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A framework to analyze hospital-wide patient flow logistics: Evidence from an Italian comparative study

Stefano Villa[a,b,*], Anna Prenestini[c,d], Isabella Giusepi[c]

[a] Department of Management, Catholic University, Rome, Italy
[b] CERISMAS, Research Centre in Health Care Management, Catholic University, Milano, Italy
[c] CERGAS, Center for Research on Health and Social Care Management, Bocconi University, Milano, Italy
[d] SDA Bocconi, School of Management, Via Roentgen, 1, 20136 Milano, Italy

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ABSTRACT

Through a comparative study of six Italian hospitals, the paper develops and tests a framework to analyze hospital-wide patient flow performance.

The framework adopts a system-wide approach to patient flow management and is structured around three different levels: (1) the hospital, (2) the pipelines (possible patient journeys within the hospital) and (3) the production units (physical spaces, such as operating rooms, where service delivery takes places).

The focus groups and the data analysis conducted within the study support that the model is a useful tool to investigate hospital-wide implications of patient flows.

The paper provides also evidence about the causes of hospital patient flow problems. Particularly, while shortage of capacity does not seem to be a relevant driver, our data shows that patient flow variability caused by inadequate allocation of capacity does represent a key problem. Results also show that the lack of coordination between different pipelines and production units is critical. Finally, the problem of overlapping between elective and unscheduled cases can be solved by setting aside a certain level of capacity for unexpected peaks.

1. Introduction

In the last years, practitioners and academics have been increasingly paying attention to the control of hospital patient flow logistics. The purpose of patient flow logistics is to optimize the management of patient flows through the various hospital production units (such as the emergency department, operating rooms, hospital beds or outpatient clinics) from the patient's arrival at the hospital to their discharge and first follow-up [1–3].

Using empirical studies, several authors [1,4–11] have reported that failure to manage patient flows is the origin of several typical hospital problems. These issues include: (i) queues and delays, (ii) under- and over-capacity utilization, (iii) variability of workload and stress for hospital personnel, (iv) errors and (v) placement of patients in inappropriate settings.

The current trend of developing hospital models that are organized around processes and patients – to improve the efficiency and quality of care provided – also makes patient flow management a relevant issue. In fact, if the goal is to overcome the traditional hospital model structured around clinical specialties, good management of patient flow throughout the new multidisciplinary hospital production settings becomes critical [3,5,12–16].

Despite this growing interest toward patient flow management, scientific studies have not yet developed a

* Corresponding author at: Catholic University, Department of Management, Largo F. Vito 1, 00168 Rome, Italy. Tel.: +39 339/1234.643.
E-mail addresses: stefano.villa@unicatt.it (S. Villa), anna.prenestini@unibocconi.it (A. Prenestini), isabella.giusepi@unibocconi.it (I. Giusepi).

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thorough and system-wide framework to measure overall hospital patient flow performance. The creation of such a model is necessary in order to (i) compare the performance of different hospitals and (ii) identify the root causes of hospital patient flow problems.

In order to fill this gap, this paper (i) presents a model to measure hospital patient flow performance and (ii) uses the model to test some explanations about the causes of hospital patient flow problems found in scientific literature.

In order to meet this twofold goal, we adopted a comparative case method approach which is extensively explained in Part 2. Part 3 presents a summary of main findings from the scientific literature to position our contribute and to identify the requirements for our model. The model is presented in Part 4, while Part 5 provides the results of the test of the model to the hospitals included in the study. The last section is dedicated to outlining the implications of the results for managers, policy makers and researchers.

2. Research goals and methods

As stated above, the main goal of the study is to develop and test an analytical framework to measure the performance of hospital patient flow logistics.

The one-year long research design was characterized by three different steps as summarized in Box 1.

The first step of the research protocol was an extensive literature review. Specifically, we carried out a literature review on MEDLINE, BSC, CILEA and EMERALD using different combinations of the following keywords: patient flow, logistics, operations management, hospital and health care.

This first step was finalized to check the state of the art of the scientific debate on this issue and identify the most relevant patient flow dimensions to start building a comprehensive and sound framework to measure hospital-wide patient flow logistics performance.

In this sense, the literature review helped the authors to frame a first theoretical model that was then necessary to test and validate through a sound research protocol.

Given this guiding research question and the lack of studies, a comparative case method approach was judged the most appropriate [17,18] in order to gain a deep insight into patient-flow issues and develop a coherent and useful theoretical model. We eventually selected an overall number of six cases, a sample size that turned out to be appropriate for reaching a certain level of theoretical saturation [19] in order to have enough material to develop the model and test in real settings.

Cases were chosen for theoretical, and not statistical, reasons [20]. To be included in the study, hospitals needed to meet three inclusion criteria [18]. First, it was necessary to select cases where patient flow logistics was central in the organizational strategy. The hospitals included in the study are the first movers on these issues in Italy; they inserted patient flow logistics as a priority in their strategic plans and, thereafter, they are involved in a series of relevant improvement projects. Second, hospitals had to have already in place a system to collect patient flow data and such data were (or were planned) to be publicly available. Finally, hospitals needed to be willing to identify four representatives, particularly: a physician working as part of the staff to the Chief Medical Officer, a nurse manager, a practicing physician and a controller or operations manager. These four representatives were required to have direct responsibility over hospital patient flow management and willing to dedicate time to the project by supporting the team in the data analysis and participating in different focus groups.

The second phase of the research (see Box 1) was characterized by a series of focus groups (six overall in one-year period) with all the representatives from each of the six hospitals. This second stage of the research protocol was aimed at two major objectives. The first was to validate the theoretical model. The dimensions that emerged from the literature review were discussed through an iterative process conducted using the Delphi methodology and Likert scale surveys from 0 to 5 to assess the relevance of the different dimensions identified in the scientific literature [21][1].

The second objective was to define indicators and tools to support the application of the model.

With the help of the focus groups, we identified the final set of indicators to include in the model, selected the qualitative tools to investigate the different hospital patient flows, and developed a standardized data collection protocol.

It is worth noting that at the end of this iterative process, all the participants confirmed the validity and appropriateness of the model to perform a comprehensive appraisal of hospital-wide patient flow logistics.

The third and last step of the project was aimed at: (i) testing the appropriateness of the model and (ii) verifying, with empirical data, the most relevant explanations (found in the scientific literature) about patient flow problems.

In order to test the appropriateness of the model we first mapped, at each hospital site, the most relevant hospital patient flows using the qualitative tools identified during the focus groups, particularly we used an activity- and actor-oriented flow chart and ISO (International Standard Organization) symbols. Then, using a standardized data collection protocol, we computed, for all the hospitals included in the study, the various indicators emerged from the focus groups.

For all six hospitals, we analyzed approximately one year of data (from January 15, 2009, to December 15, 2009) comprising 335 observations. We omitted the observations from the beginning and the end of the year to exclude those patients whose hospital stays had overlapped two separate years.

3. Literature review

A review of the scientific literature shows there are two different types of studies that have approached the issue of

[1] In order to identify the most relevant dimensions to be included in the framework we used the hospital representatives (four for each case study) as a practice expert panel. Particularly, we asked to evaluate, on a Likert scale from 0 to 5, the relevance and frequency of about 20 different sources of patient flows problems and to discuss these results.