Dedicated vs. General Wards: The impact of scarce capacity on hematology patients

Extended Abstract

Large hospitals provide several levels of care; emergency, critical, inpatient, and outpatient care. Each level of care may be offered in a specialized environment (i.e., dedicated to a certain medical specialty such as cardiology, orthopedics, endocrinology, oncology, or neurology) or a general setting where patients with different diseases are treated. In this article, we investigate the importance of using dedicated capacity and the impact of shortage in such capacity on patient risk (i.e., infections and death). We examine two types of dedicated capacity—inpatient hospitalization beds and specialized emergency services.

The medical specialty we focus on is hematology, which mostly treats cancer of the blood. As one of the most important functions of the blood is to protect the human body against invading microorganisms, these patients are particularly susceptible to infections and, since their general health is impaired, even minor infections may be life-threatening (Halfdanarson et al. 2017, Taccone et al. 2009). The patients are prescribed chemotherapy at regular intervals. These cancer-fighting treatments sadly also damage many healthy blood cells, implying that the patient is even more susceptible to infection right after protocol, and mortality rates are high (Kuderer et al. 2006). Presently, there are no clear guidelines to identify who of the hemato-oncological patients could be treated in the ambulatory setting during post-chemotherapy neutropenia and who should be hospitalized either in a general Internal-Medicine Ward (GW) or a dedicated Hematological Ward (HW). In reality, shortness of dedicated beds and economical restrictions provide an incentive towards minimizing hospital stay. Obviously, patients with active life-threatening infections or other similar conditions must be admitted; however, many centers are re-evaluating their current practice in an attempt to reduce non-essential hospitalizations. For instance, in high-risk situations (e.g., induction therapy for acute leukemia), physicians commonly choose to keep patients in the hospital for observation after the end of chemotherapy protocol until the recovery of white blood cell (WBC) counts to ensure that immediate measures are taken in case of infection development. On the other hand, low-risk patients are observed every few days via outpatient clinic services. The length and location of the observation is left to the doctors’ discretion. Due to the limited bed availability in the HWs, some patients are observed in GWs, or are discharged home early upon completion of chemotherapy.

At multiple medical centers, discharged patients developing fever or other signs of infections at home can obtain emergency care in the Hematology Outpatient Clinic (HOutC) during morning hours on weekdays; in the afternoon, at night, and during weekends, such patients are referred to the General Emergency Department (ED). The well-established importance of rapid diagnostic measures and urgent initiation of
antibiotic therapy in case of early signs of sepsis (Gaieski et al. 2010) and neutropenia (Rosa and Goldani 2014) actually supports a potential beneficial role of an emergency system dedicated to hemato-oncological patients. While such emergency facilities, termed Acute Oncology Service (AOS), are currently being promoted (e.g. Shankland et al. (2012), Bruce et al. (2017)), no large-scale econometric analysis has been conducted yet to investigate their potential effects, and the claimed benefits are supported by descriptive or qualitative evidence only.

The current study was designed to investigate the effects of dedicated healthcare resources, on prevention and treatment of infections in hemato-oncological patients. We examine two types of dedicated resources: hospitalization facilities and emergency facilities. We evaluate the rationale of keeping patients hospitalized for observation upon completion of chemotherapy, and compare the efficacy of a GW and an HW in such situations. Additionally, we compare the outcome of hemato-oncological patients treated for infection in the GW to that of patients whose infection was managed in the dedicated facilities (HW). Lastly, we compare mortality of hemato-oncological patients admitted via general ED to specialized ones (HoutC). We provide investigation of the whole process, as in such a treatment network, the hospital capacity and discharge decision impacts the outpatient clinic and emergency services capacity needed.

Our research relates to recent works in healthcare operations management that use econometrics to link capacity constraints to patient health. That empirical research mostly concentrated on how load impacts hospitalization decisions and health, in the context of ICU services (e.g. Hu et al. (2017), Kim et al. (2015), Kc and Terwiesch (2012), Anderson et al. (2012)), but inspired optimizing models to support operational decisions (Shmueli et al. 2003, Chan et al. 2012). The most relevant here is the work of Chan et al. (2017) who explored how disintegrating level of care in ICU services can be beneficial. For emergency services, there are a few papers showing that delaying patients in EDs increases ICU LOS (Chan et al. 2016) and hospitalization costs in Neurology wards (Samiedaluie et al. 2017). Our paper is different from several perspectives. The most important one, is that it does not look at differences in the level of care within the same domain, but at the (mis)match between physician specialty and patient needs. A hospital consists of multiple specialized units, and when a specific unit is full, the overflowed patients are usually physically occupying beds in a different unit, while they are still under the supervision of the medical experts of the specialized ward. On the one hand, this flexibility in capacity allocation enables higher utilization of hospital beds, but on the other hand, the availability of physicians to the misallocated patients is lower.

The second difference, is in the domain we explore. To the best of our knowledge, this is the first work to obtain, explore, and analyze a detailed longitudinal dataset of hematology patients. Our data allows us to control for changes in patient health over time, both from one visit to the hospital to another, and within each hospital stay; both have important implications for routing and discharge decisions.

Our research reveals that both infection and mortality hazard rates are non-monotone over time, and are influenced by the location of the patient (at home, or in a dedicated/non-dedicated emergency service or inpatient ward). The pattern by which the hazard rate changes over time is disease-specific.
References


