Hospital Logistics' Effect On Patient Satisfaction

Youness Frichi, Imane Ibn El Farouk, Fouad Jawab, Said Boutahari

Abstract: The objective of this paper is to examine how hospital logistics influence patient satisfaction. Based on the literature, we proposed that hospital logistics has four factors: physical accessibility, waiting time, hospital hotel services and administrative procedures. A PLS-SEM model was developed and evaluated using data from a survey of 216 patients conducted in three public hospitals in Fez-Morocco. It was found that hospital logistics positively impacts patient satisfaction, which proves its role as a key driver of patient satisfaction. Consequently, healthcare decision-makers are called upon to pay more attention to logistics activities at the hospital to, among other things, improve patient satisfaction.

Index Terms: Hospital logistics, patient satisfaction, PLS-SEM, physical accessibility, waiting time, hospital hotel services, administrative procedures.

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1 INTRODUCTION

Healthcare facilities are required to meet the health needs of the society, communities, and individuals. Measuring users' satisfaction is fundamental in assessing the quality of care [1]. In particular, patient satisfaction is a meaningful indicator of the quality of care, given the fact that patients are the most important group of stakeholders in a health system [2]. Patient satisfaction was defined as an evaluation that reflects the perceived differences between the expectations of the patient to what is actually received during the process of care [3]. The World Health Organization emphasizes the need to place patients and populations at the heart of the health system by responding to their needs and wishes [4]. In the United States, patient satisfaction plays a major role in healthcare delivery and quality of care reforms [5]. In France, since 1996, the measurement of patient satisfaction has been a regulatory requirement for hospitals [6]. In Germany, the measurement of patient satisfaction has been mandatory since 2005 as part of quality management reports [7]. In Morocco, the Ministry of health's new strategies consider patient satisfaction as an important challenge and puts it at the forefront of concerns. A growing body of scientific literature indicates that patient satisfaction is influenced by several factors such as patient expectations, patient health status, and characteristics, health professionals attitudes and behaviors [8], accessibility, waiting time, consultation time, administrative procedures, hotel services, etc. [9], [10], [3]. Some of these satisfaction factors clearly fall within the scope of hospital logistics [11], [12]. Hospital logistics is defined as a set of design, planning and execution activities that enable the purchase, inventory management and replenishment of goods and services surrounding the provision of medical services to patients [13]. It includes a wide range of activities necessary for the provision of health care from patient admission to discharge [14]. It is considered to be a key driver of patient satisfaction. In fact, satisfaction factors like physical accessibility, waiting time, hospital hotel services and administrative procedures are dependent on the effectiveness of hospital logistics. Physical accessibility (PA): is the physical ease with which patients seek health services. It includes access to hospitals through the availability of medical transportation, and access to care within the hospital, particularly in terms of the clarity of signs and communication panels, as well as the availability of human and material resources. These logistics factors enable patients to promptly benefice from the healthcare they need, and increase their satisfaction [15]. Waiting time (WT): long waiting times can result from several factors including, but not limited to, delays in scheduling, poorly organized or unclear administrative procedures, and patient flows [9], [15]. In particular, waiting times are the consequence of the mismatch between available resources (caregivers, operating rooms, beds, drugs, equipment, etc.) and care needs [16]. This mismatch is mainly due to a lack of planning, coordination, and communication in the delivery of care or because resources are allocated in a fixed manner and not adapted to the need changes [17]. Hospitals can use optimized scheduling and appointment systems to reduce patient waiting times [16], [18].

Hospital hotel services (HHS): hotel services such as catering, cleanliness, hygiene, comfort and general accommodation conditions are important services for most patients and significantly affect their satisfaction [10]. Satisfactory HHS are attributed to the effective management of catering, laundry and cleaning activities, which require adequate planning and coordination. For instance, the catering activity requires an efficient supply system to deliver fresh meals at the right time, as well as better coordination between the catering service and the care teams to take into account the nutritional specificities of each patient. The laundry activity is essential for maintaining clean linen, towels and staff uniforms, which ensures comfort and hygiene for patients. Thus, appropriate logistics circuits are a must: defining clean and dirty linen storage areas, transportation, operations' scheduling (disinfection, washing, and drying). Administrative procedures (AP): the clarity and ease of patient admission and discharge administrative procedures are crucial for patient satisfaction [19], [20]. Complex and repetitive AP have been identified as one of the main causes of long waiting times and patient dissatisfaction [18]. AP can be optimized and simplified through the use of hospital information systems and the implementation of the electronic health record [21]. Based on the literature, we propose to model hospital logistics (HL) as a second-order hierarchical component model (HCM) construct, composed of PA, WT, HHS and AP components (Figure 1). The HCM has two construct layers: higher-order (HL) and

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lower-order components (four constructs). Indeed, the HCM is appropriate in this study because it reduces total relationships between constructs and allows us to test the research hypothesis which claims that patient satisfaction (PS) is influenced by HL [22].

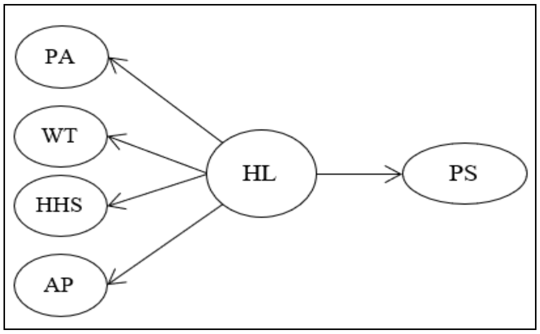

Fig. 1. *Conceptual model*

The present study represents one of the first attempts to empirically develop a structured model to examine the effect of HL factors on PS in Morocco. The Moroccan health system is composed of the public health sector and the private health sector. The first is made up of healthcare services of the Ministry of health, defense department and local authorities. The second incorporates the private for-profit sub-sector, which includes hospital clinics, pharmacies, etc., and the private not-for-profit sub-sector [2]. About 80% of healthcare services are public under the Ministry of health. For this reason, this study is conducted in public hospitals under the Ministry of health. The remainder of this paper is organized as follows. The next section described the methodology for study settings and participants, the questionnaire development, data analysis and the sample size. The third section provided the results and steps for the model assessment and validation. The fourth section discussed the obtained results. The fifth section concluded the article and gave insights into the finding's practical applications.

2 METHODS

2.1 Study Settings and Participants

This study was carried out in three public hospitals in Fez city-Morocco. The first is a prefectural hospital which has a functional bedding capacity (FBC) of 282 beds and serves a population of 1.5 million inhabitants. The second is a regional hospital with a 250 FBC and a served population of 4.5 million inhabitants. The third is a university hospital of a 950 FBC and an estimated served population of 6 million inhabitants. Patients included in this survey were hospitalized for at least 48 hours in one of the three hospitals. The 48-hours criterion is set in order to include only patients with significant experience. On the other hand, patients under 18 years of age, ambulatory care patients, and patients with critical health statutes or refused to participate were excluded. The survey was conducted during the period from November 2019 to January 2020.

2.2 Questionnaire Design

A questionnaire was developed based on the literature and the results from an exploratory qualitative study [11]. Content validity, which examines the degree to which the generated items capture the research constructs and are suitable for use in a survey, was assessed in two focus groups conducted in the prefectural and regional hospitals. Thus, some items were removed because they were inadequate, while other items were added by the participants. 42 items were included in the questionnaire (Appendix). A 7-point Likert scale was adopted in this study.

2.3 Data Analysis and Sample Size

The proposed theoretical model in Fig 1 is assessed and validated using structural equation modeling (SEM). This choice is justified in particular by the objective of this article, which aims to prove the correlation between hospital logistics and patient satisfaction. SEM is suitable and effective for modeling relationships between constructs [23]. Moreover, the SEM has known a wide application in the health and logistics sectors [24]. There are two SEM techniques for model parameter estimation, namely: PLS-SEM and CB-SEM. In this study, we used the PLS-SEM technique given its numerous advantages. It doesn't require data normal distribution and can be used for a reduced sample size [25]. Data from the survey were analyzed using SPSS version 23 and SmartPLS 3 software. The sample size was calculated based on the rule of thumb for PLS-SEM model estimation, proposed by Barclay et al. [26]. The rule of thumb specifies that the minimum sample size is 10 times the maximum number of paths aiming at any latent variable (LV) in the measurement model. In our model, the LV with the largest number of manifest variables (MV) is physical accessibility, which has 15 MV. According to the rule of thumb, a minimum of 150 participants is needed.

3 RESULTS

3.1 Participant Characteristics

A total of 216 patients were included in this study, of which 134 (62%) were female and 82 (38%) men. 40.74% of the participants were hospitalized in the university hospital, 29.16% in the regional hospital and 30% in the prefectural hospital. The majority of participants (43.51%) were between 25 and 34 years old, and 46.3% earned less than 260 USD per month. Care departments where surveyed patients were hospitalized included: Maternity (22%), Traumatology-Neurology (18%), Visceral Surgery (16%), Endocrinology (15%), Urology (5%), Dermatology (3%), and other departments (21%).

3.1 Measurement Model

The assessment of the SEM model should begin with the assessment of the measurement model [27]. The assessment of the measurement model with reflective indicators includes checking the reliability of each indicator, construct reliability, convergent validity, and discriminant validity [29].

Indicator reliability

The first step in evaluating the measurement model is to check the reliability of each item by examining its factor loading on the latent variable (LV). It is recommended to keep only items with factor loadings greater than 0.708 since they indicate that the construct explains more than 50% of the indicator variance [30]. Consequently, 9 items of the LV physical accessibility, 1 item of the LV waiting time and 5 items of the LV hospital hotel services were eliminated as their factor loadings were less than 0.708. Also, these items did not show significant factor loadings with any of the other LV in the model. Furthermore, it was observed that the elimination of these items increased the validity of their latent variables (AVE values). All the other items were kept (Table 1).

Internal consistency

Two indices were used in order to examine internal consistency: Cronbach's Alpha and the Dillon-Goldstein coefficient also known as CR (Composite Reliability). The values of these indices must be greater than 0.7 or 0.8 [22]. The results of Cronbach Alpha and CR are satisfactory (Table 1).

Validity

Convergent validity is the extent to which a measure correlates positively with alternative measures of the same construct. It was examined by considering the average variance extracted (AVE), which has to be greater than 0.5 (Table 2). Discriminant validity indicates the extent to which a construct is different from all other constructs in the model. Indicators' cross-loadings are the first criterion to be examined for discriminant validity. In fact, an indicator's outer loading on the associated construct should be greater than all of its loadings on other constructs of the model [22]. Cross-loadings results are given in Table 2.

TABLE 1

ITEMS RELIABILITY, INTERNAL CONSISTENCY, AND CONVERGENT VALIDITY

Construct	Items	Loading	Cronbach α	CR	AVE
PA	PA3	0.825	0.919	0.935	0.676
	PA4	0.859			
	PA7	0.756			
	PA11	0.769			
	PA12	0.841			
	PA13	0.750			
WT	WT1	0.864	0.893	0.926	0.758
	WT2	0.862			
	WT4	0.832			
	WT5	0.922			
HHS	HHS3	0.811	0.923	0.937	0.650
	HHS4	0.854			
	HHS5	0.749			
	HHS6	0.852			
	HHS8	0.723			
	HHS9	0.850			
	HHS10	0.810			
	HHS12	0.792			
AP	AP1	0.912	0.918	0.942	0.802
	AP2	0.878			
	AP3	0.894			
	AP4	0.899			
PS	PS1	0.850	0.931	0.949	0.787
	PS2	0.939			
	PS3	0.888			
	PS4	0.805			
	PS5	0.946			

TABLE 2

ITEMS CROSS-LOADINGS

	PA	WT	HHS	AP	PS
PA3	**0,825**	0,640	0,497	0,671	0,547
PA4	**0,859**	0,654	0,487	0,673	0,572
PA6	**0,592**	0,637	0,350	0,581	0,402
PA7	**0,756**	0,639	0,476	0,573	0,566
PA11	**0,769**	0,681	0,627	0,556	0,677
PA12	**0,841**	0,718	0,594	0,694	0,572
PA13	**0,750**	0,575	0,649	0,609	0,529
PA15	**0,937**	0,792	0,642	0,750	0,738
WT1	0,648	**0,864**	0,514	0,566	0,555
WT2	0,746	**0,862**	0,580	0,707	0,551
WT4	0,669	**0,832**	0,501	0,605	0,497
WT5	0,783	**0,922**	0,556	0,650	0,612
HHS3	0,621	0,584	**0,811**	0,552	0,606
HHS4	0,556	0,485	**0,854**	0,449	0,629
HHS5	0,482	0,390	**0,749**	0,415	0,445
HHS6	0,680	0,634	**0,852**	0,604	0,632
HHS8	0,448	0,384	**0,723**	0,376	0,539
HHS9	0,594	0,534	**0,850**	0,564	0,625
HHS10	0,518	0,468	**0,810**	0,495	0,687
HHS12	0,525	0,460	**0,792**	0,461	0,641
AP1	0,728	0,668	0,518	**0,912**	0,478
AP2	0,626	0,586	0,532	**0,878**	0,498
AP3	0,648	0,600	0,541	**0,894**	0,511
AP4	0,811	0,741	0,603	**0,899**	0,582
PS1	0,635	0,531	0,617	0,525	**0,850**
PS2	0,704	0,621	0,711	0,570	**0,939**
PS3	0,657	0,579	0,666	0,548	**0,888**
PS4	0,586	0,514	0,582	0,384	**0,805**
PS5	0,665	0,577	0,729	0,527	**0,946**

In addition to the cross-loadings criterion, discriminant validity is also examined by Fornell-Larcker criterion [31]. It compares the square root of the AVE values with the LV correlations. The objective is to ensure that a construct shares more variance with its associated indicators than with any other construct. Thus, the square root of each construct's AVE should be greater than its highest correlation with any other construct. The results of this test are given in Table 3.

TABLE 3

DISCRIMINANT VALIDITY

	PA	WT	HHS	AP	PS
PA	**0.822**				
WT	0.794	**0.870**			
HHS	0.692	0.619	**0.806**		
AP	0.790	0.728	0.614	**0.896**	
PS	0.733	0.637	0.747	0.579	**0.887**

3.2 Hierarchical HL Model

HL was modeled as a second-order hierarchical reflective construct, composed of four first-order reflective constructs (PA, WT, HHS, and AP), representing 27 items. The hierarchical structure of HL explains the variance of its components: PA (88.1%), WT (77.3%), HHS (71.9%) and AP (75.0%). All the path coefficients from HL to its components were significant at p-value < 0.01 (Table 4).

3.3 Structural Model

After assessing and validating the reliability and validity of the measurement model, the next step is to assess the structural model. The assessment of the structural model includes the significance of path coefficients, coefficient of determination R2, and the predictive relevance Q² [30]. Figure 2 provides a graphical representation of the structural model.

TABLE 4

THE HIERARCHICAL MODEL OF HOSPITAL LOGISTICS

	PA	WT	HHS	AP
R²	0.881	0.773	0.719	0.750
β	0.939	0.879	0.848	0.866
p-value	<0.01	<0.01	<0.01	<0.01

Path coefficient estimation

The execution of the PLS-SEM algorithm allows the estimation of the structural model coefficients (path coefficients) linking latent variables, and thus to test the research hypotheses. However, the significance of a path coefficient ultimately depends on its standard deviation obtained by bootstrapping. For this purpose, we performed a Bootstrap of 5000 subsamples as recommended by Hair et al. [22]. Table 5 shows that the path coefficient linking HL to PS is significant at p-value<0.01.

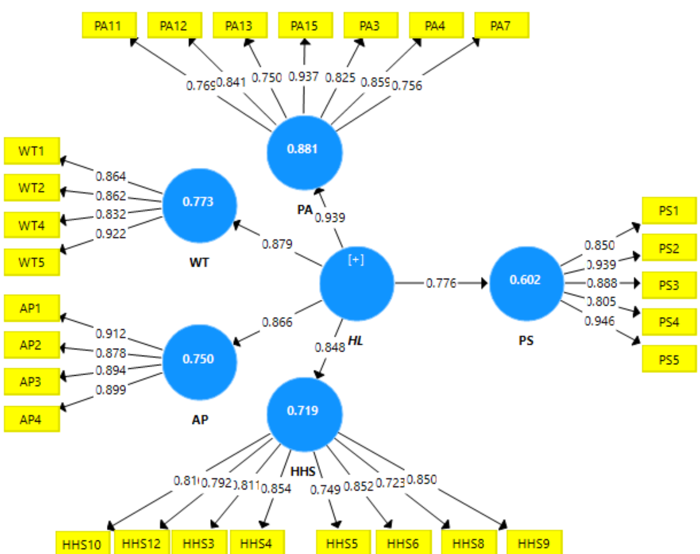

***Fig. 2**. Final SEM-PLS model*

TABLE 5

PATH COEFFICIENT AND HYPOTHESIS TESTING

	Standard Beta	Standard Error	t-statistics	p-value	Conclusion
HL → PS	0.776	0.028	27.502	<0.01	Accepted

Coefficient of determination R^2

The coefficient of determination R² is a commonly used indicator for evaluating the structural model. It represents the exogenous latent variables' effect on the endogenous latent variable. It is a measure of the model's predictive accuracy [30]. R^2 values of 0.75, 0.50 or 0.25 for the endogenous latent variable are respectively described as substantial, moderate, or weak. From the analysis, the R^2 value of the endogenous latent variable PS is 0.602. It can be concluded that 60.2% of the variance of the endogenous latent variable PS is explained by the exogenous latent variable HL.

Predictive relevance Q²

The assessment of the model predictive relevance Q² is based on the blindfolding procedure. This procedure consists of removing individual points in the data matrix of endogenous variables and estimating the model parameters using the remaining data. Using these estimates as inputs, the blindfolding procedure predicts data points that have been removed. The differences between the predicted values and the original values are used to calculate the value of Q². As a rule, Q^2 values greater than 0, 0.25 and 0.50 illustrate small, medium and large predictive relevance [30]. The Q^2 value of the endogenous variable PS is 0.469, which clearly support the predictive relevance of the model.

4 DISCUSSION

The main objective of this paper was to assess the influence of hospital logistics on patient satisfaction. With this in mind, a survey was conducted among hospitalized patients in three public hospitals in Fez-Morocco. Several patient satisfaction studies in Morocco have included certain logistics factors [32], [33], [34]. However, this study is the first to examine the effect of logistics factors in an integrated way within a model to generate a comprehensive evidence base, upon which decisions could be made. In this study, hospital logistics (HL) was modeled as a hierarchical latent variable composed of four first-order latent variables, namely: physical accessibility, waiting time, hospital hotel services, and administrative procedures. Empirical findings showed that the entire four first-order variables were significantly associated with HL and PS. Thus confirmed the existence of a strong relationship between HL components and PS. In fact, 60.2% of the variance in satisfaction is explained by the HL components used in this study. Consequently, any improvement in the effectiveness of HL activities would have a positive impact on PS. In particular, the model showed that the physical accessibility component presents a much larger positive impact on satisfaction than any of the other logistics components. It has the highest path coefficient with HL, which proves its critical aspect. This is not a surprising result because the health system in Morocco, is recognized to be suffering from accessibility issues: distance, availability of caregivers, drug availability, etc. [35], [36], [37], [38]. In this study, items that have shown the highest factor loadings with the physical accessibility component, after the overall judgment on accessibility, are related to medical transportation. This can be explained by the poor organization of the medical transportation system. In fact, it suffers from several issues, namely the lack of coordination between stakeholders and the inadequacy of the ambulance fleet [39]. It is considered one of the weakest links in the healthcare supply chain. In order to overcome transportation issues, some researchers have suggested exploring collaboration among healthcare supply chain stakeholders [39]. Besides medical transportation, the availability and accessibility of technical equipment and facilities have shown also a high factor loading with the physical accessibility component. One reason to explain this finding, in addition to being insufficient in number, medical equipment often breaks down due to a lack of follow-up and preventive maintenance. The second hospital logistics factor that has a high impact on patient satisfaction is the waiting time component. This is similar to other national and international studies [9], [40], [8], [10]. Long waiting times are the consequence of the mismatch between healthcare needs and the available resources [16]. Haghighinejad et al. [41] have studied the effects of increasing the number of beds, physicians, nurses and equipment in an emergency department. Their simulated results showed a significant improvement in reducing the waiting time. Other researchers have proposed to apply industrial engineering and operation research tools to reduce waiting time [42], and developing forecasting models to predict the number of patients in order to adapt hospital resources [43].

5 CONCLUSION

The main aim of this research was to highlight the importance of hospital logistics in patient satisfaction. Data analysis and results from the survey showed a strong relationship between the hospital logistics components and patient satisfaction. That proves that logistics activities within hospitals are critical and of crucial importance. Hence, efficient actions and the coordination of all hospital logistics activities contribute to patient satisfaction. However, in the Moroccan context, these activities are often fragmented between care units, hospital pharmacy, medical transportation services, subcontractors (for laundry, cleanliness and catering activities), etc. Consequently, hospital logistics is under the auspices of no department, which leads to poor organization and performance of logistics activities. Healthcare decision-makers should pay more attention to these issues in order to improve patient satisfaction and quality of care. Further researches are required for the integration of logistics activities.

APPENDIX

QUESTIONNAIRE ITEMS

Variables	Items	
Physical accessibility (PA)	PA1	The time required to reach this hospital
	PA2	Hospital geographic location
	PA3	Access to ambulances
	PA4	Adequate number of ambulances
	PA5	Availability of adequate parking
	PA6	The emergency department is easily accessible
	PA7	Availability of support and guidance staff
	PA8	Patient lanes and passageways are illuminated
	PA9	Signs and orientation panels exist and are clear
	PA10	Hospital accessibility to people with disabilities
	PA11	Availability of qualified and specialized physicians and nurses
	PA12	Availability and accessibility of technical equipment and facilities
	PA13	Drug availability
	PA14	Blood availability
	PA15	Overall judgment on the accessibility of care
Waiting time (WT)	WT1	Waiting time in the emergency department
	WT2	Waiting time for medical tests and radiological examinations
	WT3	Waiting time for discharge decision and actual exit
	WT4	Information on waiting times
	WT5	Overall assessment of waiting times
Hospital hotel services (HHS)	HHS1	Cleanliness of waiting rooms and examination rooms
	HHS2	The comfort of waiting and examination rooms
	HHS3	In-patient rooms and beds are available
	HHS4	Cleanliness of patient rooms
	HHS5	The in-patient rooms are well equipped
	HHS6	The comfort of the patients' rooms
	HHS7	Toilets are sufficient in number and easily accessible
	HHS8	Toilets are connected to water, are clean and have toilet paper, disinfectants, etc.
	HHS9	The smell in the hospital is pleasant
	HHS10	Meals are of good quality
	HHS11	Meals are in sufficient quantities
	HHS12	Meals are fresh
	HHS13	Meals are served on time, without delays
Administrative procedures (AP)	AP1	Clarity and ease of the administrative admission process
	AP2	Clarity and ease of payment procedure
	AP3	Clarity and organization of the discharge process
	AP4	Overall assessment of the administrative organization
Patient satisfaction (PS)	PS1	Care meets patients' needs and expectations
	PS2	Likelihood of recommending the hospital to friends and family if needed
	PS3	Likelihood of returning to this hospital if needed
	PS4	The proximity of this hospital to an ideal hospital
	PS5	Overall Satisfaction

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REFERENCES

[1] A. Más, P. Parra, R. Bermejo, M. Hidalgo, and J. Calle, “Improving quality in healthcare: What makes a satisfied patient ?,” Rev. Calid. Asist., vol. 31, no. 4, pp. 196–203, 2016.

[2] Y. Frichi, F. Jawab, and S. Boutahari, “The Mixed-Method 5W2D Approach for Health System Stakeholders Analysis in Quality of Care: An Application to the Moroccan Context,” Int. J. Environ. Res. Public Health, vol. 16, no. 16, p. 2899, Aug. 2019.

[3] A. Mohd and A. Chakravarty, “Patient satisfaction with services of the outpatient department,” Med. J. Armed Forces India, vol. 70, no. 3, pp. 237–242, 2014.

[4] WHO, “The World Health Report 2000 - Health Systems: Improving Performance,” 2000.

[5] R. Mohan and K. S. Kumar, “A Study on the Satisfaction of Patients With Reference To Hospital Services,” Int. J. Bus. Econ. Manag. Res., vol. 1, no. 3, pp. 15–25, 2011.

[6] S. Tricaud-vialle and A. Morineau, “Amélioration des propriétés de mesure d’un questionnaire de satisfaction des patients hospitalisés : application d ’ un modèle de mesure à variable latente centrale,” in 42èmes Journées de Statistique, 2010.

[7] T. Schoenfelder, J. Klewer, and J. Kugler, “Determinants of patient satisfaction: A study among 39 hospitals in an in-patient setting in Germany,” Int. J. Qual. Heal. Care, vol. 23, no. 5, pp. 503–509, 2011.

[8] S. Waters, S. J. Edmondston, P. J. Yates, and D. F. Gucciardi, “Identification of factors influencing patient satisfaction with orthopaedic outpatient clinic consultation : A qualitative study,” Man. Ther., vol. 25, pp. 48–55, 2016.

[9] C. Bleustein, D. B. Rothschild, A. Valen, E. Valaitis, L. Schweitzer, and R. Jones, “Wait Times, Patient Satisfaction Scores, and the Perception of Care,” Am. J. Manag. Care, vol. 20, no. 5, pp. 393–400, 2014.

[10] N. Delanian Halsdorfer et al., “An assessment of patient satisfaction for a short-stay program in a physical and rehabilitation medicine day hospital,”

Ann. Phys. Rehabil. Med., vol. 54, no. 4, pp. 236–247, 2011.
[11] Y. Frichi, F. Jawab, and S. Boutahari, “An Exploratory Qualitative Study of the Influence of Hospital Logistics Factors on Quality of Care and Patient Satisfaction at Public Hospitals in Morocco,” Adv. Sci. Technol. Eng. Syst. J., vol. 4, no. 6, pp. 414–422, 2019.
[12] Y. Frichi, F. Jawab, and S. Boutahari, “Patient satisfaction factors and their correspondence with hospital logistics activities,” in Proceedings of the International Conference on Industrial Engineering and Operations Management, 2018, pp. 1141–1147.
[13] S. Landry and M. Beaulieu, “La logistique hospitalière : un remède aux maux du secteur de la santé?,” Gestion, vol. 26, no. 4, pp. 34–41, 2002.
[14] F. Jawab, Y. Frichi, and S. Boutahari, “Hospital Logistics Activities,” in International Conference on Industrial Engineering and Operations Management, 2018.
[15] M. M. Derebe, M. B. Shiferaw, and M. A. Ayalew, “Low satisfaction of clients for the health service provision in West Amhara region, Ethiopia,” PLoS One, vol. 12, no. 6, pp. 1–10, 2017.
[16] T. Melo, “A note on challenges and opportunities for Operations Research in hospital logistics,” Tech. reports Logist. Saarl. Bus. Sch., no. 2, pp. 1–13, 2012.
[17] S. Villa, A. Prenestini, and I. Giusepi, “A framework to analyze hospital-wide patient flow logistics: Evidence from an Italian comparative study,” Health Policy (New. York)., vol. 115, no. 2–3, pp. 196–205, 2014.
[18] B. A. Ahmad, K. Khairatul, and A. Farnaza, “An assessment of patient waiting and consultation time in a primary healthcare clinic.,” Malaysian Fam. physician Off. J. Acad. Fam. Physicians Malaysia, vol. 12, no. 1, pp. 14–21, 2017.
[19] M. Duggirala, C. Rajendran, and R. N. Anantharaman, “Patient-perceived dimensions of total quality service in healthcare,” Benchmarking An Int. J., vol. 15, no. 5, pp. 560–583, 2008.
[20] B. Mohamed and N. A. Azizan, “Perceived service quality’s effect on patient satisfaction and behavioural compliance,” Int. J. Health Care Qual. Assur., vol. 28, no. 3, pp. 300–314, 2015.
[21] L. Zemour, A. Belghitri, I. Damouche, K. Reguieg, R. Tedjani, and N. Midoun, “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,” Rev. Epidemiol. Sante Publique, vol. 64, p. S260, 2016.
[22] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) - Second Edition, Second. Los Angeles: SAGE Publications, Inc, 2017.
[23] R. B. Kline, Principles and Practice of Structural Equation Modeling - Third Edition. The Guilford Press, 2011.
[24] Y. Frichi, F. Jawab, and S. Boutahari, “SEM to analyze the interaction between hospital logistics and quality of care, a systematic review,” in International Colloquium on Logistics and Supply Chain Management, LOGISTIQUA 2019, 2019.
[25] J. C. V. Schmalbach and F. J. Maza Avila, “Structural equation models applied for evaluating service quality and satisfaction in the healthcare system of Cartagena de Indias D. T. Y C. (Colombia),” Econ. Sociol., vol. 11, no. 2, pp. 200–215, 2018.
[26] D. Barclay, C. Higgins, and R. Thompson, “The Partial Least Squares Approach to Causal Modeling: Personal Computer Adoption and Use as an Illustration, Technology Studies,” Spec. Issue Res. Methodol., vol. 2, no. 2, pp. 285–309, 1995.
[27] S. McQuitty and M. Wolf, “Structural Equation Modeling: A Practical Introduction,” J. African Bus., vol. 14, no. 1, pp. 58–69, 2013.
[28] R. D. Hays, D. Revicki, and K. S. Coyne, “Application of Structural Equation Modeling to Health Outcomes Research,” Eval. Health Prof., vol. 28, no. 3, pp. 295–309, 2005.
[29] M. Sarstedt and J.-H. Cheah, “Partial least squares structural equation modeling using SmartPLS: a software review,” J. Mark. Anal., no. 1, 2019.
[30] J. F. Hair, J. J. Risher, M. Sarstedt, and C. M. Ringle, “When to use and how to report the results of PLS-SEM,” Eur. Bus. Rev., vol. 31, no. 1, pp. 2–24, 2019.
[31] C. Fornell and D. F. Larcker, “Evaluating Structural Equation Models with Unobservable Variables and Measurement Error,” J. Mark. Res., vol. 18, no. 1, pp. 39–50, 1981.
[32] K. Amazian, I. Toughrai, N. Benmansour, S. A. Laalim, M. E. A. El Alami, and K. Mazaz, “Enquête de satisfaction des patients atteints de cancer dans un hôpital universitaire au Maroc,” Sante Publique (Paris)., vol. 25, no. 5, pp. 627–632, 2013.
[33] J. Kasouati, L. Bouti, O. Zidouh, Z. Abd El Hamid, A. Boufaresse, and M. Mrabet, “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,” Rev. Epidemiol. Sante Publique, vol. 63, p. S75, 2015.
[34] N. Damghi et al., “Patient satisfaction in a Moroccan emergency department,” Int. Arch. Med., vol. 6, no. 1, p. 20, 2013.
[35] I. Ibn El Farouk, A. Talbi, and F. Jawab, “Development of a Set of Indicators to Manage Medicines Supply Chain in Moroccan Public Hospital , Application of the SCOR Model,” Int. J. Bus. Dev., vol. 3, no. 3, pp. 147–158, 2013.
[36] Ministère de la Santé, “Enquête Nationale sur la Population et la Santé Familiale (ENPSF) - 2018,” Rabat, Morocco, 2018.
[37] HCP, “Les indicateurs sociaux du Maroc - Edition 2018,” Rabat, 2018.
[38] M. Legros and F. Chaoui, “Les systèmes de santé en Algérie, Maroc et Tunisie : Défis nationaux et enjeux partagés,” Paris, 2012.
[39] Y. Frichi, A. Ben Kacem, F. Jawab, O. Kamach, and S. Chafik, “Improving Interhospital Medical Patient

Transportation in Morocco: A Forecasting Collaborative Approach," in Transportation, Logistics, and Supply Chain Management in Home Healthcare: Emerging Research and Opportunities, J. Euchi, Ed. Pennsylvania, USA: IGI Global, 2020, pp. 136–162.

[40] E. Bouaiti, S. Zidouh, A. Boufaress, J. Kessouati, M. Mrabet, and L. Belyamani, "Facteurs déterminants de la satisfaction des patients consultant aux urgences de l'hôpital militaire d'instruction Mohamed V de Rabat, Maroc," Rev. Epidemiol. Sante Publique, vol. 64, pp. S140–S141, 2016.

[41] H. A. Haghighinejad et al., "Using queuing theory and simulation modelling to reduce waiting times in an Iranian emergency department," Int. J. Community Based Nurs. Midwifery, vol. 4, no. 1, pp. 11–26, 2016.

[42] D. Gupta and B. Denton, "Appointment scheduling in health care: Challenges and opportunities," IIE Trans., vol. 40, no. 9, pp. 800–819, 2008.

[43] D. Golmohammadi, "Predicting hospital admissions to reduce emergency department boarding," Int. J. Prod. Econ., vol. 182, pp. 535–544, 2016.