

# Process Mapping and RFID: Complementarities

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## INTRODUCTION

Variability is inherent in health care and is a result of many complex interactions between patients and providers, and those among providers. Physician autonomy is one aspect that causes variability. Professionals with autonomy tend to have control over conditions, processes, and procedures (Walter & Lopez, 2008) and this leads to the existence of differentiated process pathways. Providers work in their respective silos and hence are often unaware of how their role in a process relates to others, and how their input impacts the entire process. This lack of awareness can result in decisions that negatively impact the entire process. Also, well intentioned attempts at improvement that lack a systems perspective can lead to sub-optimization (Simons & Moore, 1992).

In an attempt to reduce process variability, hospitals have adopted conventional process mapping techniques. Process maps are best suited for routine linear transformations of homogeneous inputs into standard outputs, found in “factory” environments. However, the value obtained by hospitals using these maps is limited. For non-routine processes exhibited in health care scenarios, process issues cannot be resolved by forcing dynamic disjointed procedures into process maps (Biazzo, 2002). Thus, a significant gap exists between what is mapped and what actually occurs. Radio Frequency Identification (RFID) has the ability to automatically identify and collect data (Fosso Wamba, Lefebvre, Bendavid, & Lefebvre, 2008; E.W.T. Ngai, Poon, Suk, & Ng,

2009; Sellitto, Burgess, & Hawking, 2007; Ting, Kwok, Tsang, & Lee, 2011). The data obtained from RFID can be integrated with existing data to improve the process model. This also reduces the need for manual data collection which is the primary cause for missing and inaccurate data. Such data collection can enable understanding of complex interactions in health care, variability in the process, and support continuous process improvement efforts.

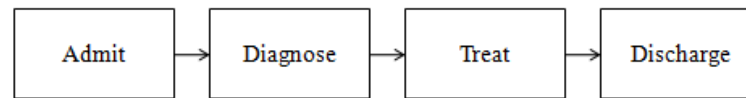
The purpose is to review process mapping and RFID, their applications, benefits and drawbacks. This highlights the complementary nature of process mapping and RFID. Finally, issues relating to adoption of RFID and future research directions are identified.

## BACKGROUND

### Process Mapping

A process map is a visual tool used to document activities needed to achieve a certain outcome. Specifically, a process map illustrates what will be done, who will be doing it, where it will be done, and who depends on it being done (Klotz, Horman, Bi, & Bechtel, 2008). This tool has been widely adopted by improvement practitioners in the public and private sector due to its ability to improve process visibility. Process visibility refers to the ability to see and understand all aspects of a process at any point in time (Klotz, et al., 2008). The degree of visibility is partially dependent

Figure 1. Example of high-level hospital process map



upon the type of process map selected. There are different process mapping methods based on the application – basic flowcharts, value stream maps, SIPOC diagrams, and spaghetti maps. Basic flowcharts provide simple flow of activities, sometimes with the time required for each activity. Value stream maps are used in lean projects and depict the value addition in each activity and show process times, delays, wait times, inventory levels, defects, etc. SIPOC diagrams are used to provide high-level perspective of the process while highlighting Suppliers, Inputs, Process, Outputs and Customers. They are used for six sigma projects. Spaghetti maps are used to illustrate flows and are useful for finding inefficiencies in physical processes and unnecessary handoffs in digital processes. Three most common process map types are: high-level, low-level, and cross functional. A high-level process map provides minimal visibility, because it only shows core processes. Figure 1, illustrates a high-level process map of the core processes performed in a hospital.

Unlike high-level process maps, low-level process maps divide core processes into sub-processes, providing a finer level of detail. Additional symbols are needed to illustrate activities at this visibility level. For instance, decision diamonds are used to distinguish between two different process flow pathways, contingent on whether a condition is met or not. Information storage, data input, and output symbols are also employed. Of the three process map types mentioned, cross functional maps provide the greatest level of visibility. Sub-processes are segmented into cross functional swim lanes assigning responsibility to each activity, decision, document, or data. This segmentation allows for the presentation of steps that make up a process, a key feature of cross

functional maps (Damelio, 1996). Figure 2, illustrates a cross functional map developed by a Lean Team Committee at a large academic hospital in the United States. This process map was used as part of an improvement project to identify value added and non-value added activities.

Based on the purpose and the amount of detail, the three types of process maps have different levels of process visibility, see Table 1. A collaboratively constructed process map using a multidisciplinary team tends to better reflect the actual process. Also, these efforts help stakeholders know their position in relation to others (O'Donnell & O'Donnell, 2008).

### Application of Process Mapping in Healthcare

Process mapping has been used extensively in healthcare, and two examples to improve health care processes are presented here. Lean Six Sigma has been applied to reduce trauma center overcrowding (Parks, Klein, Frankel, & Friese, 2008). The study was performed at a Level I trauma center that had 150,000 ED visits and over 5,000 trauma activations annually. In the define stage, a SIPOC (suppliers, inputs, process, outputs, and customers) chart was used to provide a broad understanding of the process and to develop project boundaries. In the last step of the define stage, a detailed cross functional process map was constructed to visualize the flow of trauma patients from the time of arrival to their discharge. In the data collection phase, a study (n=43) was conducted to measure the delays between each step of the process. Process delays were segmented into two groups: a high performing group (total median delay < 3 hours) and a low performing group (total median delay ≥

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