

Chapter 19

Using Patient Flow to Examine Hospital Operations

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ABSTRACT

Adopting an admission-to-discharge patient flow perspective has the potential to improve hospital operations. Flow paths provide insight regarding patient care needs, support resource allocation and capacity planning decisions, and improve the operational performance of the hospitals. Studying patient flow through systems engineering tools and applications can help decision makers assess and improve care delivery. This chapter presents current research and techniques used to describe, measure, and model inpatient flow. We formally define patient flow from an operational standpoint and discuss why it is crucial for operational decisions. Systems engineering techniques, which describe and analyze inpatient flow, are introduced. The chapter concludes with a discussion of emerging approaches to capture patient flow.

INTRODUCTION

The coordination and allocation of personnel, physical space, and equipment required to meet patient needs is an important problem for hospitals. Unanticipated waits and delays add tremendous cost and can negatively impact outcomes. For this reason, policy makers advocate the study of patient flow for analyzing operational decisions.

(Joint Commission Resources, 2004; Vissers & Beech, 2005)

Compared to sophisticated operations management techniques used in other industries, operations management in hospitals is fairly rudimentary. Most hospitals manage their operations with census snapshot reports along with ad hoc use of multiple data sources to augment their managerial intuition. (Isken, 2002) Since the early 1970s researchers have been advocating a holistic analysis of hospital operations by using a patient

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flow approach. Although research has illustrated that short term operational decision-making can be refined by adopting a this perspective, implementation rates are scant. As of May 2011, there were approximately 700 article citations in PubMed containing the phrase “patient flow”. The vast majority of these studies consider the clinical perspective of patient flow. Of the remaining studies, most take a managerial perspective while a smaller subset considers using patient flow for operational analysis.

The intent of this chapter is to present current research and techniques to describe inpatient flow. The chapter begins with a brief discussion of the advantages of using patient flow and continues with a formal definition of patient flow. Current challenges in measuring patient flow are then presented following by a summary of techniques to describe patient flow. The chapter concludes with an examination of future research areas.

PATIENT FLOW

Patient flow can be described from two perspectives, the clinical and the operational. (Côté, 2000; Marshall et al., 2005) From a clinical point of view, patient flow represents the progression of a patient’s health status. Accordingly, understanding patient flow in a clinical sense offers providers, patients, and hospital administration insight about care needs associated with disease progression or recovery status. (Côté, 2000) On the other hand, from an operational point of view, patient flow can be thought of as the movement of patients through a set of events or locations in a health care facility. (Côté, 2000) In the context of this chapter, we focus on patient flow from the operational perspective. This section formally defines patient flow and illustrates why it is important to use this approach when performing operational analysis.

Definition of Patient Flow

Before discussing systems engineering tools and applications used for patient flow, we provide a formal definition of patient flow. Typically flow patterns are defined from the point where the patient first enters, or is admitted to the hospital, and ends at the point of discharge. Between these two points, there is a set of conditions, activities, services, or locations that the patient may encounter. Within these points, the patient requires a variety of health care resources (e.g. beds, examining rooms, operating rooms, physicians, nurses, and/or medical procedures). (Cote, 2000, Marshall et al., 2005, Kucukyazici et al., 2010) Therefore from an operational standpoint, the term patient flow encompasses the following four elements:

- The set of events during a patient’s stay,
- The precedence/sequence of events,
- The duration of events, and
- The resources required to perform these events.

In this chapter, we use the term model as an ideal analytical description capable of encompassing the four above concepts. It is important to note that not all existing patient flow models address all four areas of patient flow.

Figure 1 is a simple hypothetical illustration of a patient flow from an operational standpoint. Note that the patient’s journey is described in terms of time, resources and events. A patient is registered by a clerk, an event which takes 10 minutes. The patient then waits 45 minutes for a blood draw which requires two resources, a nurse and an exam room (assuming that the materials for drawing blood are negligible). The next event, lab analysis, occurs 200 minutes later and requires a lab technician for 10 minutes. After a 55 minute wait, a physician uses the results from the lab to consult with the patient in an exam room, an event which take 15 minutes. Forty-five minutes later, the patient is discharged, an event which

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