

# Describing and analysing process interfaces in healthcare: An Operations Management perspective

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## Abstract

A generic framework is developed to describe and analyse the performance of process interfaces in a healthcare setting. This framework was assessed in an exploratory case study in different interface situations regarding handover of care in regional hospitals. Our study indicates that handover performance is determined by three elements: information, communication, and responsibility and their interaction effects. But also the organizational context, as studied from an Operations Management perspective, seems to be an important determinant for handover performance. Our approach and framework provide a new insight to practitioners and researchers in analysing the handover situation in a healthcare setting.

**Keywords:** healthcare, handover, Operations Management

## Introduction

The healthcare process of many patients consist of complementary care steps, which form a medical supply-chain (Lillrank et al., 2011). Handover of care encompasses the process interface between these care steps and is crucial for the continuity of this healthcare supply-chain. Unfortunately, recent studies show that in up to 40% of the situations errors in the handover process easily lead to medical errors. (Hesselink, 2014; Schoen et al., 2007). Handover of care is becoming even more important due to increasing cooperation between healthcare professionals. This is caused by medical and societal developments like medical (hyper)specialisation, the developing medical technology, shorter hospital stay, and a growing population of elderly people. A population characterized by increasing multi- and comorbidity (Minkman et al., 2009; Meijboom et al., 2011).

The interest in organising healthcare in a more process oriented way in order to improve collaboration among health professionals is increasing. Studies indicate that these improvements lead to a more effective and efficient service offered to the patient (Meijboom et al., 2011). Studies in the field of Operations Management indicate that in order to understand the performance of process interfaces knowledge from different disciplines and viewpoints is required (Croom et al., 2000). However, many studies on medical handover performance apply a mono disciplinary perspective in studying the performance of handover in a healthcare setting (Dobrzykowski et al., 2014; Vries & Huijsman, 2011). It is for this reason why a study was initiated to increase our

understanding on handover performance. This study was started from the notion that describing and analysing process interfaces in a healthcare setting might benefit from an Operations Management perspective.

In this paper handover of care is positioned within the healthcare supply-chain as a process interface function. A definition of handover of care is given. In order to understand handover performance a literature study was performed. A generic framework is derived from this study in order to describe and analyse handover performance. Insights from this literature review were used in an exploratory case study on handover of care in multiple case situations in three hospitals in the Netherlands. The results of this case study are discussed and give a more detailed insight to practitioners and researchers on handover performance.

### **Theoretical background and framework**

In creating a relevant and safe output for a patient almost any healthcare process is a combination and continuation of several care steps. In care processes input is transformed into output by the use of productive resources (Lillrank et al., 2011). Care steps can be defined as events, episodes, processes, pathways, or supply-chains which correspond with different organizational levels (Lillrank et al., 2011). In this way a medical supply-chain, including handover of care, can be described on different levels of aggregation within and between organizations. Handover of care is the interface function at the boundary of care steps at these different organizational levels (Miller, 1970). This corresponds with the supply-chain integration of manufacturing companies at different organizational levels (Vries & Huijsman, 2011; Croom et al., 2000) and positions the interaction and performance of the healthcare supply-chain within the characteristics of Operations Management.

Different elements are important for handover of care. First of all it is about the transfer of professional responsibility for a patient from one professional to another professional (Scott, 2012). It is about the transfer of specific information dealing with the continuity of the healthcare process (Riesenberg et al., 2009) and communication in order to understand transferred information during the handover process (Hesselink et al., 2012). In this paper the next definition of handover of care based upon these elements is used: "Handover of care is the process in which in communication with the patient the acquired information and the responsibility for the continuation and safety of the underlying care process is transferred from one care step to the next care step". According to this definition and insights from literature (Scott, 2012; Riesenberg et al., 2009; Hesselink et al., 2012) three elements are important for handover performance: information, communication, and responsibility. Whereas each of these elements has two dimensions. Information deals with medical and process information. Communication is about the understanding of information by patients and professionals. Whereas responsibility deals with the transfer of professional medical responsibility regarding the safety of the patient from one professional to the next professional and the responsibility for the handover process itself.

With respect to these elements information, communication, and responsibility a literature review has been performed to explore the bodies of knowledge regarding handover performance. More specific hospital discharge, as an example of handover of care, was taken into account during this literature review.

With respect to information it seems that well connected IT systems allow a more efficient and reliable information exchange (Callen et al., 2008; Callen et al., 2010; Gaskin et al., 2012). An example is the use of an IT-medication system during hospital

discharge (Gilbert et al., 2012). But, in other situations Information Technology did not improve information exchange (Callen et al., 2010; Johnson & Cowin, 2013). Other studies indicate that information quality is not just about systems. The involvement of patients and next of kin during information exchange is reported as crucial for information quality (Storm et al., 2014). There is also insufficient knowledge on patient's home situation. This is mainly caused by a bad exchange of patient specific information between hospital and social care (Hesselink et al., 2013). In some, more complex, situations a low intrinsic quality of information in itself was reported which was not transferred in the right way and on the right time (Hesselink et al., 2013).

With respect to handover performance and communication patients do not feel empowered. Not involving patients during handover leads to unmet coordination and information needs of these patients (Hesselink et al., 2012; Søndergaard et al., 2013). One of the reasons is a cognitive artefact at the patient - doctor interaction (Johnson & Cowin, 2013) which leads to a communication gap (Hesselink et al., 2012; Hesselink et al., 2013). A gap which is diminished if a liaison nurse is involved in the hospital discharge process (Buurman et al., 2010; Hesselink et al., 2012; Hesselink et al., 2013). Frequently the lack of respect between medical professionals (Hesselink et al., 2013; Tandjung et al., 2011) is reported. Underestimation of general practitioners by physicians is an example of discouraging relationships.

Unfortunately, there seems to be a lot of uncertainty about procedures, tasks, and responsibilities with respect to the handover process (Asprey et al., 2013; Hesselink et al., 2012). The result is a responsibility gap between doctors, nurses, social care, and general practitioners (Hesselink et al., 2012; Hesselink et al., 2013). This leads to competing interests and a communication and responsibility gap between these professionals (Hesselink et al., 2012).

But, handover performance does not only depend on information, communication, and transfer of responsibility during the handover process itself. Handover performance is also determined by the organizational context (Hesselink et al., 2012) as clearly indicated by additional results from our literature review.

With respect to the handover process standardisation of routines (Storm et al., 2014) and well implemented handover mnemonics and discharge templates (Riesenberg et al., 2009) seem to be important for handover performance. It is also important that different reports and processes on medical and social diagnoses run parallel (Atwal, 2002) during hospital discharge to improve handover performance. This lack of coordination and integration is discussed by different authors. Examples are bad accessibility of care providers and contact persons, shift work structures or weekend discharge disrupting procedures, and low prioritization of discharge consultations (Hesselink et al., 2012). The effect is that important aspects of discharge processes are ignored or neglected (Atwal, 2002) and lead to ineffective discharge procedures (Gaskin et al., 2012), a lack of coordination of care, and non-standardised processes which lead to errors and put patients at risk (Groene et al., 2012). Inpatient care seems to be hospital centric (Johnson & Cowin, 2013) which leads to a fragmented handover organisation during hospital discharge (Groene et al., 2012). Whereas lack of time, different incentives, different quality indicators, and pressure on available hospital beds (Atwal, 2002; Hesselink et al., 2012) seem to determine hospital discharge more directly instead of a safe continuation of care for the patient.

Inter organisational staff meetings and training on transitional care (Storm et al., 2014) are important for knowledge development. But also site visits, a liaison nurse (Buurman et al., 2010), and teach backs (Storm et al., 2014) supported by audit and feedback

(Dinescu et al., 2011) are examples of systems improving organisational knowledge. Unfortunately, also a lack of collaboration between hospital and community workers (Hesselink et al., 2013) is reported, while patient’s role in information transfer is overestimated (Groene et al., 2012).

The handover process, as indicated before (Lillrank et al., 2011), is an integral part of the healthcare supply-chain. Our findings regarding the organizational context of handover performance, as described above, resemble also findings of Operations Management literature regarding supply-chain performance. Knowledge from Operations Management indicate that integration and coordination of primary and planning processes are important for supply-chain performance (de Vries & Huijsman, 2011). Other authors describe also the importance of organisational systems enhancing, capturing, and developing joint knowledge creation (Croom et al., 2000; Harland et al., 2004; Cao et al., 2010; Tsai, 2002). Whereas organisational systems enhancing relationships and social coordination (Croom et al., 2000; Harland et al., 2004) and focus on the integration, sharing, and use of resources and assets (Croom et al., 2000; Harland et al., 2004; Cao et al., 2010) are also important for supply-chain performance.

A generic framework was developed (figure 1). This framework is based upon our findings from the performed literature review on handover performance and knowledge of Operations management literature regarding the supply-chain performance. Our literature review indicates, in line with the definition of handover of care, that three elements are important for handover performance: information (Callen et al., 2008; Callen et al., 2010; Gaskin et al., 2012), communication (Søndergaard et al., 2013; Buurman et al., 2010; Johnson & Cowin, 2013), and responsibility (Asprey et al., 2013; Hesselink et al., 2012). Whereas handover performance is indicated as complete, correct and timely information, checked upon understanding during communication, and clearly addressed responsibility during and after the handover process.

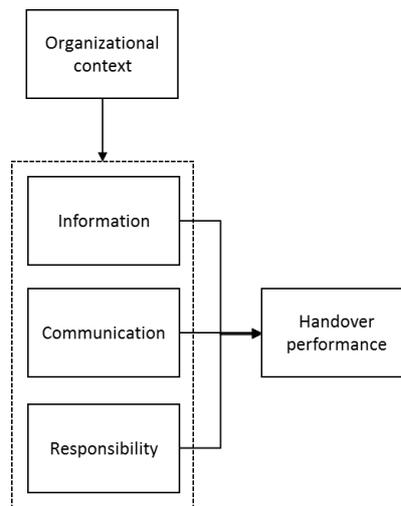


Figure 1: Framework

But information, communication, and responsibility regarding handover performance also depends upon the organizational context. This in line with knowledge from Operations Management regarding supply-chain performance (Vries & Huijsman, 2011; Cao et al., 2010; Croom et al., 2000; Lillrank et al., 2011). Examples of this organizational context regarding handover of care are clear procedures and complete mnemonics (Storm et al., 2014; Riesenber et al., 2009), knowledge creation (Storm et al., 2014; Buurman

et al., 2010), integration of resources (Hesselink et al., 2013; Groene et al., 2012), process continuation (Atwal, 2002), and organizational focus and responsibility for patients safety (Hesselink et al., 2012; Johnson & Cowin, 2013).

These findings support our framework as presented in figure 1. However, it is not clear if this Operations Management approach fully applies to the healthcare supply-chain and handover of care and if there is sufficient scientific support for this approach. In order to asses these findings and our framework in a more detailed way an exploratory case study was performed.

## **Methodology**

Three regional hospitals in the Netherlands were involved in our exploratory case study. In these hospitals the handover during hospital discharge was studied from hospital to social care organizations and primary care in six case situations. The case study was performed by 14 different semi-structured interviews with doctors, nurses and employees from the quality department of each hospital involved in the hospital discharge process. The interviews were recorded, transcribed and coded. By using our generic framework (figure 1) and based upon the findings of our literature review deductive coding was used. At first order information, communication, responsibility, and the organizational context was used for coding. Second order coding was derived from the literature on Operations Management regarding supply-chain performance. Third order codes were derived from our literature review on handover performance at hospital discharge. These third order codes were used in analysing the interviews. Additionally, inductive coding at this third order level was applied. This additional selective coding resulted in axial coding at second order level and was transferred towards first order coding at the level of our framework. Additionally, documentation was studied and different observations were part of our case study.

## **Results**

A short overview of results is given in Table 1. Cases #1, #2, and #3 deal with hospital discharge towards general practitioners. Cases #4, #5, and #6 deal with hospital discharge towards social care organisations.

In our cases it was obvious that information (IT)-systems did not always improve information exchange (Callen et al., 2010; Johnson & Cowin, 2013), especially in complex and multi-morbidity situations. Social care institutions don't always have an IT-system or have an IT-system that is not capable to exchange information between the involved hospital and the social care organization. Handwritten letters, using the patient as a postman, is common in this situation. But this IT-system gap leads also to situations of insufficient knowledge on patient's home or social situation by the hospital to deliver good quality care (Hesselink et al., 2013). Sometimes IT-systems seem to be of low quality: "by the way information is presented it is a wonder if you can understand it". IT-medication systems are in almost any case situation not well connected an insufficient. This situation enhances problems in understanding the medication situation of a patient: "sometimes patients hand over a bag full of little medicine boxes and still you have to guess what they are using".

With respect to communication there is a cognitive artefact at the patient – doctor interaction (Johnson & Cowin, 2013). In some situations a liaison nurse or a warm interaction process (Buurman et al., 2010) enables to overcome this artefact. Timely communication is mentioned as important. Although, different medical disciplines within

Table 1: Results exploratory case study

Case	Information	Communication	Responsibility	Organizational context
#1	<i>Weak:</i> Medical information differs and may last up till 2 weeks after discharge; Medication systems imperfect.	<i>Weak:</i> Patient not involved in medical transfer. <i>Weak:</i> Hospital centric.	<i>Strong:</i> Transfer nurse (social care). <i>Weak:</i> Differs for each Physician for medical transfer.	<i>Strong:</i> Hospital in the lead (accepted?). <i>Weak:</i> Different for each department.
#2	<i>Weak:</i> Medical information differs and may last up till 2 weeks after discharge; Medication systems imperfect; Low quality IT systems.	<i>Strong:</i> Case manager in complex situations. <i>Weak:</i> Depends upon nurse and situation.	<i>Weak:</i> Differs for each Physician for medical transfer.	<i>Strong:</i> Hospital in the lead (accepted!); Handover process starts already during intake. <i>Weak:</i> Different for each department.
#3	<i>Weak:</i> Medical information differs and may last up till 2 weeks after discharge; Medication systems imperfect; IT system insufficient.	<i>Weak:</i> Depends upon nurse and situation.	<i>Weak:</i> Differs for each Physician for medical transfer.	<i>Weak:</i> Different for each department; Lack of procedures.
#4	<i>Weak:</i> Medical information may last up till 2 weeks after discharge; Social information unclear; Medication systems imperfect.	<i>Strong:</i> Starting a network (results unknown); <i>Weak:</i> Hospital centric.	<i>Weak:</i> Differs for each Physician for medical transfer; Not addressed for social care or paramedical care.	<i>Weak:</i> Different for each department; Fragmented between organizations; Problems increase upon complexity (no procedures in those situations).
#5	<i>Weak:</i> Medical information may last up till 2 weeks after discharge; Social information separate letter; Medication systems imperfect; No knowledge of social situation.	<i>Strong:</i> Case manager in complex situations; Network of organizations; Information checked upon understanding. <i>Weak:</i> Sometimes no contact or communication with social care physician.	<i>Weak:</i> Differs for each Physician for medical transfer; Not addressed for social care of paramedical care.	<i>Strong:</i> Hospital in the lead (accepted!); Handover process starts already during intake; Certain amount of standardization. <i>Weak:</i> Different for each department; Problems increase upon complexity.
#6	<i>Weak:</i> Medical information may last up till 2 weeks after discharge; Social information Separate; Medication systems imperfect; IT system insufficient.	<i>Weak:</i> Depends upon nurse and situation.	<i>Weak:</i> Differs for each Physician for medical transfer; Not addressed for social care of paramedical care.	<i>Weak:</i> differs for each Physician for medical transfer; Uncertain or no procedures upon raising complexity.

the hospital have their own communication priorities: “also medical information should be given within 24 hours at hospital discharge, but a lot of physicians have their own way of communication and their own time pace, resulting in even up to two weeks of delay”.

Uncertainties in procedures and responsibilities (Asprey et al., 2013; Hesselink et al., 2012) illustrate the gap between doctors, social care, and general practitioners and lead to competing interests. This is even more urgent in complex and multi-morbidity situations especially when effective feedback regarding responsibilities is lacking: “if, after a handover, the situation is not clear for me, I just go on with my own job or we do the same thing again”.

In our case situations good examples of integration and coordination of primary and planning processes (Vries & Huijsman, 2011) are found like well implemented handover mnemonics and discharge templates (Riesenberg et al., 2009). But, when healthcare situations became more complex, due to multiple interactions between medical and social care as in the situation of multi-morbidity, handover mnemonics seem to be insufficient and misunderstandings occur: “each professional uses his own language, and of course they don’t understand each other”. This results in a fragmented handover interface organization were non standardised procedures or the absence of procedures put patients at risk (Groene et al., 2012). It is also obvious that mnemonics and information systems are multi interpretable. This leads to differentiation, fragmentation and insufficient discharge procedures which occur during weekend discharge or are caused by shift work structures (Hesselink et al., 2012). As mentioned during an interview: “you’ll be better off during daytime as a patient”. But is not only the fragmentation of the handover interface function that is mentioned. A lot of interviewees mention also the organizational fragmentation of the healthcare system within the hospital and between involved healthcare organizations. It is a system in which each professional has its own goal-setting: “a hospital is a market place where everyone shouts for itself”. Illustrative is that questions regarding performance indicators of handover performance or patients’ perception on handover performance could not be answered by any interviewee: “the patient, no idea what his perception is, might be interesting, indeed”. Some interviewees mention a regional network structure between medical, para-medical or social care organizations as an important issue in getting to know each other. Organizational systems focussing on integration sharing and the use of resources and assets (Croom et al., 2000; Harland et al., 2004; Cao et al., 2010) could not be found. Instead, interviewees mention lack of time (Atwal, 2002; Hesselink et al., 2012), high organizational pressure, health professional behaviour, and other incentives being more important while not focussing on handover performance: “as a surgeon I get payed for the number of operations, that is my performance indicator, not the way I send my patient at home”.

## **Discussion**

It was impossible for any hospital involved in our case study to give a straight performance indicator on handover performance. Performance criteria on handover of care were not available. In some situations, an estimation of failures of 20% was given.

In all our cases healthcare is organized in a fragmented way. The negative performance effect of this organizational fragmentation increases when healthcare becomes more complicated, for instance due to multi- or comorbidity or a mixture of medical and social care (Meijboom et al., 2011; Minkman et al., 2009). Whereas in these multi- or comorbidity, and mix situations the involvement and interaction of more and different medical, social, and nursing departments and co-workers within or outside the hospital is essential. Our study indicates, on the contrary, that the medical and social (hyper)specialisation seem to focus practitioners even more on their own individual

professional tasks within their own organizational boundaries. Professionals indicate that they suffer under organizational pressure and organizational incentives and performance indicators. In our case situations practitioners indicate that the experienced organizational pressure leads to a lack of time for the handover process which results in a decreasing information quality or a postponement of information.

In our literature review on handover performance this organizational fragmentation was also indicated as a fragmented handover organization caused by shift work structures, weekend discharge, and non-standardised handover procedures (Asprey et al., 2013; Groene et al., 2012; Hesselink et al., 2012). In fact, a general goal setting for the medical supply-chain as a whole and its outcome is missing.

In our cases handover performance seems to decrease when information is of low quality. Unfortunately, information quality decreases even more in complex situations, suffering from organizational fragmentation. Examples are lack of social information, isolated medication systems, and inadequate functioning IT-systems. Information quality also decreases when information is not checked upon understanding during the communication process. In only one case situation this understanding was checked in about 50% of the situations. Unfortunately, this effect was not measured. These findings are in line with our literature review (Gaskin et al., 2012; Hesselink et al., 2012; Hesselink et al., 2013; Johnson et al., 2013; Storm et al., 2014; Tandjung et al., 2011). When IT-systems are unable to support the handover process this is adjusted by improvisation using other communication systems like telephone, spoken, or written information.

Organizational fragmentation also leads to a communication gap where each professional is focussing on own medical terminology topics and is not aligned with the successor in the medical supply-chain. A network structure as mentioned in our case study as a possible solution, a case manager, or a so-called transitional care bridge are examples of closing this communication gap and alignment between medical and social care (Buurman et al., 2010). Unfortunately, this introduces a new extra handover situation. Organizational fragmentation leads also to responsibility gaps between professionals. These findings are in line with our literature review (Hesselink, et al., 2013; Tandjung et al., 2011).

In this paper a generic framework (figure 1) on handover performance was developed in order to describe and analyse process interfaces in a healthcare setting. Results from a literature review on handover performance indicate that information, communication, and responsibility are important elements in determining handover performance. The organisational context is also important. These findings are supported by insights from Operations Management and, what's more, by the results of our exploratory case study.

Our study indicates, as discussed before, that gaps from within the organisational context lead to gaps in information, communication, and responsibility during the handover process at hospital discharge. But also information gaps lead to communication gaps, whereas communication gaps lead to information gaps and so on. Our study indicates that it are merely these interaction effects between information, communication, responsibility, and organizational context that seem to be important in describing, analysing and understanding handover performance.

Our study has indicated that it is possible, with the use of our framework (figure 1), to describe and analyse handover situations in different case situations at three levels. At the first level handover performance is described and analysed by three elements: information, communication, and responsibility. At a second level handover performance is described and analysed by the interaction effects between these three elements. At a third level it is the organizational context, as described from an Operations Management

perspective, that interacts with information, communication, and responsibility and determines handover performance in this way. Future research on these interaction effects and their mechanism at all three levels should gain further insight in handover performance in similar and other situations. In order to describe, analyse, and improve handover of care as the crucial process interface that supports the continuity within the healthcare supply-chain.

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