

Hospital logistics: an effective tool in improving the quality of care

Youness Frichi, Fouad Jawab, Said Boutahari, Karim Zehmed, Imane Moufad, Kawtar Akoudad, Nassima Laaraj

Laboratory of Manufacturing, Energy and Sustainable Development
Sidi Mohamed Ben Abdellah University
Fez, Morocco

youness.frichi@usmba.ac.ma, fouad.jawab@usmba.ac.ma, boutahari@yahoo.fr,
karim.zehmed@usmba.ac.ma, imane.moufad@gmail.com, kawtar.akoudad1988@gmail.com,
nassima.laaraj1@usmba.ac.ma

Abstract

The main objective of this paper is to highlight the potential of hospital logistics for improving the quality of care. In this perspective, we have apprehended the quality of care in three main dimensions: patient satisfaction, care providers' satisfaction and the compliance with care standards established by the WHO. The literature relating to these dimensions shows that the areas of hospital logistics interferes with the determinants of satisfaction as well as the care quality standards. This led us to conclude that improving the quality of care depends on the efficiency of the logistics activities within hospitals. The methodology adopted was based on the synthesis of articles and scientific reports dealing with the following topics: *quality of care, patients' satisfaction, satisfaction of caregivers, hospital logistics*.

1. Introduction

Healthcare institutions are subject to changes in their social, economic and regulatory environments, which force them to improve the quality of care. In this context, they need to meet a set of requirements including those relating to satisfaction (patient satisfaction and care provider's satisfaction) and to comply with international standards of quality of care. Understanding of the concept of quality of care, the variables influencing patient satisfaction and variables affecting healthcare professionals' satisfaction and also standards of quality of care, is needed to improve the quality of care.

Although many factors may contribute to the satisfaction of patients and providers, it is important to identify those factors that have the potential to be systematically improved within healthcare facilities and could have tremendous implications for quality of care. The same for quality care standards that constitute references to ensure good quality.

In order to provide high quality, Healthcare institutions may adopt a variety of approaches including the optimization of their logistics, that has been considered, by several authors, as one of the efficient ways to improve the quality of care (Bourgeon *et al.*, 2001; Kriegel *et al.*, 2013; Costin, 2010). This article establishes the link between hospital logistics and quality of care, and examines how strong is the impact of an effective logistics on the delivery of a high quality. It is beyond the scope of this paper to cover all aspects of quality of care. Instead, interest will be given to the field of hospital logistics as a tool of quality improvement.

The remainder of the paper is organized as follows. The next section present the research methodology followed to treat the subject, section 3 tends to address the issue of quality from three dimensions: patient satisfaction, healthcare providers' satisfaction and compliance with relevant WHO standards. It provides a brief review of the literature and a synthesis of patient and providers' satisfaction factors, and a list of standards of quality of care relating to logistics areas. Section 4 is devoted to understanding the role of hospital logistics in improving the quality of care.

2. Methods

The approach adopted to deal with quality of care was based on the exploration of three dimensions: patient satisfaction, healthcare providers' satisfaction and standards of quality of care. The two first dimensions were studied to identify factors that are important for patient and care providers and influencing their satisfaction. This

was based on a synthesis of studies and surveys conducted in various countries and care departments on different categories of patients and healthcare providers. The third dimension was focused on WHO standards of quality of care; however the research was limited with standards relating to the logistics. In the second part of this paper the focus was on hospital logistics and its impact on the quality of care.

The followed methodology is based on a concise analysis of articles dealing with the following topics: *patient satisfaction, healthcare providers' satisfaction, quality of care, hospital logistics* available on *ScienceDirect, Springer, Scopus, Cairn, PubMed, Google Scholar*, also the WHO website has been of an ultimate use in the research of standards. Inclusion criteria were as follow: (i) diversity: articles from different countries and reporting various health care services, (ii) recency: the most recent articles were favored, generally published between 2000 and 2017, (iii) relevance: articles directly related to the purpose of our research. In total more than seventy articles and reports were selected for this paper.

3. Quality of care

3.1. Definition

The concept of quality of care has been the subject of specific definitions in the literature, however there is no consensus on a standardized definition. The WHO¹ definition of quality is, *the extent to which health care services provided to individuals and patient populations improve desired health outcomes. In order to achieve this, health care must be safe, effective, timely, efficient, equitable and people-centred* (WHO, 2017). The IOM² study committee has defined the quality of care as *the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge* (Lohr and Schroeder, 1990). Quality in healthcare is a multifaceted concept, it has been described and associated with numerous dimensions including: safety, effectiveness, patient-centeredness, timeliness, equity, efficiency, accessibility, etc.(Institute of Medicine, 2001; OMS, 2006; Kelley and Hurst, 2006).

3.2. Evaluation of quality of care

The key tasks for quality assessment and measurement is to quantify the gap between reality and expectations in reference to certain standards and guidelines (Akachi and Kruk, 2017), this will reveal the weak links on which improvement efforts should be concentrated. Morel (2012) has highlighted two approaches to assessing the quality of care: 1) *Real quality*, which assesses the technical aspects of care, procedures and processes of care. This approach is based on science data, protocols, recommendations and care plans. 2) *Quality perceived* by the patient and his family, it is based on the feelings of the patient, and is related to both the quality of the service and the relational quality of the person providing the care. As a result, we distinguish quality with respect to patient satisfaction and the quality of compliance with standards.

a) Patient satisfaction

Patient satisfaction has been defined as an evaluation that reflects the perceived differences between expectations of the patient to what is actually received during the process of care (Mohd and Chakravarty, 2014). The importance of patient opinion is recognized and enforced in many countries. In France and Germany measuring patient satisfaction has been a regulatory obligation for hospitals (Perruche, Pourriat and Claessens, 2008; Schoenfelder, Klewer and Kugler, 2011). In Algeria, user representatives are members of the boards of directors of university hospitals (Chougrani and Ouhadji, 2014) and in Switzerland, patients form associations to defend their rights and interests (Garnerin *et al.*, 2001).

Patient satisfaction is an essential element in the evaluation of the quality of care (Más *et al.*, 2016). Therefore, identifying key factors of patient satisfaction is crucial for health facilities in order to guide their improvement efforts. Several studies and surveys have been conducted to identify patient satisfaction factors. Through a literature review we synthesis these factors in the *table 1*.

¹ World Health Organization

² Institute of Medicine

Table 1. Factors affecting patient satisfaction

Factors	References
Waiting time	(Waters <i>et al.</i> , 2016) - (Bleustein <i>et al.</i> , 2014) - (Kasouati <i>et al.</i> , 2015) - (Lerebours <i>et al.</i> , 2015)
Consulting time	(Howie <i>et al.</i> , 1991) - (Ko <i>et al.</i> , 2009) - (Gaujal <i>et al.</i> , 2016)
Interpersonal aspects : relationship, information, trust, confidence, privacy, etc.	(Bouaiti <i>et al.</i> , 2016) - (Waters <i>et al.</i> , 2016) - (Kapoor, 2014) - (Tennakoon and de Zoysa, 2014)
Pain management	(Kasouati <i>et al.</i> , 2015) (Ko <i>et al.</i> , 2009)
Logistics conditions : accommodations, catering, Cleanliness, hygiene	(Chougrani and Ouhadji, 2014) - (Chang and Chang, 2013) - (Gerbaud <i>et al.</i> , 2002)
Administrative procedures	(Amazian <i>et al.</i> , 2013) - (Canoui-poitaine <i>et al.</i> , 2008)
Patients expectations	(Waters <i>et al.</i> , 2016)
Previous visits	(Bleustein <i>et al.</i> , 2014)
Accessibility	(Delanian Halsdorfer <i>et al.</i> , 2011) - (Mohd and Chakravarty, 2014)
Health care costs	(Nguyen Thi <i>et al.</i> , 2002) - (Moifo <i>et al.</i> , 2014)

Patients' opinions and comments are important in identifying sources of dissatisfaction and areas for improvement (Boyer *et al.*, 2006). However, patient satisfaction remains subjective and do not provide an overall assessment of all dimensions of quality of care. Patients judge only the aspects that they can perceive, especially those relating to organization, comfort, hotel services, etc. because they do not have the required skills to judge the technical quality. Quality of care requires, beyond patient satisfaction, the perception and representation of professionals who are key elements (Chougrani and Ouhadji, 2014). According to Eiriz and António Figueiredo (2005), an approach based on both customers and providers offers a much more complete picture of health care quality than simply measuring customer satisfaction.

b) Healthcare providers' satisfaction

It is considered to be impossible to understand the problems of healthcare provision and to make significant changes in the medical field without understanding the care providers (Qian and Lim, 2008). Providers' satisfaction plays a great role in their performance and therefore is reflected as satisfaction and compliance among their patients (Kumar *et al.*, 2013). In their study Haas *et al.*, (2000) have found that patients of a physician with high professional satisfaction had higher satisfaction with their care than patients of physicians with lower satisfaction. In order to have a global view of factors influencing providers' satisfaction, we synthesis the satisfaction factors in *table 2*, through a literature review of papers dealt with the issue of providers' satisfaction.

Table 2 : Factors affecting care providers' satisfaction

Factors	References
Workload	(Crilly <i>et al.</i> , 2017) - (Cathébras <i>et al.</i> , 2004)
Working environment (cleanliness, ease of maintenance,	(Mourshed and Zhao, 2012) -
Availability of human resources	(Casellas <i>et al.</i> , 2013) - (Islam <i>et al.</i> , 2015)
Availability of materials (drugs, equipment, supply, etc.)	(Sawadogo <i>et al.</i> , 2017)
Administrative burden	(de Bonnières <i>et al.</i> , 2010) - (Cathébras <i>et al.</i> , 2004)
Work organization and coordination	(Very <i>et al.</i> , 2016)
Relational aspects	(de Bonnières <i>et al.</i> , 2010)
Salary	(Pruthi <i>et al.</i> , 2016) - (Qian and Lim, 2008)
Motivation (professional carrier, promotion, etc.)	(Merchaoui <i>et al.</i> , 2016) - (Qian and Lim, 2008)- (Kumar <i>et al.</i> , 2013)

c) Standards of quality of care

In a WHO publication, quality was defined as *the degree to which the resources for health care or the services included in health care correspond to specified standards. Those standards, if applied, are generally expected to lead to desired results* (Roemer and Montoya-Aguilar, 1988). Therefore the assessment of quality of care should

be based on references and standards. The WHO has established a set of standards, if fulfilled in care settings, could ensure quality care. The establishment of these standards is carried out according to specificities relating to the types of care (primary or hospital care), types of patients (women, newborns, mentally ill, adolescents, etc.), and types of healthcare setting (laboratory, hospital service, outpatient department, blood transfusion service, etc.). Standards include clinical and technical aspects as well as organizational and logistics aspects. Given the purpose of our research, we have selected standards that concern organizational and logistics aspects of care. The content of selected standards was summarized and divided into major health areas:

- **Information system:** the health facility have a mechanism for data collection, analysis and feedback as part of its activities to support quality improvement (WHO, 2016). Health-care providers and support staff use data on service utilization and quality of care for action planning and implementation of quality improvement initiatives (WHO and UNAIDS, 2015).
- **Material resources:** the health facility has the equipment, medicines, supplies and technology needed to ensure effective service provision. A system of procurement, stock management and maintenance is in place to deliver the required package of services (WHO and UNAIDS, 2015; WHO, 2016). There are ample furnishings, and they are comfortable and in good condition (WHO, 2012).
- **Human resources:** health care staff with sufficiently diverse skills are available around the clock (WHO, 2016; 2012)
- **Sanitation:** water, sanitation, hand hygiene and waste disposal facilities are functioning, reliable, safe and sufficient for the needs of staff and patients (WHO, 2016). The bathing and toilet facilities are clean and working properly (WHO, 2012). A reliable drinking-water point is accessible for staff and patients at all times (WHO, 2008).
- **Waste management:** healthcare waste is segregated, collected, transported, treated and disposed of safely. Waste containers with different color codes or recognizable symbols are in place and placed at sensible locations (WHO, 2008; 2005).
- **Cleanliness and hygiene:** the health facility has a welcoming and clean environment (WHO and UNAIDS, 2015; WHO, 2012; 2016).
- **Laundry:** laundry and surfaces in the health-care environment are kept clean (WHO, 2008).
- **Building design:** the building is in a good state of repair and accessible for people with physical disabilities. The building's lighting (artificial and natural), heating and ventilation provide a comfortable living environment. Men and women as well as children and older persons have separate sleeping quarters. Sufficient numbers of clean blankets and bedding are available to service users (WHO, 2012; 2008).
- **Food preparation and storage:** food is available in sufficient quantities, is of good quality and meet with the service user's preferences and physical health requirements (WHO, 2012). The food is stored and prepared in a way that minimizes the risk of disease transmission (WHO, 2008).

The *figure 1* below, summarized our model of quality of care. It takes into account the three dimensions: patient satisfaction, care providers' satisfaction and care quality standard.



Figure 1. Quality of care from three angles: patient satisfaction, providers' satisfaction and standards

4. The role of hospital logistics in improving the quality of care

Healthcare institutions may adopt a variety of approaches to improve the quality of care, such as TQM (Chow-Chua et Goh; 2000), radical innovation through process reengineering (Bertolini *et al.*, 2011), six sigma (Liberatore, 2013), lean approach (Curatolo *et al.*, 2014) and an effective hospital logistics which is one of the relevant tools that can help hospitals to significantly improve the quality of care.

4.1. Definition of hospital logistics

Landry and Beaulieu (2002) have defined hospital logistics as *a set of design, planning and execution activities which enable the purchase, inventory management and replenishment of goods and services surrounding the provision of medical services to patients*. For Ibn El Farouk *et al.*, (2012), it is concerned with the management of flows, it was defined as *a set of processes that exchange physical, information and financial flows in order to ensure all the necessary conditions to offer a better quality to the patient*. Hence, the main mission of hospital logistics is to provide the different actors of the hospital with material resources to operate. Its role is essential in the care process (Costin, 2010).

4.2. Hospital logistics activities

The basic role of hospitals is to provide healthcare to patients. This mission is assured and supported by a set of logistics activities. Logistics in hospitals include a wide range of activities that involve various department in their management (Jawab *et al.*, 2018). Its scope is very broad, ranging from resource sizing, planning and scheduling activities to hotel activities (figure 2). It is associated with purchasing, stock management, replenishment and information system which are essential to ensure products availability. Hotel activities such as catering, cleanliness, hygiene, laundry, etc., and transport activities, which include the transportation of materials (mails, samples, etc.), and people (staff or patients) within health facilities or between the sites of a hospital center (Jawab *et al.*, 2018; Jawab, 2007). Maintenance and waste management fall also into the field of hospital logistics. According to Kriegel *et al.*, (2013), logistics within hospital manages a variety of flows: people flows (patients, visitors, employees) and product flows (drugs, linen, meals, etc.).

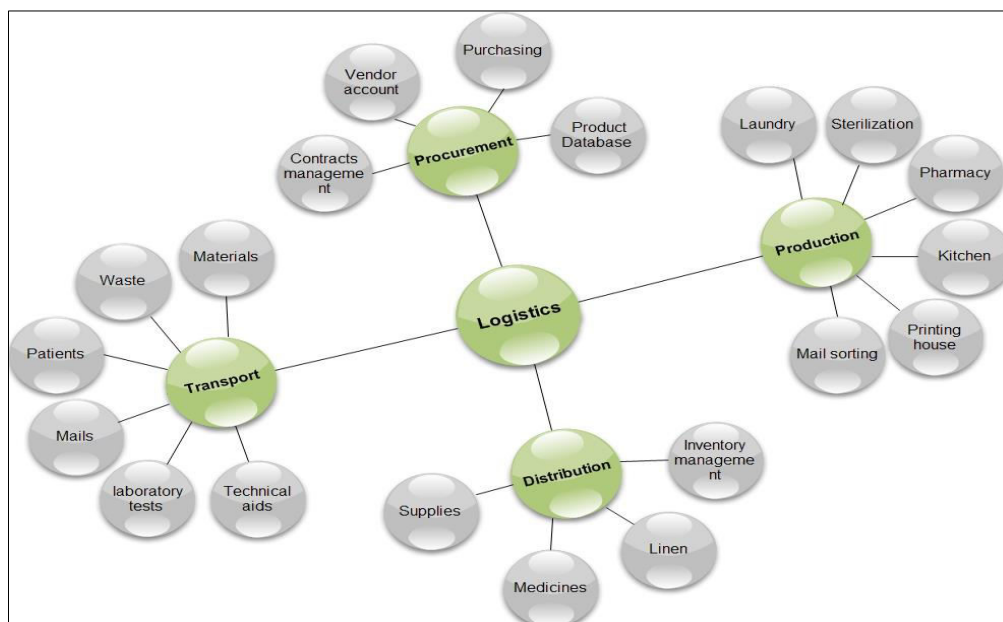


Figure 2 : hospital logistics activities
Source: Chow and Heaver,(1994) adapted by Beaulieu *et al.*, (2014)

4.3. Hospital logistics as a tool of quality improvement

To improve the quality of care, healthcare facilities priorities are often focused on clinical activities, and tend to neglect logistics activities, because they seem simple and straightforward and not considered as taking part in the core processes of care. However, these activities impact significantly on the quality of health care provided and on hospital costs (Bourgeon, Constantin and Karolszyk, 2001; Melo, 2012). Jawab (2007) has emphasized that

the quality of care is one of the major issues of hospital logistics. The goal is to determine the most effective organization of care production, in order to achieve a high quality of service for both patients and medical staff. For patients, quality concerns the rapidity of service and respecting deadlines and personal preferences. As for the medical staff, quality relates to the distribution of the workloads on the different members in a fair way.

Hospital logistics may address several aspects of quality of care, especially those associated with patient and providers' satisfaction as well as standards. A better management of hospital logistics could improve the quality of care, in particular in terms of:

- *Reducing waiting time:* one of the most causes of waiting time is the not adequacy in the synchronization between resources and needs. Waiting is the consequence of the mismatch between resources availability (care staff, medicine, equipment, furniture, etc.) and care needs. This mismatch is most likely attributed to the lack of logistics activities as planning, coordination, and communication in delivering health care services (Melo, 2012). Hospitals may rely on scheduling activity to reduce waiting times. A good appointment schedule keeps patient waiting times short. Furthermore, according to the same author, inventory management can help mitigate the mismatch between supply and demand, for example the two-bin concept simplifies the process of determining and replenishing supply needs in a care unit.
- *Improving human resources availability:* researches have proved that clinical staff spend between 10% and 30% of their time on logistics tasks (Landry and Philippe, 2004; Bourgeon *et al.*, 2001). Research in hospital logistics may suggest a number of measures to decrease the time that nurses devote to ordering and restocking medical supplies. Some authors have suggested to have dedicated staff for the execution of logistics activities, that would free the care providers from some administrative and logistics tasks, and enable them to give more time to patients (Costin, 2010; Landry and Beaulieu, 2002).
- *Improving material resources availability:* an effective logistics system helps provide appropriate supplies to health providers, increasing their professional satisfaction, motivation, and morale. Motivated staff are more likely to deliver a higher quality of service (USAID, 2011). Drugs availability is vital for hospitals to function and provide care to patient. A shortage of drugs may have bad consequences on patients' lives. Logistics researches concern areas such as the development of a set of indicators on drugs availability (Ibn El Farouk *et al.*, 2013).
- *Information system:* The information system is the core of logistics systems. It enable the coordination and exchange of accurate, timely and adequate information between all stakeholders. This will reduce the likelihood of duplicated tests because everybody can check whether a test has been conducted or not (Meijboom *et al.*, 2011). Administrative procedures of patient records can also be simplified by the introduction of the electronic medical record (EMR), through the use of hospital information systems (Zemour *et al.*, 2016), that facilitate the management of information flows. Improved information systems for recording and tracking patient data, their health, and the care they receive are critical to making significant progress in improving quality (OECD, 2004). The optimization of administrative procedures would also reduce waiting times as the time spent on organizing files, looking for information. An effective information systems allows also to track inventory levels and consumption of medical supplies and drugs (USAID, 2011).
- *Improving physical access to healthcare:* problems of access to care, whether within or outside hospitals, have been reported as one of the main barriers to improving health status. Logistics activities such as patient transportation, patient handling, maintenance and building design, etc. largely condition physical access to care. For example, Beaudry *et al.*, (2010) state that, in many hospitals, patient transportation is poorly managed, leading to patient inconvenience, disruptions, and added costs. A late delivery of a patient to a service unit, disrupts the initially planned schedule of the department and the following appointments are often delayed, thus rendering waiting time inevitable. The improvement of transportation system (extra-hospital and intra-hospital transport) can reduce waiting times and improve health outcomes (Syed, Gerber and Sharp, 2013).
- *Hotel services:* as it was found previously, activities such as cleanliness, hygiene, catering, laundry, etc. are key elements of patient and providers' satisfaction, and emphasized by quality standards. Hospital logistics handle these support activities, and make sure that they are appropriately planned and coordinated. The frequency of the intervention of the cleaning teams has to be regular and to keep the care environment clean and hygienic. The catering activity had to take into account both of the patients' preferences and the care teams recommendations.

While the above list of potential areas of improvement in hospital logistics is by no means exhaustive, it illustrates the wide range of opportunities for improving the quality of care using effective logistics within the hospital environment.

Conclusion

This study was designated to identify opportunities for care quality improvement offered by hospital logistics. If the practice of care is by definition a clinical matter, the latter is supported by a range of logistics activities ensuring the proper delivery of the care service. These activities include design for resource sizing, planning and scheduling, procurement of medical and non-medical supplies, transportation of products and patients, hotel activities, etc. All of these activities are necessary for the provision of care to patients, and for the working conditions of healthcare providers, and are part of quality standards. The literature review of both patient and care providers' satisfaction revealed that most of satisfaction factors are related to hospital logistics. As a result, improving the efficiency of hospital logistics activities can provide opportunities for health facilities to increase the quality of care (Landry and Beaulieu, 2013). In our view, there is much room for hospital logistics to improve resource management to meet the demand for care, and in consequence enhance the quality of care.

References

- Akachi, Y. and Kruk, M. E. (2017) 'Quality of care : measuring a neglected driver of improved health', *Bulletin of the World Health Organization*, 95(6), pp. 465–472.
- Amazian, K. *et al.* (2013) 'Enquête de satisfaction des patients atteints de cancer dans un hôpital universitaire au Maroc', *Sante Publique*, 25(5), pp. 627–632.
- Beaudry, A. *et al.* (2010) 'Dynamic transportation of patients in hospitals', *OR Spectrum*, 32(1), pp. 77–107.
- Beaulieu, M. *et al.* (2014) 'La logistique hospitalière au Québec : passé, présent et futur', *Gestion*, 39(3), pp. 56–62.
- Bertolini, M. *et al.* (2011) 'Business process re- engineering in healthcare management: a case study', *Business Process Management Journal*, 17(1), pp. 42–66.
- Bleustein, C. *et al.* (2014) 'Wait Times, Patient Satisfaction Scores, and the Perception of Care', *The American Journal of Managed Care*, 20(5), pp. 393–400.
- de Bonnières, A., Estryng-Behar, M. and Lassaunière, J. M. (2010) 'Déterminants de la satisfaction professionnelle des médecins et infirmières de soins palliatifs', *Medecine Palliative - Soins de support - Accompagnement - Éthique*, 9(4), pp. 167–176.
- Bouaiti, E. *et al.* (2016) 'Facteurs déterminants de la satisfaction des patients consultant aux urgences de l'hôpital militaire d'instruction Mohamed V de Rabat, Maroc', *Revue d'Épidémiologie et de Santé Publique*. 64, pp. S140–S141.
- Bourgeon, B., Constantin, A. and Karolszyk, G. (2001) 'Evaluation des coûts logistiques hospitaliers en France et aux Pays-Bas', *Logistique & Management*, 9(1), pp. 81–87.
- Boyer, L. *et al.* (2006) 'Perception and use of the results of patient satisfaction surveys by care providers in a French teaching hospital', *International Journal for Quality in Health Care*, 18(5), pp. 359–364.
- Canoui-poitaine, F., Logerot, H. and Frank-soltysiak, M. (2008) 'Évaluation de la satisfaction des professionnels et des patients d'une unité multidisciplinaire de chirurgie ambulatoire', *Pratiques et Organisation des Soins*, 39(4), pp. 323–330.
- Casellas, F. *et al.* (2013) 'Satisfaction of health care professionals managing patients with inflammatory bowel disease', *Journal of Crohn's and Colitis*. European Crohn's and Colitis Organisation, 7(7), pp. e249–e255.
- Cathébras, P. *et al.* (2004) 'Épuisement Professionnel Chez Les Médecins Généralistes', *La Presse Médicale*, 33(22), pp. 1569–1574.
- Chang, W. and Chang, Y. (2013) 'Patient satisfaction analysis : Identifying key drivers and enhancing service quality of dental care', *Journal of Dental Sciences*. Elsevier Taiwan LLC, 8(3), pp. 239–247.
- Chougrani, S. and Ouhadji, S. (2014) 'Les questionnaires de sortie et la place des usagers dans le projet qualité à l'Établissement hospitalier universitaire d'Oran', *Santé Publique*, Vol. 26(4), pp. 499–508.
- Chow-Chua, C. and Goh, M. (2000) 'Quality improvement in the healthcare industry: some evidence from Singapore', *International journal of health care quality assurance*, 13(5), pp. 223–229.
- Chow, G. and Heaver, T. (1994) 'Logistics in the Canadian health care industry', *Canadian Logistics Journal*, 1(1), pp. 29–73.
- Costin, M. (2010) 'Logistique hospitalière, un outil du management : le cas des hôpitaux français et moldaves', *Humanisme et Entreprise*, 299(4), pp. 29–48.
- Crilly, J. *et al.* (2017) 'Measuring the impact of the working environment on emergency department nurses: A cross-sectional pilot study', *International Emergency Nursing*, 31, pp. 9–14.
- Curatolo, N. *et al.* (2014) 'Démarches d'amélioration en milieu hospitalier: Du management de la qualité totale

- au Lean', *Annales Pharmaceutiques Francaises*. Elsevier Masson SAS, 73(4), pp. 245–256.
- Delanian Halsdorfer, N. *et al.* (2011) 'An assessment of patient satisfaction for a short-stay program in a physical and rehabilitation medicine day hospital', *Annals of Physical and Rehabilitation Medicine*. Elsevier Masson SAS, 54(4), pp. 236–247.
- Eiriz, V. and António Figueiredo, J. (2005) 'Quality evaluation in health care services based on customer-provider relationships', *International Journal of Health Care Quality Assurance*, 18(6), pp. 404–412.
- Garnerin, P. *et al.* (2001) 'Qualité des soins', *Bulletin des médecins suisses*, 82(38), pp. 2020–2024.
- Gaujal, L. *et al.* (2016) 'Première enquête de satisfaction dans une unité de chirurgie ambulatoire dédiée à la cancérologie', *Bulletin du Cancer*. Société Française du Cancer, 103(4), pp. 330–335.
- Gerbaud, L. *et al.* (2002) 'L'utilisation des questionnaires de sortie, une enquête auprès de 7 centres hospitaliers', *Sante Publique*, 14(1), pp. 21–30.
- Haas, J. S. *et al.* (2000) 'Is the professional satisfaction of general internists associated with patient satisfaction?', *Journal of General Internal Medicine*, 15(2), pp. 122–128.
- Howie, J. G. R. *et al.* (1991) 'Long to short consultation ratio : a proxy measure of quality of care for general practice', *British Journal of General Practice*, 41(343), pp. 48–54.
- Ibn El Farouk, I., Talbi, A. and Jawab, F. (2012) 'Chaîne logistique hospitalière : définition, état de l'art et pistes d'amélioration', in *CIGIMS, FES/MAROC*.
- Ibn El Farouk, I., Talbi, A. and Jawab, F. (2013) 'Development of a Set of Indicators to Manage Medicines Supply Chain in Moroccan Public Hospital , Application of the SCOR Model', *International Journal of Business Development*, 3(3), pp. 147–158.
- Institute of Medicine (2001) *Improving the 21st-century health care system, Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington.
- Islam, F. *et al.* (2015) 'Perceptions of health care providers and patients on quality of care in maternal and neonatal health in fourteen Bangladesh government healthcare facilities: A mixed-method study', *BMC Health Services Research*. BMC Health Services Research, 15(1), p. 273.
- Jawab, F. (2007) 'L'enjeu logistique dans les établissements hospitaliers', in *SIM*. Fès, pp. 1–13.
- Jawab, F., Frichi, Y. and Boutahari, S. (2018) 'Hospital Logistics Activities', in *International Conference on Industrial Engineering and Operations Management*, pp. 3228–3237, Bandung, Indonesia.
- Kapoor, D. A. (2014) 'Determinants of Patient Satisfaction with Urology Practice', *Urology Practice*. Elsevier Ltd, 1(3), pp. 122–126.
- Kasouati, J. *et al.* (2015) 'Évaluation de la satisfaction des patients de la prise en charge de la douleur au service des urgences de l'Hôpital Militaire d'Instruction Mohamed V, Rabat, Maroc', *Revue d'Épidémiologie et de Santé Publique*. Elsevier Masson SAS, 63, p. S75.
- Kelley, E. and Hurst, J. (2006) *Health care quality indicators project - Conceptual framework paper, OECD health working papers*.
- Ko, H. H. *et al.* (2009) 'Factors influencing patient satisfaction when undergoing endoscopic procedures', *Gastrointestinal Endoscopy*. American Society for Gastrointestinal Endoscopy, 69(4), pp. 883–891.
- Kriegel, J. *et al.* (2013) 'Advanced services in hospital logistics in the German health service sector', *Logistics Research*, 6(2–3), pp. 47–56.
- Kumar, R. *et al.* (2013) 'Job satisfaction among public health professionals working in public sector : a cross sectional study from Pakistan', *Human Resources for Health*, 11(1), pp. 1–5.
- Landry, S. and Beaulieu, M. (2002) 'La logistique hospitalière : un remède aux maux du secteur de la santé?', *Gestion*, 26(4), pp. 34–41.
- Landry, S. and Beaulieu, M. (2013) 'The Challenges of Hospital Supply Chain Management, from Central Stores to Nursing Units', in Springer (ed.) *Handbook of Healthcare Operations Management - Methods and Applications*. New York, pp. 465–482.
- Landry, S. and Philippe, R. (2004) 'How logistics can service healthcare', *Supply Chain Forum : An International Journal*, 5(2), pp. 24–30.
- Lerebours, F. *et al.* (2015) 'Satisfaction des patientes traitées par chimiothérapie en hôpital de jour pour un cancer du sein : résultats de l'enquête TemporELLES', *Bulletin du Cancer*. Société Française du Cancer, 102(4), pp. 316–323.
- Liberatore, M. J. (2013) 'Six Sigma in healthcare delivery', *International Journal of Health Care Quality Assurance*, 26(7), pp. 601–626.
- Lohr, K. N. and Schroeder, S. A. (1990) 'A strategy for quality assurance in medicare', *THE NEW ENGLAND JOURNAL OF MEDICINE*, 322(10), pp. 707–712.
- Más, A. *et al.* (2016) 'Improving quality in healthcare: What makes a satisfied patient?', *Revista de Calidad Asistencial*. SECA, 31(4), pp. 196–203.
- Meijboom, B., Schmidt-Bakx, S. and Wesert, G. (2011) 'Supply chain management practices for improving patient-oriented care', *Supply Chain Management: An International Journal*, 16(3), pp. 166–175.
- Melo, T. (2012) *A note on challenges and opportunities for Operations Research in hospital logistics, Technical*

reports on logistics of the Saarland Business School.

- Merchaoui, I. *et al.* (2016) 'Satisfaction des médecins des groupements de médecine de travail de leur carrière professionnelle : à propos d'une étude nationale tunisienne', *Archives des Maladies Professionnelles et de l'Environnement*, 77(3), pp. 425–426.
- Mohd, A. and Chakravarty, A. (2014) 'Patient satisfaction with services of the outpatient department', *Medical Journal Armed Forces India*, 70(3), pp. 237–242.
- Moifo, B. *et al.* (2014) 'Enquête de satisfaction des patients au service de radiologie de l'hôpital général de Douala - Cameroun', *Journal Africain d'Imagerie Médicale*, 6(1), pp. 52–63.
- Morel, M.-A. (2012) 'Qualité des soins', in Formarier, M. and Jovic, L. (eds) *Les concepts en sciences infirmières (2ème édition)*. Association de recherche en soins infirmiers (ARSI), pp. 256–260.
- Mourshed, M. and Zhao, Y. (2012) 'Healthcare providers' perception of design factors related to physical environments in hospitals', *Journal of Environmental Psychology*. 32(4), pp. 362–370.
- Nguyen Thi, P. L. *et al.* (2002) 'Satisfaction des patients hospitalisés à Hô Chi Minh-Ville, Viet Nam', *Santé Publique*, 14(4), pp. 345–360.
- OECD (2004) *Vers des systèmes de santé plus performants*.
- WHO (2006) *Quality of care: a process for making strategic choices in health systems*, Genève.
- Perruche, F., Pourriat, J.-L. and Claessens, Y.-E. (2008) 'Satisfaction des patients consultant aux urgences: Mise au point', *Journal Européen des Urgences*, 21(1), pp. 14–21.
- Pruthi, N. R. *et al.* (2016) 'Factors Related to Job Satisfaction in Urology', *Urology Practice*. 3(3), pp. 169–174.
- Qian, F. and Lim, M. K. (2008) 'Professional satisfaction among Singapore physicians', *Health Policy*, 85(3), pp. 363–371.
- Roemer, M. . and Montoya-Aguilar, C. (1988) *Quality assessment and assurance in primary health care*. Geneva.
- Sawadogo, S. *et al.* (2017) 'Facteurs associés à la satisfaction des prescripteurs de produits sanguins labiles au Burkina Faso', *Transfusion Clinique et Biologique*. 24(4), pp. 440–448.
- Schoenfelder, T., Klewer, J. and Kugler, J. (2011) 'Determinants of patient satisfaction: A study among 39 hospitals in an in-patient setting in Germany', *International Journal for Quality in Health Care*, 23(5), pp. 503–509.
- Syed, S. T., Gerber, B. S. and Sharp, L. K. (2013) 'Traveling Towards Disease: Transportation Barriers to Health Care Access', *Journal of Community Health*, 38(5), pp. 976–993.
- Tennakoon, T. and de Zoysa, P. (2014) 'Patient satisfaction with physiotherapy services in an Asian country: A report from Sri Lanka', *Hong Kong Physiotherapy Journal*. 32(2), pp. 79–85.
- USAID (2011) *DELIVER PROJECT - The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities*, USAID | DELIVER PROJECT, Task Order 1.
- Very, E. *et al.* (2016) 'Facteurs de satisfaction et d'épuisement des psychiatres aux urgences', *L'Encephale*. pp. 1–5.
- Waters, S. *et al.* (2016) 'Identification of factors influencing patient satisfaction with orthopaedic outpatient clinic consultation : A qualitative study', *Manual Therapy*. Elsevier Ltd, 25, pp. 48–55. WHO (2005) *Management of solid health-care waste at primary health-care centres: a decision-making guide*. Geneva.
- WHO (2008) *Essential Environmental Health Standards in Health Care*.
- WHO (2012) *QualityRights Toolkit: Assessing and improving quality and human rights in mental health and social care facilities*.
- WHO (2016) *Standards for improving quality of maternal and newborn care in health facilities*. Geneva.
- WHO (2017) *What is Quality of Care and why is it important?*
- WHO and UNAIDS (2015) 'Global standards for quality health-care services for adolescents: a guide to implement a standards-driven approach to improve the quality of health care services for adolescents', *World Health Organization*, 1, pp. 1–40.
- Zemour, L. *et al.* (2016) 'Mesure de la satisfaction des utilisateurs du dossier électronique médical au sein du système d'information hospitalier à l'établissement hospitalier et universitaire d'Oran, Algérie', *Revue d'Épidémiologie et de Santé Publique*. 64, p. S260.

Youness Frichi received the engineering degree in industrial engineering from the National School of Applied Sciences in 2013. He joined the Ministry of Industry, Investment, Trade and Digital Economy since July 2014. He is, in parallel, a PhD student in the Laboratory of Manufacturing, Energy and Sustainable Development at Sidi Mohamed Ben Abdellah University, Fez, Morocco. His research interests are mainly focused on logistics and in particular hospital logistics.

Fouad Jawab is a professor of higher education at Fez Higher School of Technology (EST) in Morocco. He is member of the Research Laboratory of Manufacturing, Energy and Sustainable Development and Director of the Research Laboratory in International Management, Decision Making and Logistics. He has headed the

Department of Management Science and Technology and directed the Logistics Management and Transportation training program at the EST, and is currently coordinating the "LOGISTICS" professional license. Hospital logistics is one of its main areas of research interest.

Said Boutahari is a research professor (Grade professor of higher education) in the Department of Mechanical Engineering, Production and Industrial Maintenance at Fez higher School of Technology. He is also member of the research Laboratory of Manufacturing, Energy And Sustainable Development at Sidi Mohamed Ben Abdellah University, Fez. His research areas include Automated Production, Industrial Engineering and Logistics.

Karim Zehmed holds a master's degree in economics and management and he's, currently, a PhD student at Research Laboratory of International Management, Decision-making techniques and Logistic at the high school of technology of Sidi Mohamed Ben Abdullah University-Fez-Morocco. He is interested in the field of governance and performance of urban public transport.

Imane Moufad received the engineering degree in industrial engineering from the National School of Applied Sciences in 2013. She is a PhD student in the Laboratory of Manufacturing, Energy and Sustainable Development at Sidi Mohamed Ben Abdellah University, Fez, Morocco. His research interests are mainly focused on logistics and transport in particular urban logistics and urban Freight transport.

Kawtar Akoudad is an industrial engineer from the National School of Applied Sciences and a PhD student at the Laboratory of Manufacturing, Energy and Sustainable Development at the College of Technology of Sidi Mohamed Ben Abdellah University - Fez - Morocco. She is interested in management sciences and industrial engineering and specializes in the field of logistics, international transport, and Supply Chain Management.

Nassima Laaraj received the engineering degree in industrial engineering from the National High School of Electricity and Mechanics in Casablanca, Morocco in 2014. She is a PhD student in the Laboratory of Manufacturing, Energy and Sustainable Development at Sidi Mohamed Ben Abdellah University, Fez, Morocco. Her research works are in the field of logistics and transport, and particularly faucalised on road safety.