

# **Behaviors in Healthcare: the study of patient satisfaction in Emergency Department**

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## **Abstract**

The human behaviors, although important in all Operations Management sectors, play a highly relevant role in healthcare, where the human factors are predominantly involved. Leveraging the novelty and potential of the wearable sensor approach, this research aims to identify and evaluate the main behavioral factors affecting patient satisfaction in the Emergency Department (ED), with the final goal of supporting the ED service (re-)design in a holistic perspective. 42 patients and 112 practitioners in an Italian emergency department were monitored using Sociometric badges. Results show that patient satisfaction is greatly influenced by the behaviors and interactions of medical teams.

**Keywords:** Behavioral Operations Management, Wearable sensors, Healthcare Management

## **Introduction**

Behavioral Operations Management investigates behavioral issues in Operations Management (OM), on the ground that almost all organizations, as socio-technical systems, contain “people” (Loch and Wu, 2007; Croson et al., 2013; Schorsch et al., 2017). The accuracy of OM theories and the success of related tools/techniques heavily depend on the understanding of human behaviors (Gino and Pisano, 2008; Bendoly et al., 2010; Bendoly et al., 2006). Therefore, behavioral operations start from the study of

people's (employees, managers, customers, and, in general, all stakeholders) behaviors at micro-level in order to permit operations management to make better recommendations of how to design/improve processes, management practices, organizations, and supply chains (Croson et al., 2013; Katsikopoulos and Gigerenzer, 2013; Schorsch et al., 2017).

The human behaviors, although important in all OM sectors (Bendoly et al., 2010; Loch and Wu, 2007), play a more relevant role in many service domains, e.g. healthcare, where the human factors are predominantly involved (Cook et al., 2002; Fitzsimmons et al., 2008; Bendoly et al., 2015).

However, although human behaviors are recognized as central for effective design and management of healthcare services (Fitzsimmons et al., 2008; Brailsford and Schmidt, 2003), relatively little attention has been paid to quantitatively assess behavioral aspects in healthcare operations and generally in service OM (Croson et al., 2013). Individual and team behaviors produce significant "inputs" for many healthcare processes with a relevant impact on patient care, patient satisfaction, and efficiency (Brailsford and Schmidt, 2003; Manser, 2009; Di Ciccio et al., 2015). Therefore, the effect of human (individual or group) behaviors on OM models and on their related outcomes emerges as a serious limitation that should be overcome.

Difficulties in quantitatively analyzing behavioral factors in the real operation environments are a probable cause for the poor consideration of such elements in the OM context. Indeed, studies of behavioral operations are often conducted through "laboratory experiments" rather than with investigations in the real context (Croson et al., 2013; Katok, 2011; Fügner et al., 2017). In addition, the data collection, in both simulated and real environments, is usually conducted by interviews, direct observations, questionnaires, and reports rather than by quantitatively measuring the actual behaviors. As a consequence, data collection is commonly carried out in a batch way suffering from subjectivity, memory effect, and observer's influence on the system, which implies a lower data quality and trustworthiness (Olguín et al., 2009a; Kim et al., 2012).

Nevertheless, innovative data-driven approaches - e.g. based on wearable sensors - may offer a possibility for overcoming these limits. Enabling automatic and objective measurements of human behaviors, these tools do not need the presence of observers and collect data in real time, increasing data richness and reliability and simplifying the analysis of real operation contexts (Olguín et al., 2009a; Croson et al., 2013; Kim et al., 2012).

Leveraging the novelty and potential of the wearable sensor approach, this research aims to identify and evaluate the main behavioral factors affecting patient satisfaction in the Emergency Department (ED), with the final goal of supporting the ED service (re-)design in a holistic perspective. Specifically, using the Sociometric Badges, this exploratory study quantitatively investigates the influence of ED medical team behaviors on the patients' satisfaction and the perceived service performance.

In so doing, this work tries to provide researchers and practitioners with new directions for supporting the ED service (re-)design in a more holistic perspective, effectively modeling individual and team behaviors in the ED systems,

## **Theoretical background**

Patient satisfaction can be defined as subjective patient perception deriving from matching the services received and expectations regarding the service process and related outcome (Ross et al., 1987; Jain et al., 2017). Although the improvement of the

patient's health is at the core of any healthcare service, the relationship among patient and practitioners also contributes to the service value and might strongly influence the customer perception of the service performance itself (Ware et al., 1983; Boquiren et al., 2015). Indeed, not always a good medical result leads patient satisfaction as well as poor medical outcome might not correspond to a complete patient dissatisfaction. The relationship between patient and practitioners is recognized as an important component of patient satisfaction (Sitzia and Wood, 1997; Boquiren et al., 2015), investigating connections between technical and non-technical service performance is still an open issue which has only been addressed by a few researchers quantitatively.

Unquestionably, patient-practitioners relationships are multifaceted, subjective and hard to analyze in a systematic way. Social interactions, leadership, coordination and collaboration attitude, completeness and consistency of the information exchange, courtesy are just some of the many constituent variables which are at the basis of such a construct (LaVela and Gallan, 2014; Boquiren et al., 2015). Most of these factors may be identified, at least partially, through unconscious social “honest” signals (Pentland, 2008) in verbal and particularly non-verbal communication during teamwork and individual/group interactions with patients which are typical of healthcare service operations.

In fact, verbal communication in medical care is the fundamental instrument by which the doctor-patient relationship is crafted and by which therapeutic goals are achieved (Detmar et al., 2002; Roter and Hall, 2006; Dong et al., 2014). Doctors need information to establish the right diagnosis and treatment plan. Patients need to know and understand what the matter is and to feel known and understood by doctors (Ong et al., 1995). Both the doctors and patients alternate between information-giving and information-seeking phases. The way and the mood in which information is transmitted to the patient, the time devotes to explain and inform him, and simplicity in interactions affect the awareness degree of patient about his health condition and the satisfaction for medical care services (Ong et al., 1995; Boquiren et al., 2015). Therefore, communication is recognized also as an important element for creating good interpersonal relationship and increasing patient satisfaction (Finney Rutten et al., 2015).

As well as verbal communication, non-verbal behaviors highly affect the relationship between patient and practitioners and, in its turn, the patient perception of care services (Bensing, 1991; Trout et al., 2000; Robinson, 2006). Non-verbal behaviors refer to communicative actions distinct from speech, such as facial expressions, gesturing, body posture, physical distance (proximity), and positioning. Patients are very sensitive to such behaviors that convey the emotional tone of interpersonal interaction (Robinson, 2006), in particular in an Emergency Department where patients and relatives feel more strong emotions such as fear, anxiety, and uncertainty (Trout et al., 2000; Chang et al., 2016). Larsen and Smith (1981), for example, investigated the relationship between doctors' non-verbal activities and patient satisfaction discovering that the higher closeness in interactions was, the higher was patient satisfaction. Similarly, Beck and colleagues (2002) also confirmed that some nonverbal behaviors like head nodding, leaning forward, direct body orientation, and gaze positively associated with service perception, while Boissy and colleagues (2016) proved that training courses on communication skills (verbal and non-verbal) for physicians might improve patient satisfaction.

Up to date, although many hospitals and policy makers are interested to measure and maximize patient satisfaction (Welch, 2010), only a few few studies quantitatively analyze the relationship between practitioners-patient behaviors and patient satisfaction

in healthcare service and specifically in EDs. Main challenges are still related to systematically measure individual and team behaviors in such dynamic environments (Mazzocco et al., 2009; Kim et al., 2012; Rosen et al., 2014). Towards this purpose, this paper proposes a novel approach for evaluating the main behavioral variables (verbal and non-verbal) trying to overcome the limits of past methods in this field.

### **Objective and methodology**

This research aims to investigate the influence of ED medical team behaviors on the overall patient satisfaction and the perceived service performance, in order to provide new directions for supporting the ED service (re-)design in a more holistic perspective.

For an effective evaluation of such relationships, a novel systematic measurement approach powered by the Sociometric Badges is adopted to obtain quantitative and reliable measures of ED team behaviors during the service operation. Indeed, traditional approaches to behavioral studies, like interviews, direct observations, questionnaires and reports, usually suffer of various biases such as subjectivity, memory effects, influence of the observer on the system (Cunningham et al., 2012; Kim et al., 2012; Pronin, 2007) that may be overtaken thanks to this innovative approach.

Sociometric Badges are sensor-based measurement tools able to automatically and directly measure individual and collective behaviors, exploiting four different sensors: accelerometer, microphones, Bluetooth, and IRDA (Olguín et al., 2009a). In this way, these tools can collect quantitative behavioral measures impossible to gather with surveys/interviews, while still guarantying privacy. Particularly, it is impossible to determine the content of the conversation or to identify the speaker from the sociometric data (Olguín et al., 2009a). They are also less intrusive than a human observer limiting any social distortions to the data and potentially enriching the data collected (Olguín et al., 2009a; Rosen et al. 2014). The suitability and usefulness of Sociometric Badges for monitoring behavioral variables is proven by past research (Kim et al., 2012), also in the healthcare field (e.g. Olguín et al., 2009b; Bucuvalas et al., 2014).

Given the lack of research evaluating the relationship between the behaviors of ED teams and their performance and the novelty of the measurement approach, an exploratory case study (Yin, 2017) was carried out for this preliminary investigation.

The case study was structured in the following three main phases:

- Research setup. The Emergency Department under examination was observed in order to define the research protocol for conducting the study with the Sociometric Badges. The preliminary ED investigation outlined all features related to the service, such as the department layout and physical distribution of medical staff in the ED, the tasks assigned to each practitioner and their interactions with the patient, how patients access to the service, and finally, patient process paths in the ED. Starting from this information, the research was designed. Specifically, all the relevant aspects for the data collection phase were delineated, as for example settings of Sociometric Badges, the medical staff involved in the evaluation, the sociometric variables to be recorded, the survey measures for the perceived performances to be included in the questionnaires, the control variables, etc..
- Data collection. In this phase, all the necessary data for the study was collected, following the protocol previously defined. The data collected was pre-processed with appropriate software (e.g. Sociometric Data Lab Software) for checking correctness and for preparing it for the subsequent analyses. In addition, incorrect or incomplete data was removed.

- Data analysis. Correlation and regression analysis was carried out. The correlation analysis allowed identifying relationships between the behavioral variables, measured with Sociometric Badges, and the outcome in term of patient satisfaction and perceived patient care. Moreover, this analysis permit to evaluate potential correlations amongst the control variables and the dependent variables. Regression analysis created models to partially explain the outcome variances with sociometric variables. In this way, it measured the effects of the behavioral variables on the patient satisfaction and patient care. Regression analysis using the control variables also allowed to exclude their significant influence on the outcomes and confirmed the relationships discovered.

Finally, experts and medical staff discussed about the achieved results and the related implications from a managerial viewpoint.

### **Case Study**

The research was conducted in Italian Emergency Department from October 2016 to February 2017. ED teams composed by a minimum of two practitioners (one doctor and one nurse) to a maximum of four (one doctor, one nurse, one specializing doctor and/or one trainee nurse) were continuously monitored during the service. Data collection involved patients with all emergency classification except for red codes (life-threatening, immediate access to care).

For each case investigated, behaviors of the ED team and of the patient were monitored using the Sociometric Badges. Team members and the patient wore the tool for the entire duration of the patient's stay. Exploiting the data recorded by Sociometric Badges, a series of behavioral variables were defined such as body movement, posture activity, speaking activity, proximity interaction, speaking network, and the level of audio.

A questionnaire (anonymous) regarding the perception and satisfaction of the service received was submitted to the patient, at the end of his/her stay in the ED. Three "patient perception" variables were extracted from this questionnaire: overall satisfaction, the perceived care effectiveness, and team responsiveness. In case the patient could not complete the questionnaire, a family member, who remained in the room during the treatments, could fill it out.

In addition, patient data was recorded in order to achieve the appropriate control variables for excluding potential influences from specific episode characteristics. Specifically, the monitored control variables were: overall length of stay in the emergency department, recording time of Sociometric Badges, Patient sex, Patient age, team members' number, and emergency severity (severity color classification).

After discarding incorrect registrations, the final dataset consisted of 42 episodes (patients) with 112 medical staff distinct recordings for a total of about 210 monitoring hours.

### **Findings**

To explore the potential relationship between behavioral (sociometric) variables and patient perceptions, "Pearson's correlation" was calculated. It was useful for getting a first insight of the data and supporting the next phases of regression analysis. The significant correlations obtained were quite numerous and, for reason of brevity, are not reported here. However, it is noteworthy to point out that there are no significant correlations between the control variables and patient perception variables.

To understand if there is a cause-effect relationship among behavioral (sociometric) variables and patient perceptions, regression analysis was carried out. Variables

recorded by the Sociometric Badges were taken as independent variables, while the *overall patient satisfaction*, the *perceived care effectiveness*, and the *perceived team responsiveness* were individually introduced in the regression models as dependent variables. Thereby, three significant regression models were identified, one for each dependent variable.

Here the findings related to the three regression models are briefly discussed:

*Overall patient satisfaction* appears positively influenced by a continuous attendance of doctors in the emergency room (low doctor's movement) and by the presence of a leader in the communication network (i.e. a dominant figures in the team speaking network). This evidence confers value to doctor attendance during the ED service delivery and to the presence of a communication leader within the ED team.

*Perceived care effectiveness* appears positively influenced by two additional factors over the previous ones: patient listening, i.e. time devoted by medical staff listening the patient (patient's speeches); and patient monitoring, i.e. a frequent check of patient's health conditions by the nurse (high nurse's activity). Coherently with previous evidence about the importance of patient centrality, findings confirm the patient expectations to be actively involved into the communication to express his/her own ideas and doubts to practitioners and appreciating the constant monitoring of his/her illnesses.

*Perceived team responsiveness* appears influenced positively by continuous attendance of doctors in the emergency room (low doctor's movement) and negatively by speech overlapping between the doctor and other people (low doctor's speech overlap). Again, this evidence enforces the importance of organized communication patterns among team members to achieve completeness and consistency of the information exchange, which is often associated with leadership, coordination, and collaboration attitudes (Boquiren et al., 2015).

In order to confirm the validity of findings, regressive models using the control variables were tested. The first check was to add the control variables, individually and together, to the regression models obtained. In any case, model performances did not considerably improve and the inserted control variables were non-significant. The second test was to build the model simply using control variables. Also in this case, no model built with the control variables was significant. These tests appear as a strong confirmation for the soundness of our findings, excluding any potential effect of the control variables.

In addition, it is interesting to note that, despite expectations, the overall throughput time (a control variable) seems not to influence the patient's judgment in the investigated setting.

## **Conclusions**

This study contributes to the stream of literature in Behavioral Operations Management supporting the development of behavioral models in healthcare domain by quantitatively exploring behavioral factors affecting patient satisfaction in the Emergency Department (ED), with the final aim of providing managers with effective service design and improvement indications. Indeed, healthcare organizations are largely composed of people, thus excluding behaviors from the study of this context means to renounce to a holistic, effective, and factual investigation of healthcare systems.

In line with previous literature (e.g., Sitzia and Wood, 1997; Boquiren et al., 2015), results confirm that practitioner (team) behaviors may highly affect patient satisfaction, which is one of the most relevant indicators monitored by national authorities in

healthcare domain. Specifically, as revealed by regressive models, patient evaluations seem to be influenced predominantly by numerous behavioral dynamics which can be associated with service attendance, risk aversion, social interactions, leadership, coordination and collaboration attitude, completeness and consistency of the information exchange in the communication networks (LaVela and Gallan, 2014; Boquiren et al., 2015). As shown in the findings section, patient satisfaction is highly influenced by the time devoted to him/her: the presence of the doctor near the patient and the level of interactions (communication) with the staff seem to have a strong impact on the perceived satisfaction and perceived care effectiveness. Moreover, patients also perceive how the team interacts and coordinates itself, favoring teams with a distributed and collaborative dialogue. Finally, the patients' judgment seems surprisingly not affected by the overall throughput time.

From a methodological perspective, the proposed data-driven approach may be applied also in other service settings, helping researchers to systematically discover and quantitative evaluate the behavioral elements affecting the service delivery and finally support the service (re-)design in complex socio-technical context. Thus, this research also provides a contribution to the problem of "how" quantitatively investigate behavioral aspects in OM field (Croson et al., 2013; Brocklesby, 2016).

#### *Managerial implications*

This study also provides a relevant contribution from a managerial perspective. The highlighted findings may offer to hospital managers relevant managerial indications for improving patient service satisfaction/perception, based on real data-driven analyses. Specifically, the findings suggest that doctors should remain physically close to the patients (possibly in eye contact range) and assume the role of communication leader assuring completeness and consistency of the information exchange within the ED team and between team members and the patients, but they should avoid to speak over other people. Moreover, all the ED team members should pay attention to the patient centrality during the service delivery by frequently monitoring the patients' health conditions and by actively involving the patient into the conversation about his/her illness and, thus, permitting him/her to express his/her own ideas and doubts.

Although it is challenging to control for all the determinants of such behaviors, these indications may support health managers during the service (re-)design phase and may be useful for training ED staff about leadership, coordination, and collaboration skills (Boquiren et al., 2015). For example, the layout could be re-designed for increasing the proximity of the doctor to the patients, placing the ED doctor desk near to the beds of current ED patients and with the possibility for them to see him continuously, or ED teams configuration may be modified in order to avoid team dispersion during the service delivery.

#### *Limitations and suggestions for future research*

This research has several limitations that point out directions for future research. The first is due to the exploratory nature of the work. Drawing on a single case study, results might be affected by the particular context. This is a common issue for many behavioral studies that limit generalization (Tröster et al., 2014). Besides, although findings are statistically significant, the sample size is quite limited. An extension of the sample in terms of number of investigated patients, teams, time window, and also possible replication to other EDs, other healthcare service setting or to completely different service contexts would be valuable.

Moreover, as the number of monitored variables and related indicators is high, the study is clearly not conclusive. Other significant, and perhaps more relevant, metrics describing behavioral dynamics of ED teams probably exist and might not be caught by sociometric measures.

Finally, as a suggestion for future development, it would be interesting to investigate behavioral variables more deeply to understand how results are affected by ED team behaviors and properly characterize the relationship among behavioral variables and performance.

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