in the current scenario. However, this typical scenario rarely reflects the real world, where the process is complicated by a variety of factors including time, patient condition, etc. As a result, we go beyond merely constructing the model to suggest improvements that can mitigate the influence of some of these factors. We will first show each step of the process (1–3) before dissecting each step.

4.2.1.1 Discovery map.

When discovering a business process at early stages, one will ideally maintain a process *inventory*.

The IBM Redbook *Scaling BPM Adoption* defines *inventory* as "a list compiled for a specific purpose," *page 49* and it is in this classic sense that an organisation should build and keep an inventory of all business processes that are relevant to its current objectives. Choosing the appropriate tool to keep the process inventory is critical to effectively organising and finding business processes (International Business, 2012) . In this study, we used Blueworks to model and analyse the process of handover to LTC.

Blueworks Live is an enterprise-class process-modelling tool offered on the software-as-a-service (SAAS) model. As it is a web application, users do not have to install or download anything to work with it, and there is no need to exchange files to share information. It offers a reliable way to start maintaining a process inventory, to organise business processes, share, collaborate, and control who may view or change business processes (International Business, 2012).

After identifying, at a very high level, the partners involved in the process, we used Blueworks to create the descriptive discovery map in Figure 4.3. This map identifies process details and links them to specific activities or milestones. We added process details to the discovery map using interactive forms like the one shown in Figure 4.4.

At this level, we gather process information from engaged care providers during the data collection process to perform a rough count of steps (activities and sub-processes), participants (swim lanes), and system integrations to form an overview. Although this process is already running, creating this high-level map allows us to analyse and further organise the process. It also helps us to identify complexities in communication at different points in the process, where different types of participants are in control.

Figure 4.3 The Discovery Map

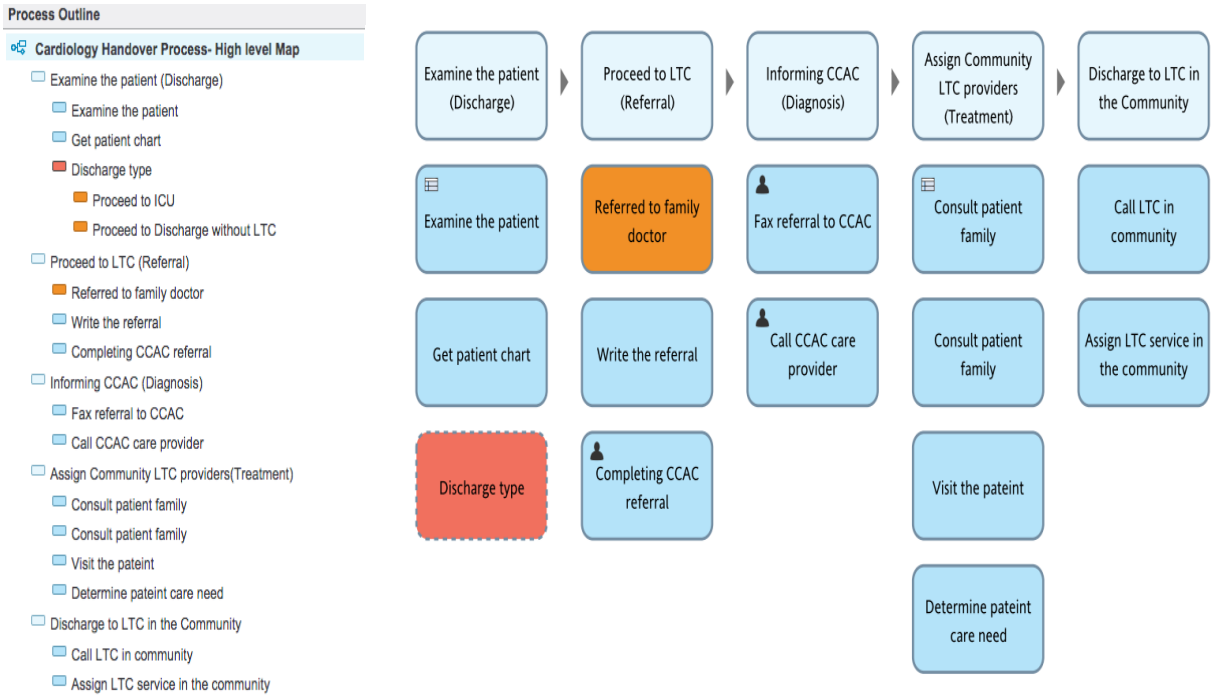
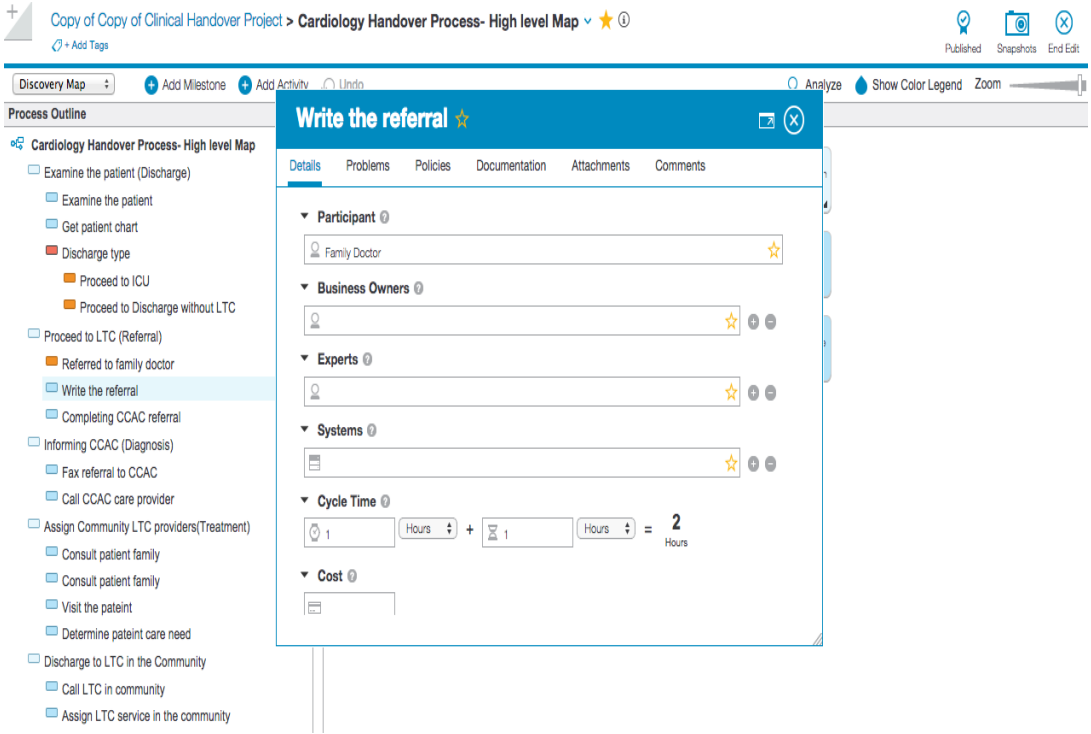


Figure 4.4 Adding Activity Details



The details added using the form shown in Figure 4.4 were also used in the as-is process diagram that captured the process's main activities and milestones. Three stakeholder categories are listed in the form shown: *participants*, *business owners*, and *experts*. Participants are the most important to capture in this research, because they designate who is responsible for completing a phase or activity that is part of the process. The main participants in this particular process are the cardiologist, family doctor, nurses, the CCAC care provider, the patient's family, and the community care providers who are responsible for taking care of the patient after they have been transferred to an LTC service in the community. The process model will not focus on experts or business owners, as they do not play an important role in the communication being studied. Cycle times, on the other hand, *are* important, representing the time each activity takes to be completed.

Engaging participants was important to this stage of the research. By brainstorming and collecting the information provided, we were able to model what we discovered to understand the process as it was running. We documented participants' stories and captured them as they were told, but refrained from documenting proposed activities that reflected participants' wants but were not yet taking place.

4.2.1.2 Determining scope and complexity.

Before moving on to create the full process diagram (the as-is model), we used the *analyse* tool in Blueworks to estimate communication complexities involved in the process, which includes different participants, process owners, experts, customers, inputs, and outputs. Figure 4.5 shows how we used the analysis mode based on two criteria that we chose to analyse communication complexities: *risk* and *problem*. This analysis revealed that there were a total of 12 risks and 12 problems, mostly related to communication deficiencies, which were identified by the care providers (participants) involved in the process.

Figure 4.5 Use of the Analysis Mode in Blueworks

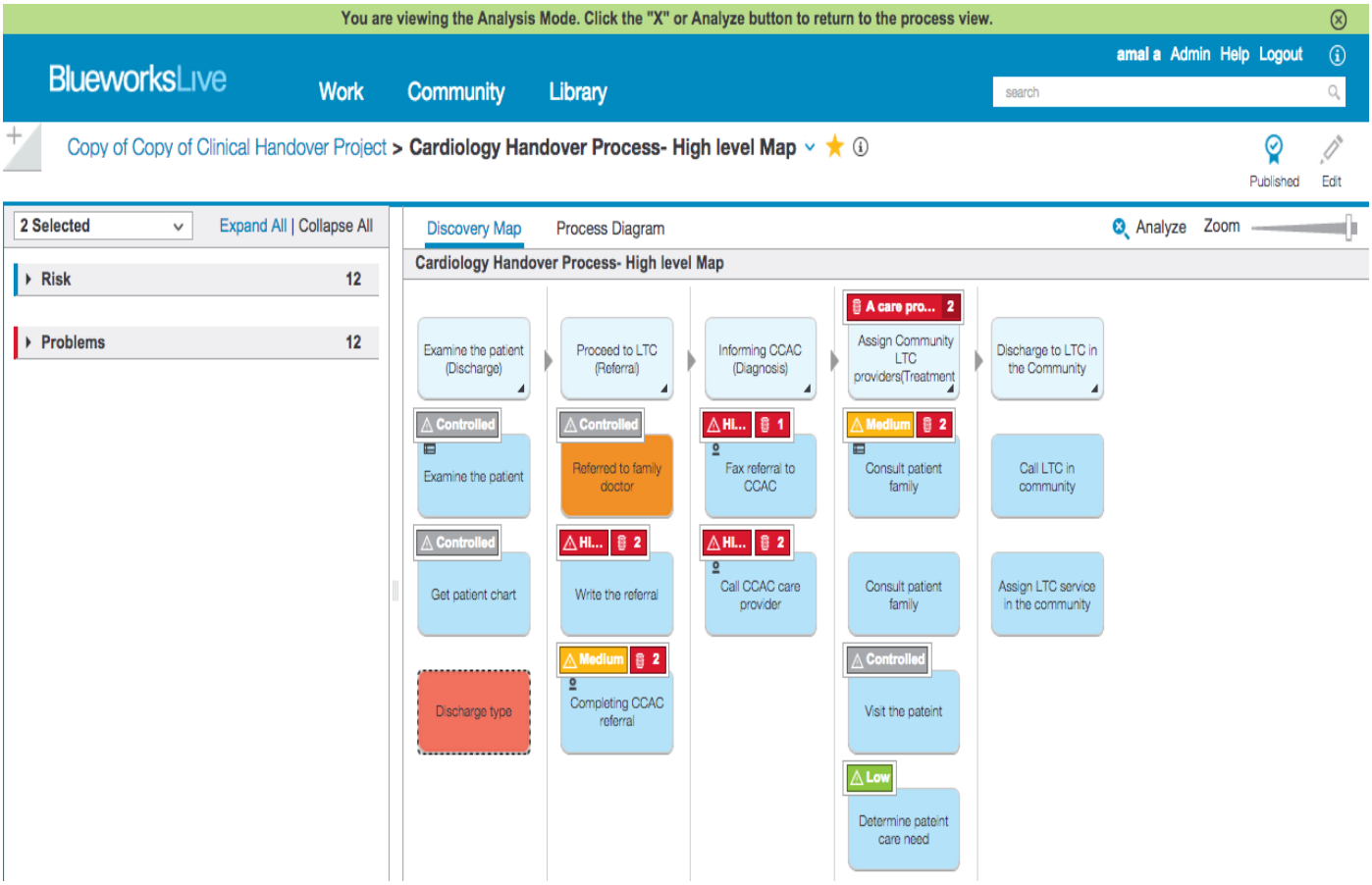


Figure 4.5 clearly shows communication issues, but does not yet determine *how* to address them. While interviewing care providers, we asked questions about any problems in the handover process. We then narrowed these questions to any issues related to the *communication structure* of the process. Problems were identified based on their direct effect on process execution, and care providers mainly mentioned issues in communication in relation to specific activities. Table 4.1 shows communication issues grouped by activity.

Table 4.1 Communication Issues Grouped by Activity

Activity	Problem definition	Problem severity	Problem frequency	Risk
Assign community LTC providers (treatment).	A care provider from CCAC might not be available at the time of the process.	Medium	Low	High
	Loss of information due to manual procedures.	Medium	Medium	
Examine the Patient	No problem identified			Controlled
Referred to family doctor	No problem identified			Controlled
Fax Referral to CCAC	The faxing machine not working properly	High	Medium	High
Consult patient family	No standardised approach with determining the appropriate LTC plan with the patient's family.	High	Medium	Medium
	The LTC service is not approved by the family	High	Medium	
Get the patient chart	No problem identified			Controlled
Write the referral	The form is badly designed, long and not clear.	High	High	High
	Lack of standardisation	Medium	Medium	
Call the CCAC care provider	A care provider from CCAC might not be available at the time of the process.	High	High	High
	Delays in communication cause delays in delivering the LTC service.	High	High	
Completing the CCAC referral	Missing information.	High	High	Medium
	Lack of standardisation with cycle time.	Medium	Medium	
Visit the patient	No problem identified.			Controlled
Determine patient care need	No problem identified.			Low

According to Blueworks, *risk* in the previous table is used to identify areas of concern or issues that may occur within an activity. Overall, we have four activities with high-risk issues, and two with medium risks. As subsequent sections will explain, we aimed to build the discovery map and identifying communication concerns early so that we could ease the improvement process by narrowing its focus on certain activities and simplifying the building of the as-is model.

Likewise, by identifying the main activities in the process and placing them under milestones in a sequential order, we created a simplified view of the end-to-end process before diving into the details. Such details add significant complexity to the finished process model, and include

routing, escalations, and business rules that place gateways, joins, splits, and events on the process diagram (International Business, 2012).

4.2.1.3 As-is process diagram.

In this section, we explain the process model for handover to LTC. The process itself is divided into three main stages:

I. Discharging the patient
II. Preparation for the handover to LTC
III. Execution of the handover to LTC

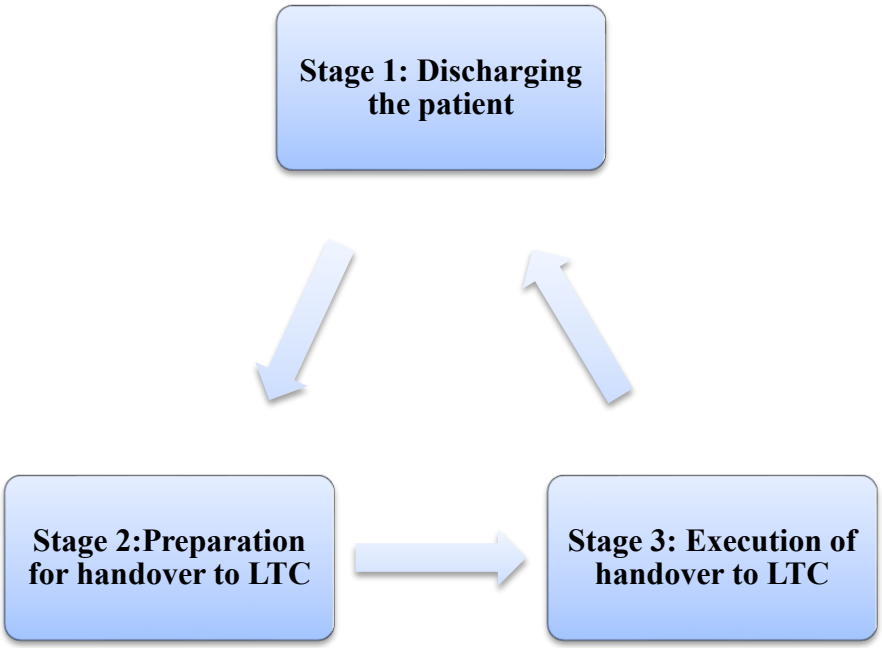
Consequently, we divided the process model into three sections corresponding to these stages.

Information flow between the participants, and the overall structure of communication across the process, is demonstrated in the as-is model in Figure 4.2. Figure 4.6 shows how the information flow in the handover process stages; the handover process stages are in accordance with the shift-change times in the hospital, which are between 7 a.m. and 12 p.m., 3 p.m. and 4:30 p.m., 11:15 p.m. and 12:30 a.m.

The following statement gives an example of how the handover process is executed in the morning, as described by a participant from the CCAC organisation:

> Well, we interact with a lot of the professionals here. We participate in interdisciplinary rounds in the morning to see where the clients are, and then we deal with private companies, community resources and organisations out there as well, so that we try to link the clients with those once they leave the hospital so that we can provide them with the best care… (Participant 3)

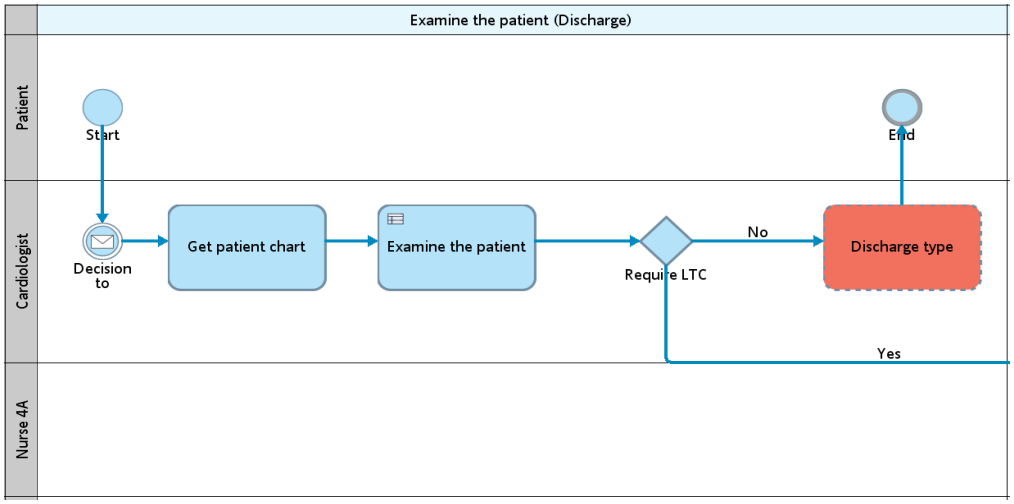
Figure 4.6 Main Stages in the Process of Handover to LTC



In the following discussion, we will explain each stage in this process before analysing it in detail.

I. Discharging the patient.

Figure 4.7 "Discharging the Patient" Stage



As identified in Figure 4.3, based on testimony from care providers, the handover process starts with the cardiologist making a decision to examine the patient. In other words, the cardiologist

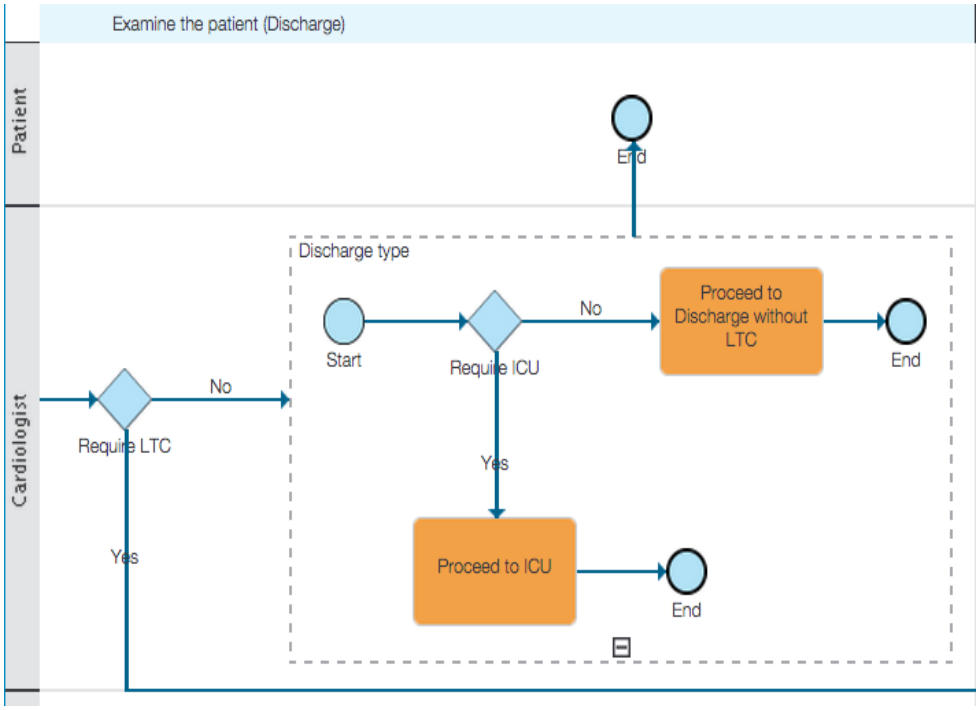
will kick off the process in response to external activity (a change in the patient condition, arrival of the time they are to be examined, etc.), but the source of that activity (typically the patient) may not be in the BPM environment.

This particular stage of the handover process does not raise issues related to communication. It is simply the initiation of handover by the cardiologist making a decision to examine the patient. As shown in Figure 4.7, the activity "Examine the patient" is a decision-type activity; its output is a decision concerning the patient's need for an LTC service. If the decision is that the patient requires LTC (yes) then the patient proceeds to the next stages of the process. If the patient does not need LTC (No), the patient goes to a sub-process called "Discharge type". Although modelling this sub-process is outside the scope of this research, making this decision accurately and efficiently is also important. When patients in the cardiology unit are discharged, they will either be transferred to LTC (from inside the hospital or outside/CCAC), home, or to the intensive care unit (ICU). Here is one care provider describing the decision-making process:

> When they come in to the unit, most of them come in from emergency, and they, some of them go to ICU, because they don't do well. If they have their angiogram, and their angioplasty and everything is done, and if we see that the patient needs to go to rehab, he can go to our rehab here before he goes home. Or if we can send the patient home with CCAC… (Participant 2)

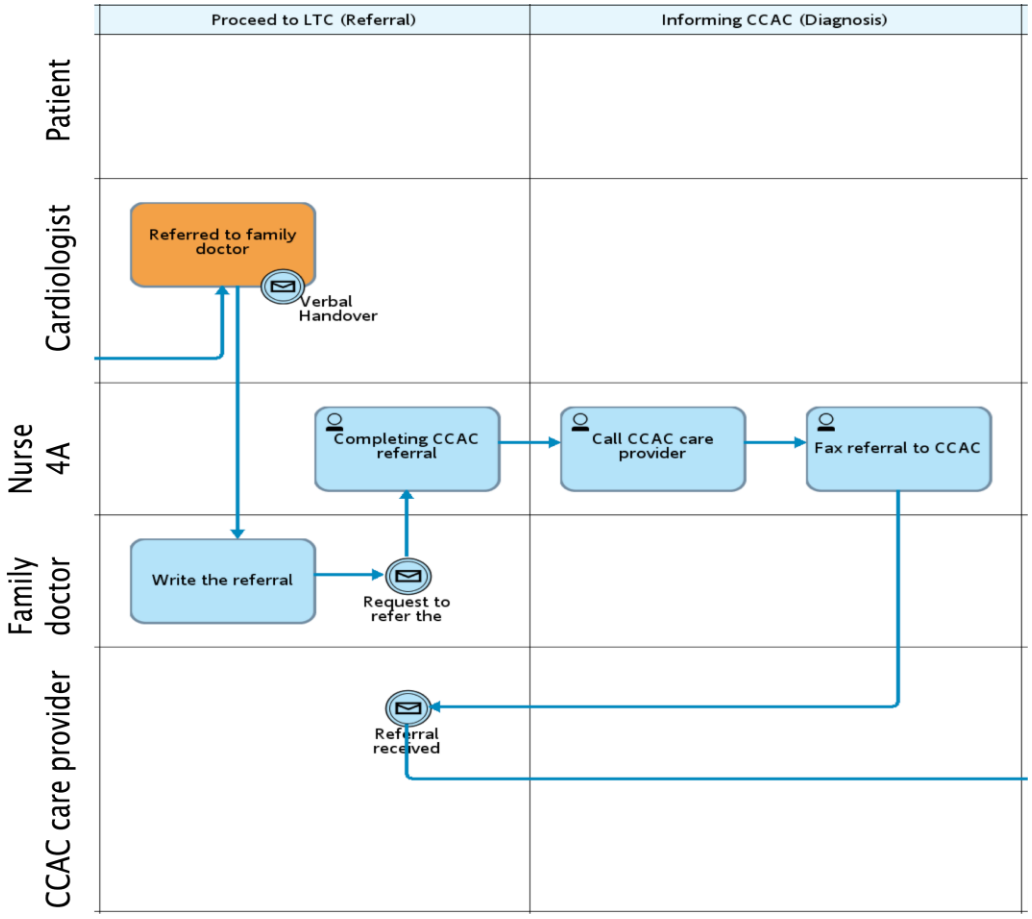
Figure 4.8 shows a model of the "Discharge type" sub-process.

Figure 4.8 “Discharge Type” Sub-process



II. Preparation for handover to LTC.

Figure 4.9 The "Preparation for Handover to LTC" Stage



This stage of the process involves preparation for handover, which includes preparing the referral and calling the CCAC care provider. It relies significantly on efficient information gathering by the nurse in the unit, so that the patient referral can be completed.

The preparation for handover process starts when the cardiologist informs the patient's family doctor that they no longer require cardiac care, and that they are ready for LTC service provided through CCAC. This is a verbal handover that we modelled as an intermediate message event attached to the activity "Referred to family doctor". These types of events do not explicitly require waiting, but do interrupt the "Referred to family doctor" activity.

The verbal handover is attached as an intermediate message event because we position it at the boundary of the activity that will be interrupted. The event occurs while the "Referred to family doctor" activity is happening, in the form of a phone call; this will immediately cancel the event

and the instance then moves through the exception flow to "Write the referral". Modelling the verbal handover as an attached event (interrupting or non-interrupting) does not provide sufficient details on the participants involved, location, and the content of the messages exchanged.

The rest of the activities are mostly manual. After the family doctor writes the LTC referral, the nurse must usually complete it by adding missing information and making corrections. The nurse relies on face-to-face verbal communication to gather most of this information. Other methods of communication used include phone calls (calling the CCAC care provider) and faxing (to send the referral to CCAC); email and messaging systems are also commonly used. At this stage of the process, these methods of communication cause delays and could result in adverse events, as one participant noted:

> Ok, so we ask the doctor to fill a paper for the need of the patient, the form of the requisition. Most of the time we have to complete, because they don't do it we[ll]—they don't do it well right away. (Participant 2)

The same participant also described difficulties in reaching the CCAC care provider:

> Sometime[s] I found that with CCAC, they, we fill the requisition, we fax it to go faster, but the fax doesn't turn well, so there's one [piece of] information missing. They can be fussy sometimes, depending who's working there. (Participant 2)

A registered nurse is responsible for completing the handover referral form. The LTC referral is a custom-made (facility-specific) form called "medical report for long-term care"; it contains information about the patient, their condition, and their care needs. A major limitation of using this form is that it does not offer patient-specific information access at the point of care for the CCAC personnel when they need it.

In the current situation, CCAC care personnel rely on communication with care providers in the cardiology unit for information. As we saw in the comment from Participant 9 on p.5, there is concern that communication using the form available does not give a full understanding of the patient's medical history and current care needs. Such concerns have adverse implications for patient safety and continuity of care.

III. Execution of the handover to LTC.

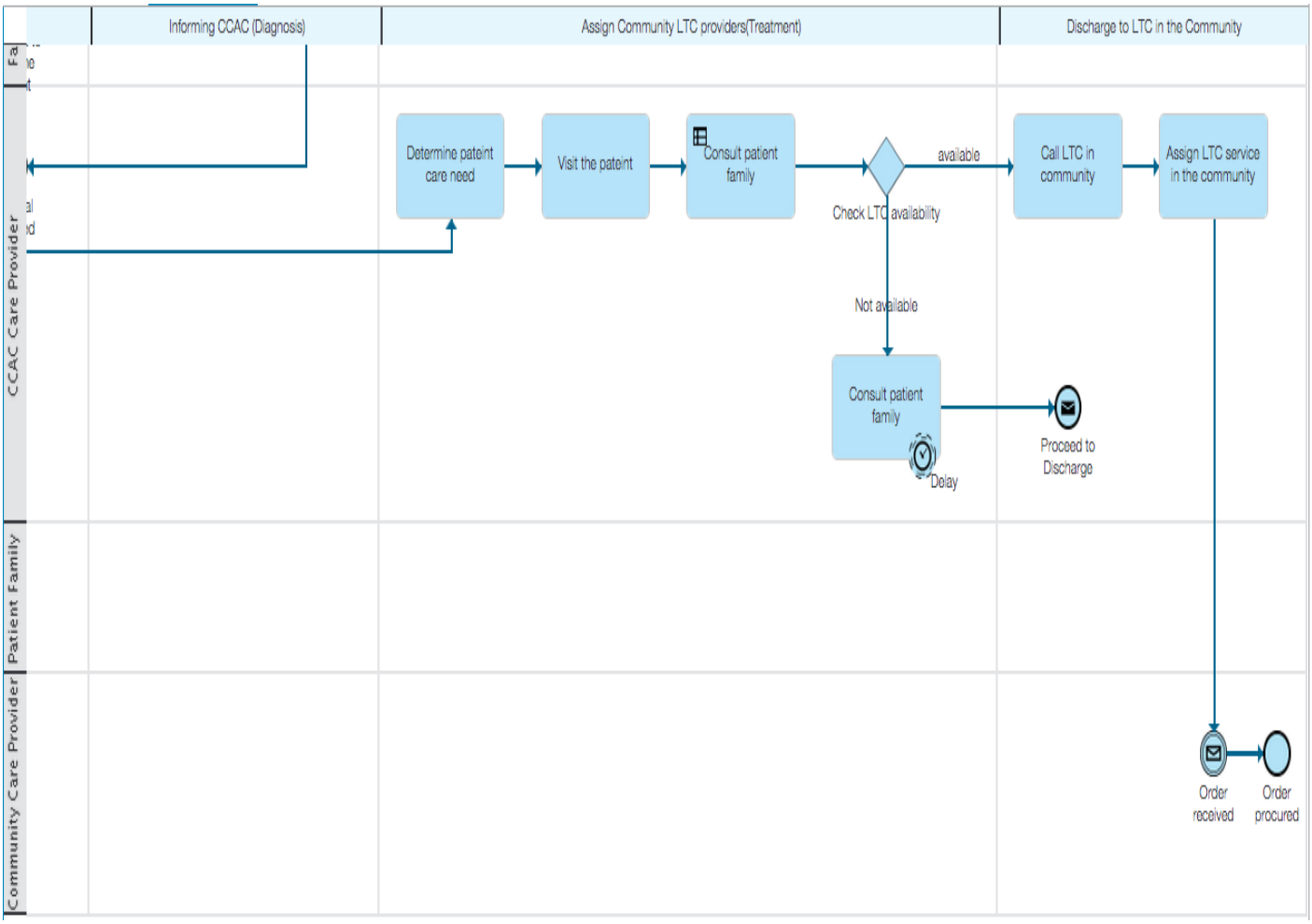


Figure 4.10 Execution of Handover to LTC

Stage III, "Execution of handover to LTC", involves a series of activities, including meetings, related to handover execution. Once the patient is ready for discharge and has been given a discharge date, and it has been established whether home help is required (personal care, nursing care, or therapists), a nurse, doctor, social worker, or therapist from the hospital will fill out a referral to CCAC. On this referral, they will provide the client's diagnosis and the services they think the client will need.

After receiving the referral, the CCAC care provider will meet the client and their family, and assess their care needs according to their eligibility criteria. They will then provide them with the care that they need, depending on what is available and after consulting the patient's family.

We modelled the consultation with the patient family as an activity with an attached, non-interrupting timer event. By using attached events, we can handle events that might suddenly occur during the execution of a task or sub-process. This event handles a delayed when we attach it to the boundary of the "consult the patient family" activity; the intermediate event catches this delay. In contrast to an error, a timer by default will not abort the activity it is attached to. Both interrupting and non-interrupting events can catch and handle occurrences, but by using the non-interrupting type (the boundary of these events is dashed) for the attached activity, we will not cancel the "consult the patient family" activity when the event "delay" is triggered. (Object Management Group, 2011).

4.2.2 Summary of research findings: Process documentation.

This section gives a summary of our research findings. However, before we move into this summary, a brief overview of some of the capabilities of Blueworks Live—the cloud-based software we used to analyse and model our process—is necessary as groundwork.

Blueworks Live allows BPM collaboration within an organisation. All the data related to the process design is stored in the cloud and accessible by all developers, analysts, etc. who are involved in optimising the process.

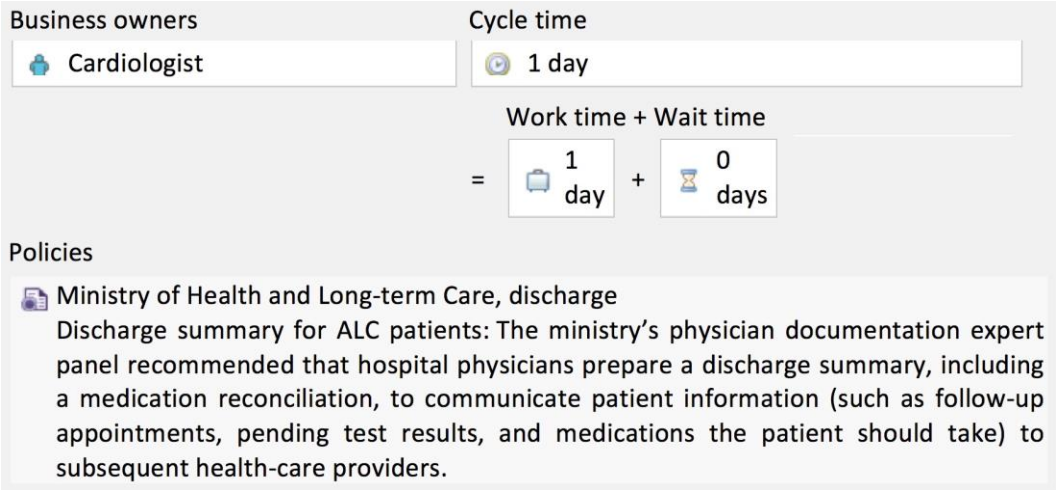
There are three levels of detail in a Blueworks document: the discovery map, process diagram, and process documentation. The discovery map shows the process in a hierarchical manner, listing only process milestones and activities. The complete process diagram uses a reduced set of elements from the BPMN 2.0 notation. The application also allows users to capture documentation on the process, which includes problems along with their descriptions and information about their severity and frequency, a feature that will be shown in use during the summary of results for this research.

In the sections that follow, we discuss the handover process documentation of the main activities that forms the overall process. The handover as-is model is broken down into a series of

activities, explained through the following images that detail each activity's key factors: participants, cycle time, and so on.

1. Examine the patient (discharge).

In the first phase of the process, the assigned cardiologist will examine the patient to determine if their cardiac problem is no longer a priority and they are ready to discharge. The process begins with discharge as it is the starting point when transferring patients to LTC settings. According to the Ministry of Health and Long-term Care, patients must be discharged to alternative agency providers' programs if they will not be going to stay with their families and if their condition requires it. The assigned cardiologist, who discusses the options with the patient's family physician, performs the activity of examining the patient.



1.1 Decision to discharge.

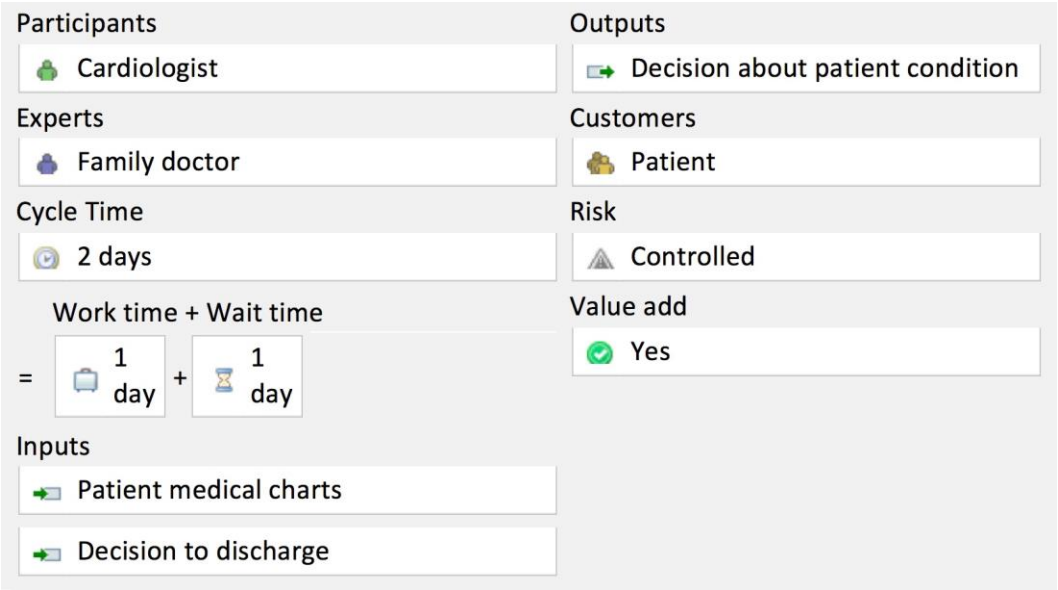
1.2 Get patient chart.

One study participant described the physician providing a patient chart as follows:

> When the patient is ready to go back home, like the patient has been discharged, so the physician has to send papers to the family physician, you know, just to make sure that he's aware of what happened in the hospital, and what would be the follow-up for the—oh, and also they have an appointment with the cardiologist if needed. Some patients, you know,

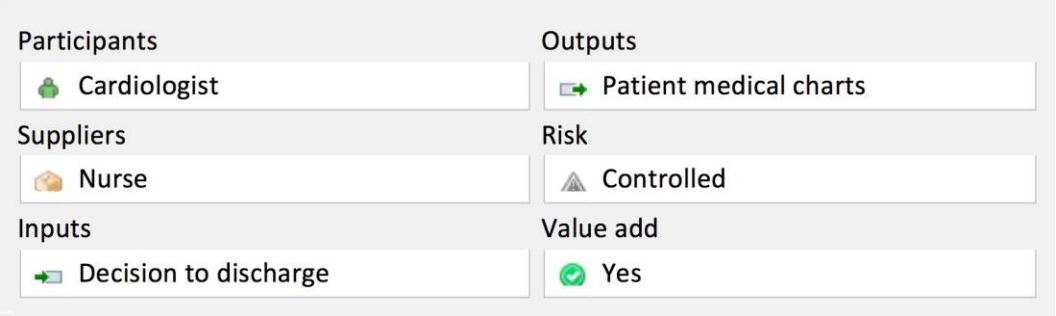
have, depending on the age, who have some auto—if they need like services at home, then we're gonna go through the CCAC program. The community care program. (Participant 1)

1.3 Examine the patient.



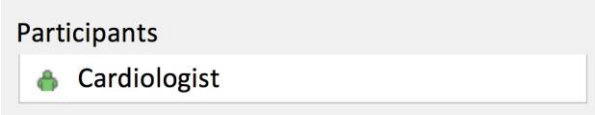
1.4 Require LTC.

1.5 Discharge type (sub-process).

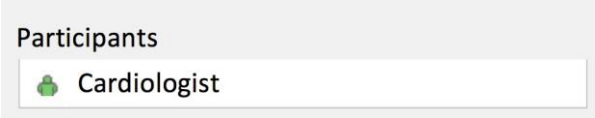


1.5.1 Require ICU.

1.5.2 Proceed to discharge without LTC.

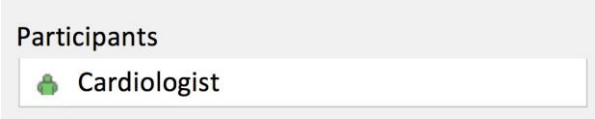


1.5.3 Proceed to ICU.



2. Proceed to LTC (referral).

2.1 Referred to family doctor.



2.1.1 Verbal handover.

This step is a verbal handover in the form of a phone call from the cardiologist to the family doctor in charge. Here is how one participant described the step:

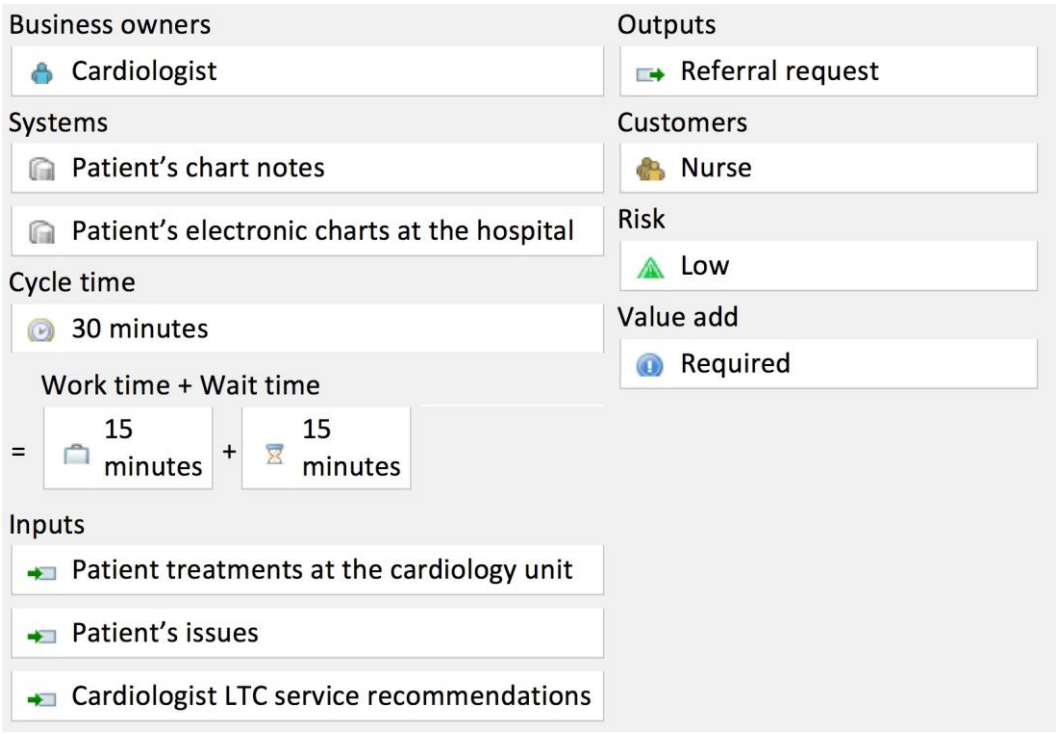
> I'll get a call from the cardiologist, who says, "I have a patient that I'd like to transfer to your care. These are the following issues, this is what we've done, and this is where I think, this is where I think they're going or this is why I think they need to continue to be in hospital but not under my care." And it's the "not under my care" part that suggests that the cardiology issued is no longer primary. So there's a verbal handover. (Participant 9)

To complete this activity, the family doctor will have access to the following documentation:

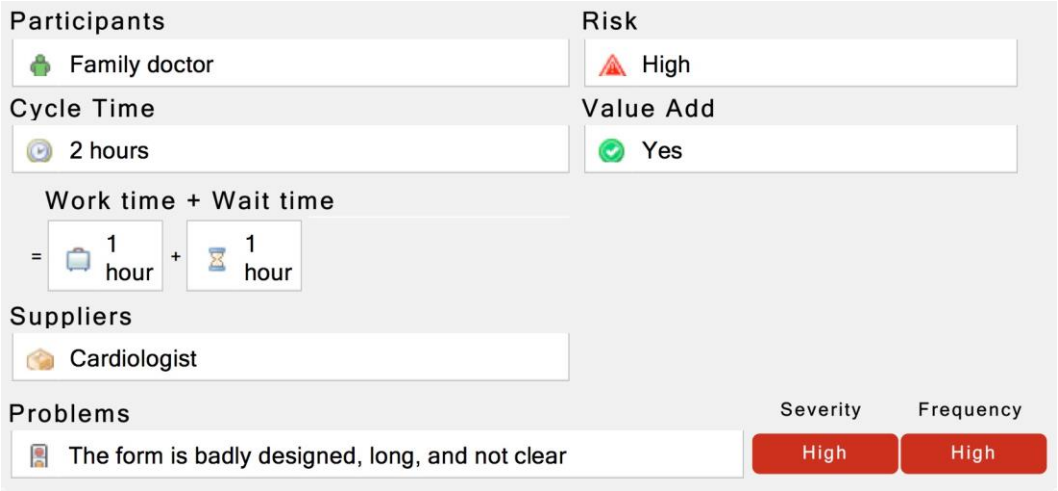
- The patient's chart notes (continuous)
- The patient's electronic charts from the hospital

Here is Participant 9, again, describing their access to documentation during this activity:

> I have access to all the chart notes, because it's a continuous chart. It's not, the chart doesn't start fresh when the patient comes to me. So I have the inpatient chart and I have all the, I have all the electronic charts from the hospital as well. (Participant 9)



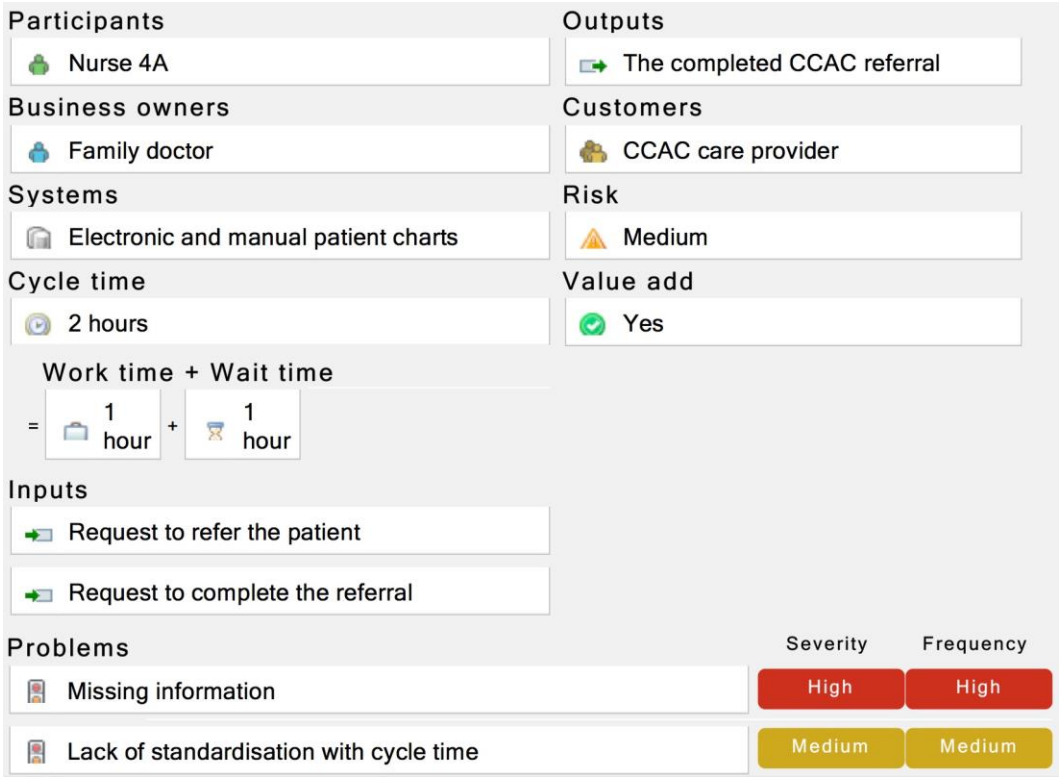
2.2 Write the referral.



2.3 Request to refer the patient.

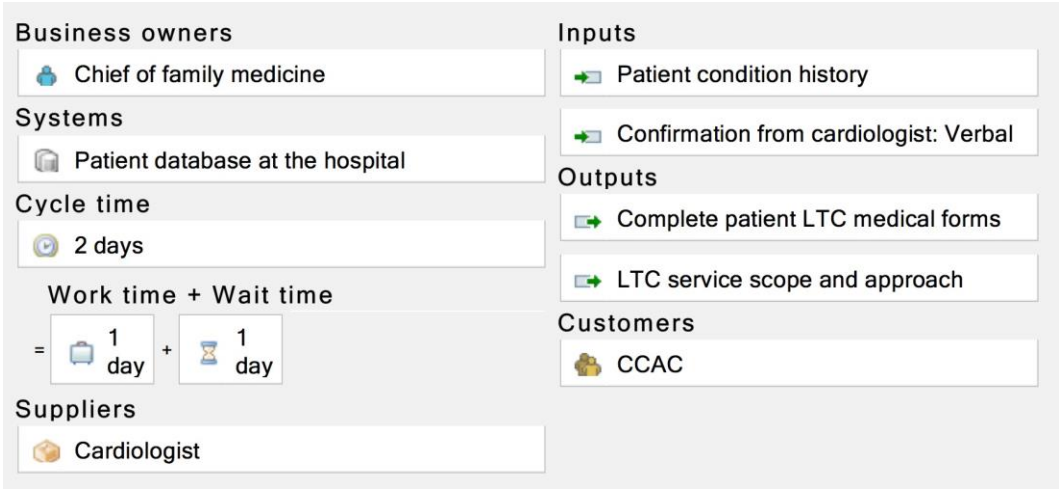
2.4 Completing CCAC referral.

The nurse will have to complete the referral after the family doctor begins it, as at this stage it will usually be missing some information.

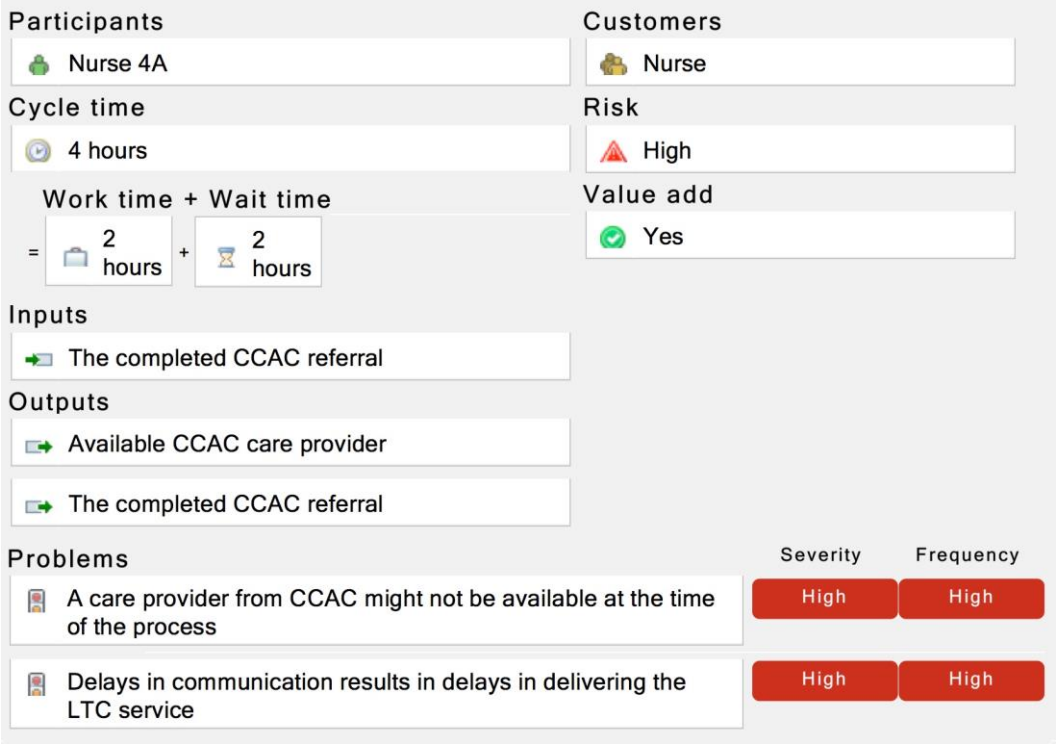


2.5 Referral received.

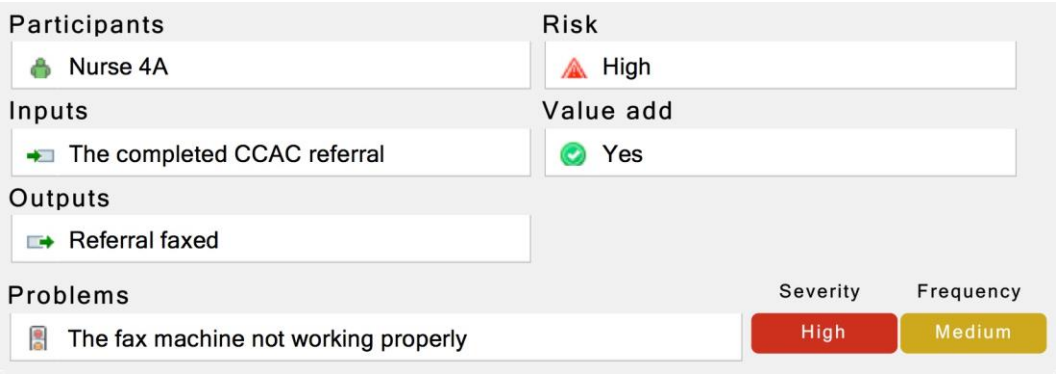
3. Informing CCAC (diagnosis).



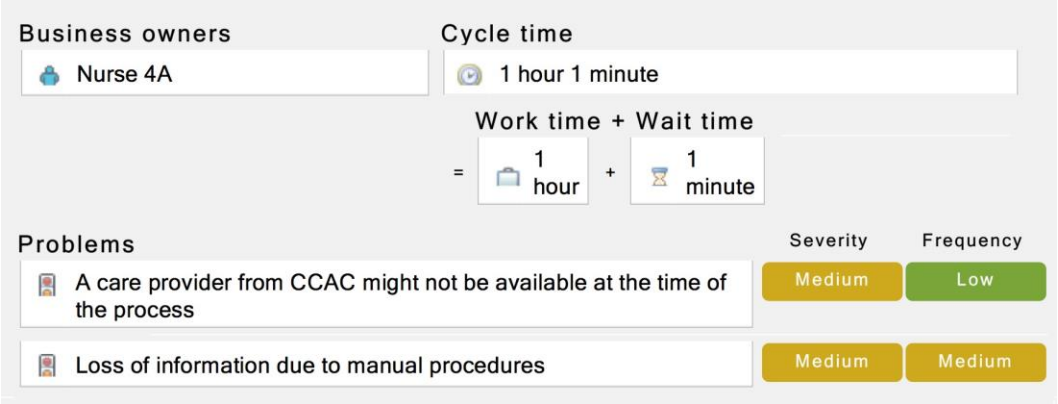
3.1. Call CCAC care provider.



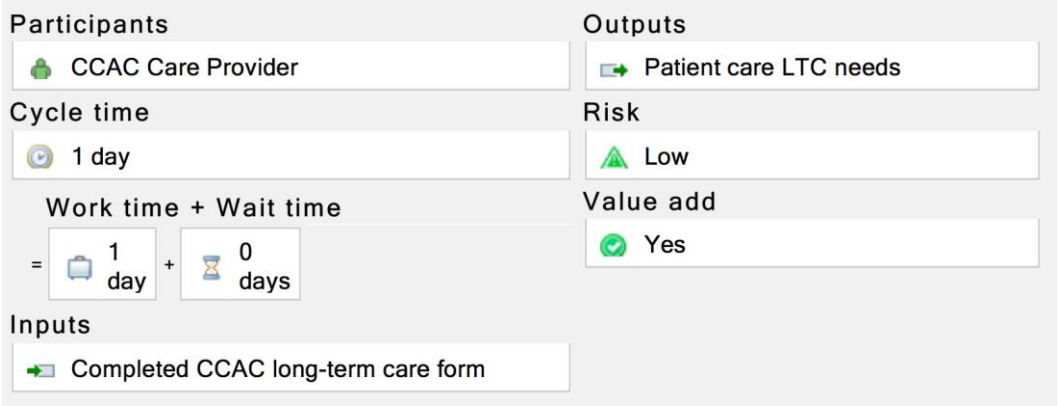
3.2. Fax referral to CCAC.



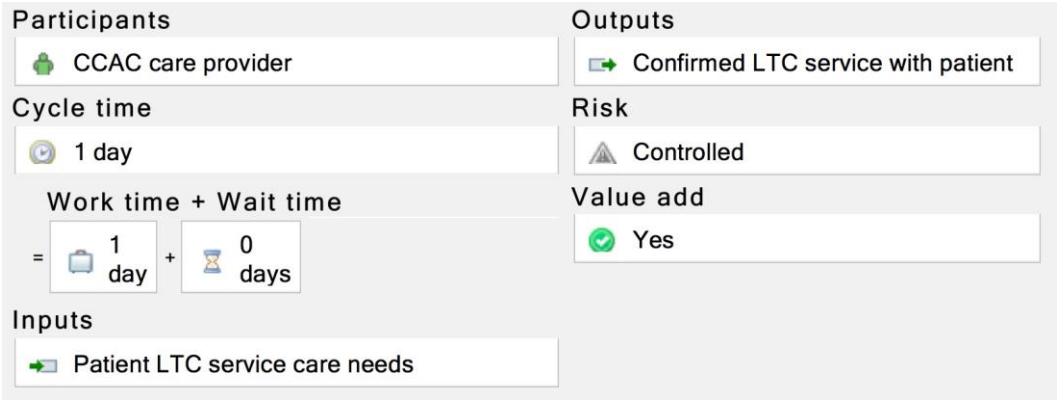
4. Assign community LTC providers (treatment).



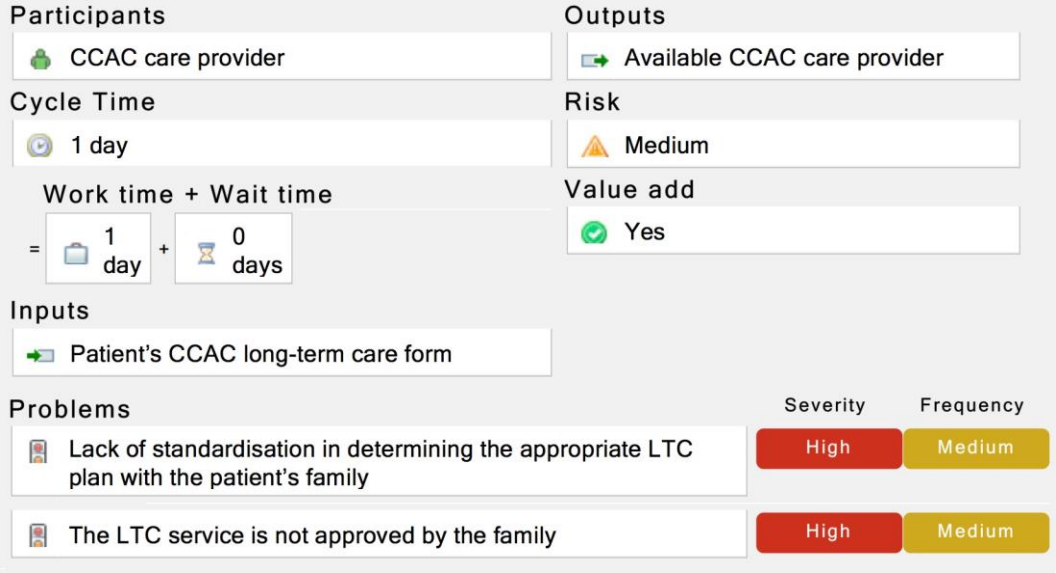
4.1. Determine patient care needs.



4.2. Visit the patient.



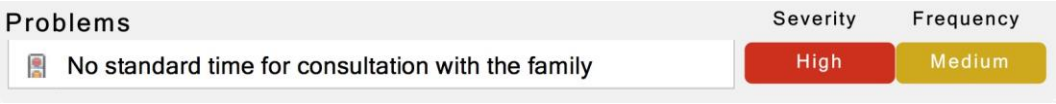
4.3. Consult patient's family.



4.4. Check LTC availability.

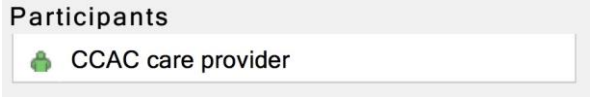
4.5. Consult patient's family.

4.5.1. Delay.



5. Discharge to LTC in the community.

5.1. Call LTC in community.



5.2. Assign LTC service in the community.

5.3. Order received.

5. Discussion

In this chapter, we discuss the study's results, measuring how they meet the objectives and answer the research questions identified in Chapter 1. We see how the process simulation identifies the main problems in that process, and also discuss the ability of certain BPM methodologies to serve as the proper techniques for modelling collaboration in health care.

While business process management (BPM) and BPM notation (BPMN) can help model information systems, we have gone a step further by modelling some aspects of the process under study using choreographies. These models, and the process of their creation, help link the BPM methodology with its real-case presentation, and help us understand how the collaboration points identified in the as-is model of the process created with BPMN can be more efficiently represented. The models also help us detect what features of the process might be inadequately represented while capturing the collaboration points, and to think about how to handle such shortcomings.

When constructing the as-is model, we look at the main states of collaboration and communication during the process. These states see care providers engaging in typical actions in care delivery. The subsequent choreography model is developed based on what the as-is model helps us identify, i.e. activities involving verbal communication.

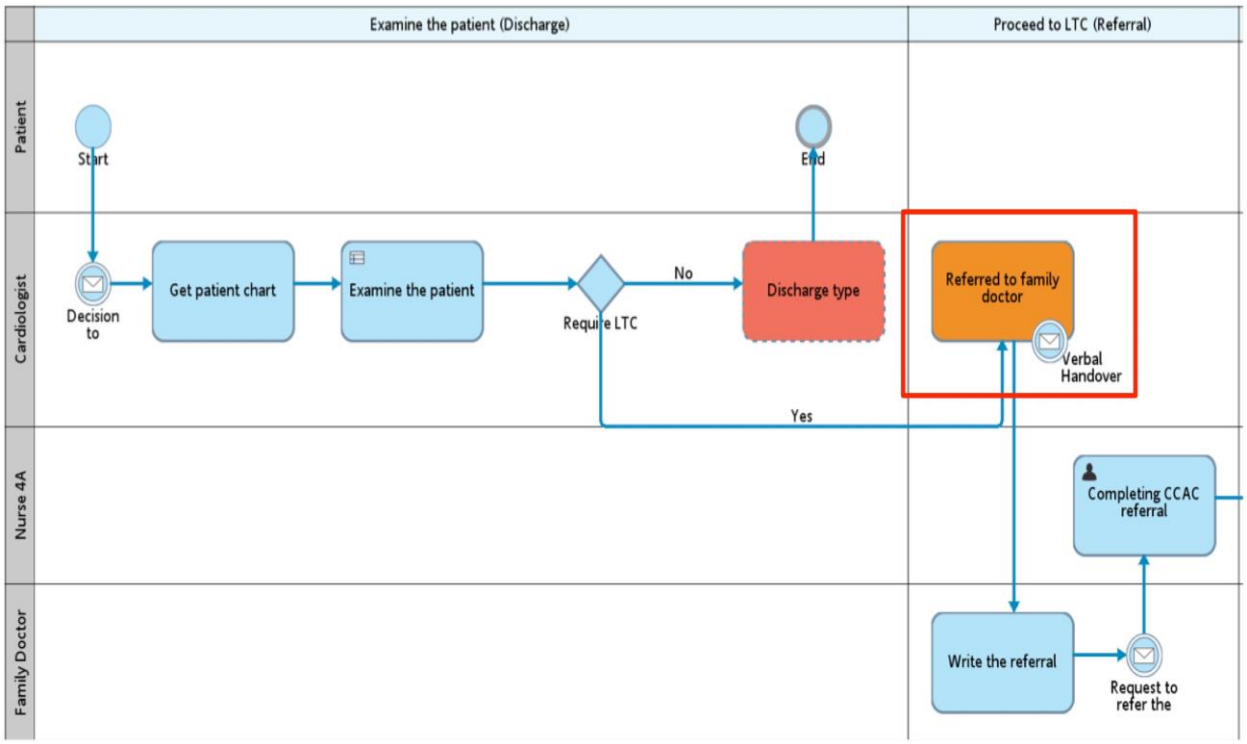
After discussing deficiencies in the existing process, as seen in the previous chapter, we chose three collaboration/communication states shown in the as-is model and identified in the simulation as posing a high risk of miscommunication and loss of information. On pages 87, 89, and 91, we showcase the states independently from the main model and provide detailed explanations of these individual states.

5.1 Deficiencies in the Process: States from the As-Is Model

5.1.1 State 1.

- 1 activity
  - referred to family doctor
- 2 participants
  - cardiologist
  - family doctor
- 1 gateway
- 1 message event

Figure 5.1 State 1: The "Referred to Family Doctor" Activity and the Verbal Handover (As-Is Model)



Activity information.

In the state above (Figure 5.1), the cardiologist initiates a verbal handover and refers the patient to the family doctor, as their cardiac-care service is no longer required. This will occur after the cardiologist confirms that the patient requires long-term care. The cardiologist will normally carry out this handover activity by making a phone call.

This verbal handover was modelled as an activity with an attached intermediate message event. Its output will result with the nurse proceeding the patient care to long-term.

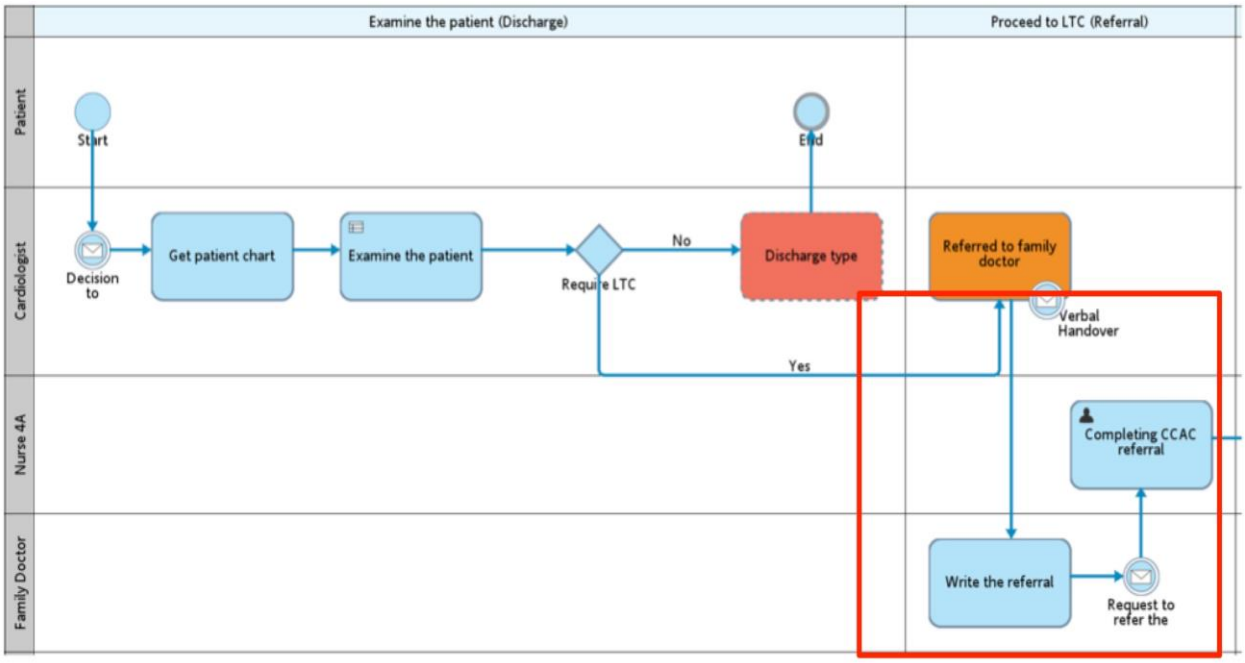
Characteristics and shortcomings of the State 1 model.

- There is no clear way to list which of the participants (the family doctor and cardiologist) are most involved in the activity at this stage.
- The model does not identify who initiates the verbal handover. This information is essential to increase the model's detail and precision, assisting with eventual standardisation of the process.
- The model does not clearly identify the activity's location. As indicated in the previous chapter, the handover usually takes place in a phone call between the cardiologist and the family doctor.
- In this state, there is no modelling for aspects of the verbal handover that are crucial to ensuring the family doctor receives the necessary information to safely provide continuity of care, or to convey particular medical meanings and representations. Communication of handover information will usually be through written, verbal, and non-verbal methods, all of which have different dynamics, which makes it difficult to model the data conveyed.

5.1.2 State 2.

- 2 activities
  - write the referral
  - completing CCAC referral
- 3 participants
  - cardiologist
  - family doctor
  - nurse 4A
- 1 message event

Figure 5.2 State 2: The "Write the Referral" and "Completing CCAC Referral" Activities, and the "Request to Refer the Patient" Message Event



Activity information.

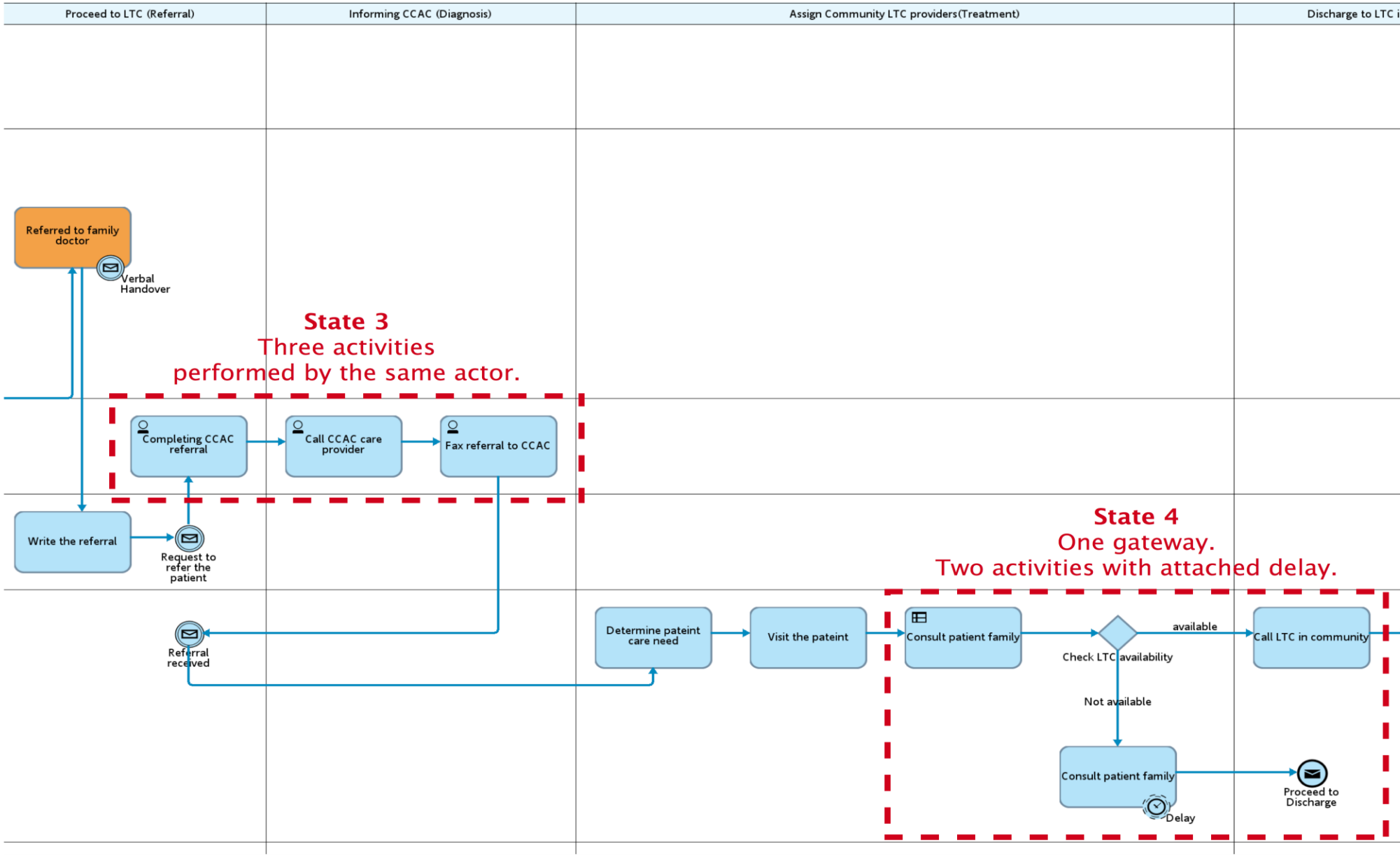
In the state shown above (Figure 5.2), the cardiologist will ask the family doctor to write the patient's referral to LTC. As an output of the verbal handover, the family doctor continues on to write the patient's referral to LTC. The request refer the patient to LTC comes in the form of a message event initiated by the family doctor after they have written the referral. In most cases, the assigned nurse in the unit will complete the referral based on data they collect. This is necessary due to there being information missing from the family doctor's referral, and occasionally some need for corrections to information provided.

Characteristics and shortcomings of the State 2 model.

There are few complications in modelling this part of the process, particularly the manual verbal and written requests. In this part of the model, the family doctor writes the referral in response to the verbal handover by the cardiologist, and then requests that the referral be completed. This request comes from the family doctor, and was modelled as a message event. This state of the model can be easily simplified or streamlined by eliminating activities that do not add value, and

which cause delays in the process. In this step, time can be saved if the family doctor and nurse collaborate more closely in writing the referral, eliminating or reducing the need for rework.

Figure 5.3 States 3 and 4: CCAC Referral and Family Consultation



5.1.3 State 3.

- 3 activities
    - complete CCAC referral
    - call CCAC care provider
    - fax referral to CCAC
- 1 participant
    - nurse

Activity information.

In this state, one actor (the nurse) performs three manual activities. After the family doctor writes the patient referral, the doctor will request that the nurse completes the referral to CCAC. This message event starts the process in which the nurse completes the referral (as discussed in relation to State 2 above), calls the CCAC care provider, and finally faxes the completed patient referral to CCAC.

Characteristics and shortcomings of the State 3 model.

We have specified that each activity is manual, which means that the activities are human-driven, with no process engine involved. According to participants in this process, there is a very high potential for delays and errors, mostly due to adverse events such as the fax machine not working or the nurse being unable to reach the CCAC care provider when needed. It is possible to address all potential errors and fault paths, but as this would add significant complexity to the diagram, at this stage of the process documentation we have only pointed out the problems.

5.1.4 State 4.

- 2 activities

    - consult the patient's family (decision task)
    - consult the patient's family
- 2 participants
    - the patient's family
    - the CCAC care provider
- 1 gateway

In State 4, we modelled consultation with the patient's family as two separate activities. The first is a decision task whose output is the family decision about the patient's LTC service. Once a decision is made, the CCAC care provider will check if that service is available. If so, the patient will move to the last phase: discharge to LTC in the community. If the service is not available, the CCAC will counsel the family again until they reach a workable decision.

Characteristics and shortcomings of the State 4 model.

We modelled this state as two activities of the same type to make it less complex. If the LTC service the family chooses is not available, the CCAC care provider will counsel the family again, causing delays in the process. The delay was modelled as a non-interrupting timer event attached to the second counselling activity. When the token arrives at the timer event, it waits for the time specified in the timer event before moving to the next step of the process. According to data we collected, there is no specific duration for the counselling process with the family, and this lack of standardisation in the process causes delays in delivering patient care.

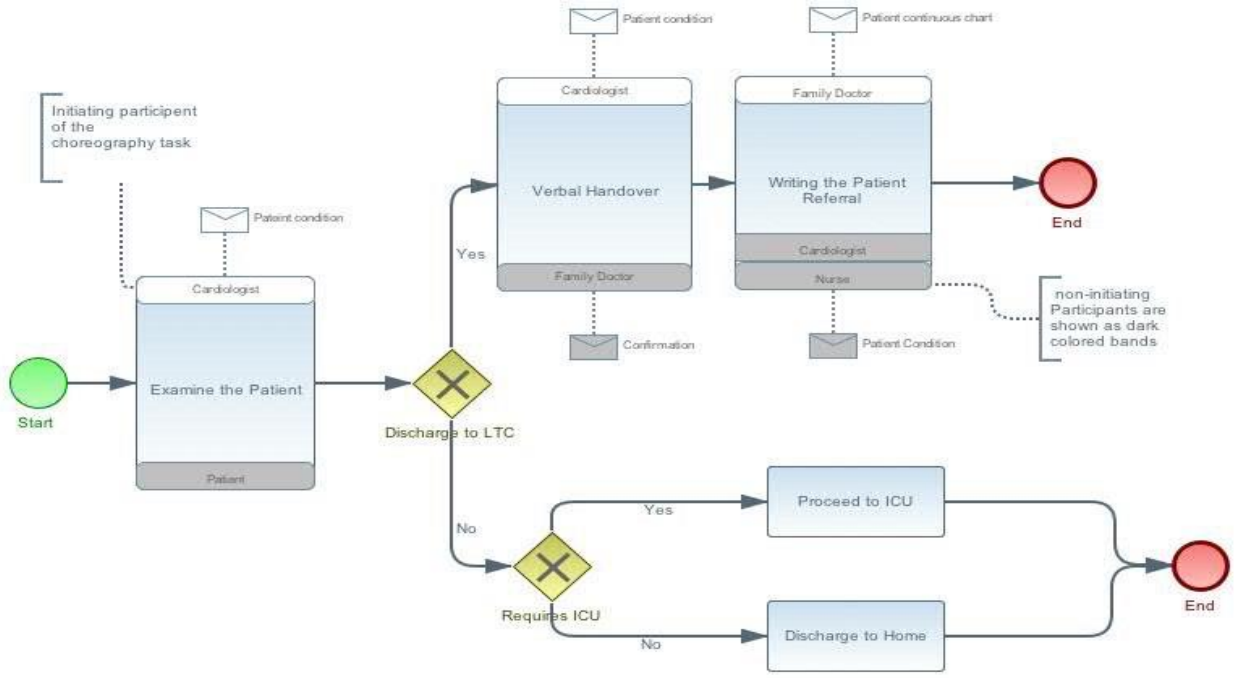
5.2 Improvements: Choreography Modelling in BPMN 2.0

Analysis of the states identified in the first part of this chapter highlights the same deficiencies we saw applied to BPMN for modelling collaboration in

multidisciplinary settings. BPMN alone was not sufficient to model the intricate collaboration aspects of the process, as we explained above.

For this reason, we went on to use another BPM methodology in an attempt to capture the collaboration between care providers involved in the handover process, and to help improve the communication in place. Figure 5.4 shows the choreography model we created.

Figure 5.4 Choreography Modelling in BPMN 2.0



This model allows us to look more closely at some of the tasks that involve the most risks and problems. In building the model, we narrowed our focus to specific tasks that have a higher requirement for efficient communication: examine the patient, verbal handover, and writing the patient referral.

In the choreography model, we can see more details about the particular parts of the processes each participant is involved in. For example, in the verbal handover task, the exact content of the verbal handover from the cardiologist's side is the patient's current condition. Moreover, in this diagram we refined the process by only showing tasks dedicated to communication between process participants. It eliminates unnecessary tasks that do not add value to the process, such as having the nurse complete the referral after the family doctor has written it. Instead, we provide for a full collaboration between the cardiologist, family doctor, and nurse, where all participate in completing the "Write the referral" task.

There are at least two participants in each interaction. The white band represents the participant who initiates the interaction by sending a message to the other participant who receives it, represented by the shaded band.

In the first task shown above, the cardiologist initiates the interaction by determining that the patient's condition requires LTC. When the cardiologist contacts the family doctor to hand the patient over to LTC, a request–response interaction takes place, where the cardiologist can request the service verbally from the family doctor.

The "Writing the patient referral" interaction follows. In this case, the initiating participant is the family doctor, who is mainly responsible for this task. However, in most cases the nurse will take over to complete the referral due to missing or incorrect information. The cardiologist will also be part of this interaction, providing a brief on the patient condition that the family doctor uses in writing the referral. Both the nurse and the family doctor contribute their knowledge of the patient's condition in this interaction, which can help minimise some of the shortcomings in the way this task is handled.

We limited our evaluation of BPMN 2.0 choreography modelling to the domains considered in the evaluation framework laid out by Cortes-Cornax, Dupuy-Chessa, Rieu & Dumas (2011). This framework is based on Krogstie, Sindre & Jorgensen's quality framework (2006), which allows for evaluation of a broad spectrum of a language's characteristics. In this paper, the authors extend the quality framework to frame it in the specific context of choreographies. We consider some areas of the evaluation in the framework of Krogstie et al., along with that provided by Cortes-Cornax et al. We specifically narrowed our focus to "domain appropriateness", due to its relation to the quality of language semantics, evaluating its conceptual foundation to express only what is in the domain.

The "domain appropriateness" requirements described by Cortes-Cornax et al. (2011) are:

- **D1. Participant specification.** The choreography language's ability to support more than one participant (service), and more than one instance of the same participant.
- **D2. Service communication.** As choreographies lack a central coordinator, a choreography language should support the presentation of communication between different participants.
- **D3. Time constraints, and D4. Exception handling.** Similar to classical diagrams, choreography diagrams in BPMN 2.0 allow definition of time constraints and exception handling (fault paths). Time flexibility and errors should be presented, and modellers should be able to define paths in the choreography that can handle such negative scenarios.

For each requirement, Cortes-Cornax et al. considered other sub-requirements for analysing the domain. Table 5.1 summarises their evaluation of choreography modelling in BPMN 2.0, with a brief explanation of each sub-requirement.

Table 5.1 Evaluating the Domain Aspects of Choreographies in BPMN 2.0

	Requirement	*Improvement (Choreographies)*	*Level of support*	*Comment*
Domain evaluation	**D1. Participant specification**	D1.1 Multilateral interaction	+	More than two participants (services) can be involved in choreography.
		D1.2 Service sets	+	Several participants of the same type might be involved in the choreography; multi-instance support.
	D2. Service communication	D2.1 Selection of services and reference passing	–/+	There is no central coordinator in choreographies. Thus, the reference of a selected participant may be passed to another participant.
		D2.2 Service correlation	–/+	Every message contains an explicit identifier.
		D2.3 Message multiplicity	–	To define the number of messages sent from one (or more) participant(s) to others, and to observe other scenarios in the servic communication.
	D3. Time constraints			
	D4. Exception handling		+	

Other observations on the use of choreographies in BPMN 2.0.

In comparable evaluations, a three-valued scale (–, –/+, +) is used to specify whether a requirement has *no direct support, no complete support*, or *full support*.

As Figure 5.4 illustrates, more than one participant may be involved in a choreography model (D1.1 Multilateral interaction). For example, the *family doctor, cardiologist*, and *nurse* are all shown as being involved in the "Writing the referral" task. BPMN 2.0 also supports multi-instance participants (D1.2 Service sets). For example, several instances of the participant *nurse* might be involved in the choreography. As the data implies, no specific type of nurse participant need be involved with writing the referral (either the head nurse or the nurse assigned to the patient).

BPMN 2.0 supports depiction of multiple participants and instances. However, it cannot be shown graphically in the model, only at the implementation level (Cortes-Cornax et al., 2011).

In relation to D2.1, service and reference passing can be done in the design or deployment phase. Unlike WS-CDL, BPMN lacks notation for *channel.* To enable dynamic message destinations, channels can be created by one participant and passed to another, allowing them to communicate with multiple participants and give separate response channels to each (Cortes-Cornax et al., 2011).

D2.2, service correlation, or a correlation key, is a set of variables used to identify an instance in a process to associate with the messages that apply (Sybase, 2013). Correlation keys can be created in models targeting the BPMN language, and can support the previous requirement (reference passing) to some extent. Accordingly, correlation keys can apply to message flows in collaboration and choreography.

Like multiple instances in choreographies, it is not clearly specified how this can be presented graphically.

D2.3, message multiplicity, allows different service communication scenarios to be considered. BPMN captures the concept of multiple participants and instances, but leaves it unclear how to show actual message exchange patterns between two multiple-instance participants (many-to-many message exchange) (Gudenkauf, 2012, p. 125).

Therefore, BPMN captures the concept of participant multiplicity but not message multiplicity.

5.3 Conclusion

It can be difficult to model health-care delivery processes effectively, often due to the intricate interactions between care providers and the numerous patient care needs that must be discerned.

In the following chapter, we conclude the thesis by identifying this study's limitations and suggesting future directions for research.

6. Conclusion

Patient handover is a vital health-care process that needs to be undertaken with care and professionalism. When patients are being transferred from hospitals to care centres in their community, undertaking this process systematically and using the right methods yields the best results. In this study, we focused on communication structures and collaboration between care providers as a key area where the handover process could be improved.

In this thesis, we have presented our as-is model of a handover process where the patient is transferred from cardiology to LTC. While building the model, we relied on data from interviews conducted at Montfort Hospital, particularly in the cardiology unit, and with the CCAC organisation. We took into account communication between care providers and complexities of the health-care environment, as well as patient needs and safety concerns. We aimed to develop this as-is model to demonstrate the process flow and the communication practices already in place.

Although existing literature has identified challenges inherent in the handover process, to date there has been little research effort to conduct a thorough analysis of handover to LTC that focuses on highlighting communication complexities.

As we found, to develop an as-is model of such a process, one needs a solid understanding of that process as a foundation. This prompted us to collect data through a qualitative case study and interviews of care providers at Montfort Hospital; through this we managed to create high-level maps that captured the main activities in the handover process.

While conducting the case study, we faced challenges in recruiting care providers that had the time to participate in such a study. Due to language barriers (English

not being the participant's first language) and the sensitivities of the particular unit, it was difficult to collect the required amount of data.

Identifying problems, risks, and complexities in the process through constructing the as-is model, we then went ahead to build the to-be model using choreography. In doing so, we attempted to present an alternative method of modelling collaboration in the process, and to minimise problematic areas using BPMN 2.0. We then evaluated the choreography model based on its "domain appropriateness" according to the work of Cortes-Cornax et al. (2011).

Future work could easily be done in the area of choreography modelling and its evaluation. We found that this method proved extremely helpful for modelling the intricate domain of health care, which presents many interactions that a process model must capture and analyse. Further possibilities for future work can be seen in the implementation and deployment stage, where modelling methodologies such as conversations could be implemented for the purpose of studying how they differ from choreography.

In our study design phase, we identified care providers from a literature review and case studies conducted in two settings. However, on reviewing this research, we found that similar work on handover processes was mostly conducted in a single setting such as an emergency room or operating room. Given the diversity of patient needs, health-care research can benefit from spanning multiple settings—as does patient care itself—and this proved one strength of the present study. Especially where LTC services like rehabilitation are concerned, patients are frequently transferred between different medical departments and care settings, and this introduces a complexity that single-setting studies do not capture.

In our discussion chapter, we demonstrated some of the deficiencies in modelling certain interactions using BPMN alone. Our results showed that BPMN cannot, by itself, capture all of the interaction and collaboration in the process studied. By building the choreography model, we tried again to capture the collaboration as best as possible.

Our evaluation of the choreography model shows slight improvements in participant specification and capturing service communication, even though choreography did not offer significant support in representing message multiplicity or defining the number of messages sent from one or more participants to others. This needs to be addressed; the relevant literature shows there is a need for, and benefits to, evaluating modelling languages and identifying areas for improvement.

This approach in analyzing and modeling handover processes should be adaptable to fit handovers to other settings. However, handover to LTC is the focus here due to the importance of such setting, lack of research and it's communication issues, specifically arising from the care providers collaborating on an individual patient care.

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Appendices

Appendix A

Consent Form

Project Title: **MANAGING CLINICAL HANDOVER PROCESSES FOR CARDIOLOGY PATIENTS USING BPM**

Researcher name: Amal Alghamdi. M.Sc Student Candidate in e-Business Technologies, multidisciplinary program at Ottawa University. Supervisor: Ms. Sarah BEN AMOR, PhD is affiliated with the Telfer School of Management at the University of Ottawa and its coordinates are;…. . Collaborator at Montfort Hospital: Ms. Carolyn Welch, cwelch@montfort.on.ca Director, Clinical Services.

Invitation to participate: I am invited (e) to participate in the above named research that is conducted by Amal Alghamdi, M.Sc candidate, working under the supervision of Mrs. Sarah Ben Amor, PhD.

Aim of the study: The main objective of this research is to provide health care organizations with a framework that can be used to effectively model Clinical Handovers processes. Contributing to the achievement of enhancing the communication levels and with this framework process modeling techniques will be used. The research attempts to address the above shortcoming by creating a framework for modeling Clinical Handover processes.

Source of Funding: This research project has no funding source.

Conflicts of Interest: No apparent conflicts of interest for this research project.

Participation: The participants will mainly be participating in an interview lasting 20 minutes, in order to complete the attached questions for this research project.

Risks: There are no known risks associated with my participation in this research.

Benefits: My participation in this research will effectively contribute to improving the care of patients by using Business Process Management (BPM). The developed framework will contributes to effectively model handover processes allowing the explicit consideration of the factors influencing the performance rather than just a quality analysis study. The direct benefit will be enhancing the communication levels between the cardiology and home and community care unites. And the indirect benefit will be the improvement of resources. However, participation in this research study provides no direct benefit to participants.

Confidentiality and anonymity: I am confident that the information I share with the researcher will remain strictly confidential. I expect that the content of this study will be used to manage the handover process of patients moving from the cardiology unite to the home and community care using BPM. This information does not contain any personal information.

Data preservation: The data collected in this research are the opinions of the cardiology care providers and home and community care providers on the handover process of patients from cardiology to the home and community care unit. The information will be initially audio recorded and written as paper notes and in a second step converted into diagrams and models to be introduced to software for analysis and modeling purposes. These papers will be stored according to regulations on the confidentiality of information at the University of Ottawa.

Compensation: No compensation for participating in this study.

Voluntary participation: My participation in research is voluntary and I am free to withdraw at any time, and / or refuse to answer certain questions, without any negative consequences. If I choose to withdraw from the study, the data collected up to that point will be destroyed.

Acceptance: I, ..., agree to participate in this research by Amal Alghamdi, M.Sc Student Candidate, in e-Business Technologies, the University of Ottawa, working under the supervision of Mrs. Sarah BEN AMOR, PhD.

For additional information about this study, I can contact the researcher at Amal Alghamdi … or her supervisor ….

For more information on the ethical aspects of this research, I can contact the Coordinator of the Committee of Research Ethics of the Montfort Hospital 713 Montreal Road, phone 613-746-4621, ext 2221 or christianbergeron@montfort.on.ca

There are two copies of the consent form, a copy that I can keep.

Signature of Participant: ..... Date: .... / .... / 2012

Signature of Researcher: ..... Date: .... / .... / 2012

Formulaire de consentement

Titre du projet : **GESTION DU PROCESSUS DE TRANSFERT DES PATIENTS DE L'UNITÉ DE CARDIOLOGIE PAR L'UTILISATION DU BUSINESS PROCESS MANAGEMENT (BPM)**

Avant d'accepter de participer à ce projet de recherche, veuillez prendre le temps de lire et de comprendre les renseignements qui suivent. Ce document vous explique le but de ce projet de recherche, ses procédures, avantages, risques et inconvénients. Nous vous invitons à poser toutes les questions que vous jugerez utiles à la personne qui vous présente de document.

Nom de la chercheuse : Amal ALGHAMDI. Étudiante Candidate à la M.Sc au programme multidisciplinaire de l'Université d'Ottawa. Nom *du superviseur : madame Sarah BEN AMOR, Ph.D* affiliée à l'École de Gestion Telfer de l'Université d'Ottawa et ses coordonnées sont; …. Coordinateur de l'Hôpital Montfort : Ms Carolyn WELCH, cwelch@montfort.on.ca, directrice des services cliniques à l'Hôpital Montfort.

Invitation à participer : Je suis invité(e) à participer à la recherche nommée ci-haut qui est menée par Amal ALGHAMDI, candidate à la M.Sc., travaillant sous la supervision de madame Sarah Ben Amor, Ph.D.

But de l'étude : Cette recherche vise dans un premier temps à identifier les déficiences existantes dans le processus de transfert des patients de l'unité de cardiologie aux soins à domicile et soins communautaires. Un cadre modélisant le processus de transfert des patients entre ces unités sera développé. Ce cadre contribuera à la résolution des déficiences identifiées et à améliorer le niveau de communication entre ces deux unités.

Source de financement : Ce projet de recherche ne dispose d'aucune source de financement.

Conflits d'intérêts : Aucun conflit d'intérêts apparent et possible à déclarer pour ce projet de recherche.

Participation : Ma participation consistera essentiellement à participer à une entrevue d'une durée de 20 minutes.

Risques : Il n'y a aucun risque connu lié à la participation à cette recherche.

Bienfaits : Ma participation à cette recherche aura pour effet de contribuer à l'amélioration de la prise en charge des patients lors de leur transfert de l'unité cardiologie aux soins à domicile et soins communautaires, par l'utilisation du Business Process Management (BPM). L'intérêt direct de cette étude est la résolution des lacunes qui seront identifiées lors du processus de transfert des patients, ainsi que l'amélioration de la communication entre le personnel de l'unité de cardiologie et les prestataires des soins à domicile et soins communautaires. Cette étude contribuera aussi dans

l'amélioration de l'économie des ressources. Toutefois, cette étude ne procure pas de bénéfices directs aux participants.

Confidentialité et anonymat : J'ai l'assurance du chercheur que l'information que je partagerai avec lui restera strictement confidentielle. Je m'attends à ce que le contenu de l'information partagée avec la chercheuse principale soit utilisé seulement pour modéliser le processus de transfert des patients de l'unité de cardiologie aux soins à domicile et soins communautaires par l'utilisation du BPM. L'information fournie ne contiendra aucun renseignement personnel.

Conservation des données : Les données recueillies dans cette recherche sont les opinions des prestataires de soins du service de cardiologie et des prestataires des soins à domicile et soins communautaires sur le processus de transfert des patients. Ces dernières seront d'abord enregistrées dans un appareil audio, puis transcrites sur papier, et enfin changer en données alphanumériques. Ces données alphanumériques seront cryptées et sauvegardées dans un appareil ordinateur au local 7116 du pavillon Desmarais de l'école de gestion Telfer à l'université d'Ottawa pour des fins de traitement et d'analyse. À la fin du processus de traitement de ces données, les résultats émanant de ce projet de recherche seront conservés selon les règlements sur la confidentialité de l'information de l'Université d'Ottawa.

Compensation : Aucune compensation pour la participation dans cette étude.

Participation volontaire : Ma participation à la recherche est volontaire et je suis libre de me retirer en tout temps, et/ou refuser de répondre à certaines questions, sans subir de conséquences négatives. Si je choisis de me retirer de l'étude, les données recueillies jusqu'à ce moment seront détruites. Je comprends que ma participation dans ce projet de recherche indépendant de mon unité de cardiologie est volontaire; de ce fait ma participation n'a aucune coïncidence avec mes tâches de travail quotidien.

Diffusion des résultats : Les résultats de ce projet de recherche seront publiés à l'université d'Ottawa selon les normes de la Faculté des études supérieurs et postdoctorales régissant la publication des thèses. De même, une copier de ces résultats sera transmisse à la direction des études cliniques de l'Hôpital Montfort.

Acceptation : Je,……., accepte de participer à cette recherche menée par Amal ALGHAMDI, candidate à la M.Sc au programme multidisciplinaire de l'Université d'Ottawa, travaillant sous la supervision de madame Sarah BEN AMOR, Ph.D.

Pour tout renseignement additionnel concernant cette étude, je peux communiquer avec le chercheur : Amal ALGHAMDI au …. ou son superviseur au ….

Pour tout renseignement sur les aspects éthiques de cette recherche, je peux m'adresser au coordonnateur du Comité d'éthique de la recherche de l'Hôpital Montfort, 713 chemin Montréal, téléphone 613-746-4621, poste 2221 ou christianbergeron@montfort.on.ca

Il y a deux copies du formulaire de consentement, dont une copie que je peux garder.

Signature du participant: …….. Date: ..../..../*2012*

Signature du chercheur: …….. Date: ..../..../*2012*

Appendix B

QUESTIONS FOR MONTFORT COMMUNITY CARE PROVIDERS IN THE RESEARCH PROJECT ENTITLED MANAGING CLINICAL HANDOVER PROCESSES FOR CARDIOLOGY PATIENTS USING BPM

The following are a series of questions for stakeholders (Home and Community Care providers at Montfort hospital). The questions can contribute to the development of the intended framework by **enabling the researcher to capture the user requirements and the environmental conditions that are needed, along with the capabilities of the current system for the analysis stage.**

1- How would you describe the clinical handover process for cardiology patients reaching your unit at the home and community care and what does it achieve?
2- Where does it take place? Who are the exact participants?
3- Which internal and external systems will this process interact with?
4- What Information flows from one person to another in relation with this process?
5- What do you see as the major critical issues facing your unit for this process? What areas for improvement have you observed?

QUESTIONS FOR CARDIOLOGY CARE PROVIDERS AT MONTFORT HOSPITAL FOR THE RESEARCH PROJECT ENTITLED MANAGING CLINICAL HANDOVER PROCESSES FOR CARDIOLOGY PATIENTS USING BPM

The following are a series of questions for policy stakeholders (cardiology care providers). The questions will contribute to the development of the intended framework by **enabling the researcher to describe the handover process, capture the user requirements, the environmental conditions, along with the capabilities and the issues of the current system.**

1- How would you describe the handover process for cardiology patients from your unit to the home and community care and what does it achieve?
2- Where does it take place? Who are the exact participants? And where are they located?
3- Which internal and external systems will this process interact with? (An explanation may required)
4- What Information flows from one person to another in relation with this process? (What are the information you need to transfer the patients from Cardiology to Home Care? And what are the documents required?)
5- What do you see as the major pain areas facing your unit for this process? What areas for improvement have you observed?
6- Have you recently did any changes to the process?
7- Is there any handover tools used during the process?
8- How do you maintain the relationship with you patients?

Appendix C

Looking for Participants for a research titled "Managing Clinical Handover Processes for Cardiology Patients"

Participants involved in the handover process of the patients movement from Cardiology to Home and Community Care units are more than welcome!

The Duration of the interviews: From 15-30 minutes

Place: In Montfort Hospital or by Phone

The study will contribute to:

- Explore the clinical handover processes between the cardiology unit and home and community care providers of patients leaving the cardiology department at one hospital.
- Identify factors that impact on the information transfer during the handover process.
- Examine the relationships and dominant forms of communication among care providers from both units during the handover.
- Improve the quality of services provided to the hospital's Cardiology patients.

The contact Information:

Amal Alghamdi

Electronic Business Technologies, MSc candidate
University of Ottawa

Email:
Phone:

Recherche participants pour un projet de recherche intitulé

«GESTION DU PROCESSUS DE TRANSFRT DES PATIENTS en CARDIOLOGIE»

Les participants impliqués dans le processus de transfert des patients de l'unité de cardiologie aux soins à domicile et soins communautaires sont les bienvenus!

La durée des entrevues: De 15 à 30 minutes

Lieu: à l'hôpital Montfort ou par téléphone

L'étude contribuera à:

- Explorer le processus de transfert des patients de l'unité de cardiologie aux soins à domicile et soins communautaires
- Identifier les facteurs qui ont un impact sur le transmission de l'information au cours de processus de transfert.
- Examiner les formes dominantes de la communication et les rapports entre les fournisseurs de soins des deux unités au cours du transfert.
- Améliorer la qualité des services fournis aux patients hospitalisés en cardiologie.

Personne à contacter:

Amal Alghamdi

Technologies des affaires électroniques, Candidate à la M.Sc
Université d'Ottawa
Email:

Téléphone: