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## Article

Modeling the impact of hospital logistics on quality of care and patient satisfaction: Results of a survey in three public healthcare facilities in Fez, Morocco

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## Modeling the Impact of Hospital Logistics on Quality of Care and Patient Satisfaction: Results of a Survey in Three Public Healthcare Facilities in Fez - Morocco

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### Abstract:

**Purpose:** The objective of this research is to examine the role of hospital logistics in improving quality of care and patient satisfaction. Thus, the paper focuses on modeling and evaluating the relationship between these three constructs.

**Design/methodology/approach:** In the present study, hospital logistics was specified as a second-order construct composed of five first-order constructs: physical accessibility, waiting time, consultation time, hospital hotel services, and administrative procedures. A questionnaire was developed and administered face-to-face to 384 hospitalized patients in three public healthcare facilities in Fez-Morocco. Collected data were processed and analyzed deploying the PLS-SEM method and using SmartPLS3 software. Data analysis was carried out by considering two types of patient circuits according to the admission modes in the healthcare facility: Urgent Patients Circuit and Scheduled Patients Circuit. Thus, two PLS-SEM models were evaluated and validated.

**Findings:** Results highlighted the significant impact of hospital logistics on quality and satisfaction. In particular, the results of the two models showed that the most preponderant hospital logistics component is physical accessibility which consists of the availability and accessibility of ambulances, medical and nursing staff, support and guidance staff, technical facilities and equipment, etc. Thus, hospital managers and health system stakeholders should pay particular attention to hospital logistics activities in general and specifically to the physical accessibility to improve the quality of care and patient satisfaction.

**Research limitations/implications:** This study only included patients from three public healthcare facilities in Fez-Morocco. Also, the model variables of hospital logistics construct are restricted and were applied in a specific context. Besides, the sample size was relatively reduced. Thus, results generalization might be limited. Further studies including more patients from other territories and including other logistics components are needed for large-scale validation of the proposed model.

**Originality/value:** The results of this study contribute to the scientific literature on hospital logistics and its role as a lever for quality of care and patient satisfaction.

**Keywords:** hospital logistics, quality of care, patient satisfaction, modeling, PLS-SEM, Morocco

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## 1. Introduction

In 2015, Member States of the United Nations adopted the seventeen Sustainable Development Goals (SDGs) to be achieved by 2030. In particular, the SDG3 on health and well-being aims to improve the health status of individuals and promote access to quality care (United Nations, 2015). Morocco, as a member state of the United Nations, has implemented several health strategies, intending to provide quality and patient-centered healthcare services. In this context, Moroccan healthcare facilities are required to constantly improve the quality of care and enhance patient satisfaction. In that respect, hospital managers often focus the improvement efforts on reorganizing medical activities and show little interest in hospital logistics activities (Jobin, Beaulieu & Boivin, 2004). This is because the primary goal of healthcare facilities is to provide care, therefore managers have historically looked at healthcare challenges through a clinical lens (Landry & Philippe, 2004). However, several scholars have suggested looking at some of these challenges through the support services lens. They have highlighted the role of hospital logistics in helping healthcare facilities respond to health system challenges. In particular, hospital logistics is considered as a determining factor and lever for quality of care and patient satisfaction (Costin, 2010; Kriegel, Jehle, Dieck & Mallory, 2013; Kwon, Kim & Martin, 2016).

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 (Landry & Beaulieu, 2002). Studies agree that optimized hospital logistics enhances patient-centered care (Chow & Heaver, 1994; Villa, Barbieri & Lega, 2009). Indeed, some patient satisfaction studies have included logistics factors in their surveys and concluded the significant impact of these factors on quality and satisfaction levels. However, to the authors' knowledge, there is no research on the evaluation of logistics factors on quality and satisfaction in an integrated way (Frichi, Jawab & Boutahari, 2019b). Hence a lack of clear and comprehensive evidence base that decision-makers could rely on to monitor the health system. Determining the extent of the contribution of hospital logistics to quality and patient's level of satisfaction is quite interesting considering the bunch of valuable information it will generate. Thus, the objective of this paper is to examine and confirm the positive impact of hospital logistics on quality of care and patient satisfaction.

The health system in Morocco is organized into two main sectors. The first is the public sector, made up of the healthcare services of the Ministry of Health, defense department and local authorities. The second is the private sector, which comprises the private for-profit sector, that includes hospital clinics, physicians' offices, dental surgery offices, pharmacies, etc., and the private not-for-profit sector, which encompasses health facilities of non-governmental organizations, Mutuels and National Fund of Social Security, Moroccan Red Crescent, etc. In this article, the focus is on the public health sector, particularly the healthcare services of the Ministry of Health, as they represent the bulk of the total healthcare offer, about 85% of the national hospital bed capacity (Bouhaddou, Bennani Othmani & Diouny, 2013).

The remainder of this paper is structured as follows. Section 2 reviewed the literature on quality of care and patient satisfaction and their interactions with hospital logistics. It formulated the research hypotheses and the theoretical research model. Section 3 detailed the methodology for hypotheses assessment and validation. It consisted of a description of the healthcare facilities where the study was conducted, the participants included in the study, the questionnaire development and data analysis. Section 4 provided the research results while describing the various steps of model validation. Section 5 interpreted and discusses the obtained results. The last section concluded the paper and gave insights into future research.

## 2. Background

### 2.1. Quality of Care and Patient Satisfaction

Definitions of quality of care (QC) have been the subject of several studies in the literature. However, there no existing or likely consensus on a standardized definition (Nylenna, Bjertnaes, Saunes & Lindahl, 2015). The American National Academy of Medicine defined QC 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 & Schroeder, 1990). This definition underlined the clinical effectiveness of healthcare with the aim of improving the outcomes. These outcomes, according to Donabedian (2003), are the effects of healthcare on the population

health status. Examples of healthcare outcomes are reduced mortality rates, restoration of function and survival, reduced hospital-acquired infections, improved patient satisfaction, etc. Furthermore, the QC should also reflect the wishes of health system stakeholders (Frichi, Jawab & Boutahari, 2019c). On that point, some researchers have proposed to link QC to stakeholder satisfaction (Bautista & Tangsoc, 2016), and particularly to the satisfaction of patients, as they are the most important stakeholder group in the health system (Frichi et al., 2019c; Symmank, Krause & Gurtner, 2015).

Patient satisfaction (PS) is an assessment that reflects the patient's perceived differences between what is expected and what is received during the care process (Mohd & Chakravarty, 2014). The measurement of PS is an essential element in the evaluation of QC (Derebe, Shiferaw & Ayalew, 2017; Más, Parra, Bermejo, Hidalgo & Calle, 2016). Indeed, the literature on the assessment of QC shows extensive use of PS measurement as an indicator of QC (Akachi & Kruk, 2017; Frosch, 2015). Thus, we hypothesize that:

*H1: Quality of care (QC) influences positively patient satisfaction (PS).*

The goal of PS studies and surveys is to understand its associated factors, whose improvement could contribute to enhancing the quality of the healthcare system (Park, Park, Kwon, Kang & Noh, 2016). Factors thought to be associated with PS include patient demographics and health characteristics (Soufi, Belayachi, Himmich, Ahid, Soufi, Zekraoui et al., 2010; Verulava, Jorbenadze, Karimi, Dangadze & Barkalaia, 2018), healthcare workers attitude and behavior (Fang, Liu & Fang, 2019), accessibility of care (Pölluste, Kallikorm, Meesaar & Lember, 2012), waiting time (Bleustein, Rothschild, Valen, Valaitis, Schweitzer & Jones, 2014), consultation time (Howie, Porter, Heaney & Hopton, 1991), administrative procedures (Mohamed & Azizan, 2015), hospital hotel services (Sevin, 2018; Suess & Mody, 2018), etc.

## 2.2. Hospital Logistics and its Interaction with QC and PS

Logistics is a rather diffuse function; it takes different forms that vary over time and context. In particular, hospital logistics (HL) has been defined in different ways in the literature. The French Association of Supply Chain and Logistics (ASLOG) defined HL as *the management of the flow of patients, products, materials, services, and the related information to ensure quality and safety at a defined level of performance and efficiency, from the provider to the patient and, as appropriate, to the final destination* (Beaulieu, Bentahar & Benzidia, 2019). HL is concerned with the management of flows to produce and deliver healthcare effectively. The HL includes a wide range of ancillary and support activities necessary in providing healthcare. It comprises planning and scheduling activities, purchase and replenishment management, distribution of equipment and medical supplies to care units, patients and products transportation, information system management, facilities maintenance, waste management, production activities such as laundry, sterilization, and hospital kitchen, etc. (Beaulieu & Venne, 2018; Jawab, Frichi & Boutahari, 2018).

Given its critical aspect in the provision of healthcare as well as its broad scope of intervention, HL is a research area that attracts researchers worldwide. In fact, the literature reviews of Moons, Waeyenbergh and Pintelon (2019), Volland, Fügner, Schoenfelder and Brunner (2017), and Narayana, Kumar Pati and Vrat (2014) highlighted the extent of studies conducted in the field of logistics in the health sector. Some of these studies argued that HL has a crucial role in improving QC and PS (Frichi, Jawab, Boutahari, Zehmed, Moufad et al., 2018; Landry & Philippe, 2004; Melo, 2012). Melo (2012) considered that logistics activities impact significantly the quality of healthcare provided. According to Landry and Philippe (2004), optimizing and reengineering healthcare logistics could bring new sources of effectiveness and efficiencies both in logistical and clinical terms. HL aims at ensuring smooth physical, information and financial flows, and reducing the waiting time by a timely provision of needed resources to meet demands of healthcare users as well as the healthcare system as a whole (Buntak, Kovačić & Martinčević, 2019; Landry & Philippe, 2004). For instance, the unavailability of supplies may postpone a planned surgical intervention and negatively impact the patient's health. Logistics services enable the necessary production factors (caregivers, medicines, medical devices, etc.) to be available, functional and accessible as needed at the point of care (Kriegel et al., 2013).

Several factors associated with PS such as physical accessibility, waiting time, consultation time, hospital hotel services, and administrative procedures are highly dependent on the effectiveness of logistics activities in hospitals

(Azzi, Persona, Sgarbossa & Bonin, 2013; Costin, 2010; Frichi, Jawab & Boutahari, 2018). In the following we provided the main interactions between HL on one hand and QC and PS on the other:

*Physical accessibility of healthcare (PA)*: it refers to geographically accessible healthcare, provided in settings where the necessary and adequate skills and resources are available and appropriate to medical needs (Munir, Hafeez, Rashid, Iqbal & Javed, 2019; WHO, 2006). It is about the physical ease with which patients receive healthcare services. To attain favorable healthcare outcomes in terms of QC and PS, healthcare services should be combined with improvements in PA (Munir et al., 2019). The PA includes access to healthcare facilities, which means the availability of medical transportation and access to care within the healthcare facility, particularly in terms of the availability of human resources (doctors, nurses, laboratory technicians, etc.) and materials (drugs, medical supplies, technical equipment, etc.). Thus, the ease of PA contributes to enhancing PS and QC (Derebe et al., 2017; Verulava et al., 2018).

*Waiting time (WT)*: is the time between the patient's arrival at the hospital and the consultation (Assefa, Mosse & Hailemichael, Y., 2011). Some authors include in WT, post-consultation time when patients have to wait in order to retrieve their medical record and physician's note before leaving the healthcare facility (Johnson & Russell, 2015). WT was considered as a dimension of PS and a critical component of QC (Bleustein et al., 2014). In most PS studies, long WT has been found frustrating to patients and a predictor of patient dissatisfaction (Abu-Odah, Abu Salah, El-Khateeb & El-Nems, 2018; Hussain, Asif, Jameel & Hwang, 2019). WT can result from several factors, including delays in intervention planning, poor organization, unclear and complex administrative procedures, large patient flows, unavailable resources to meet medical needs, etc. (Bleustein et al., 2014; Derebe et al., 2017).

*Consultation time (CT)*: is the time that caregivers spend with the patient (Assefa et al., 2011). It is considered to be an important attribute of PS and QC. Long CT is associated with higher satisfaction (Bleustein et al., 2014). The CT can be shortened because caregivers spent a huge amount of their time managing administrative and logistics activities, organizing care units and recording patients' information, which reduces the available time for consultations (Howie et al., 1991). Therefore, it is necessary to free caregivers from these time-consuming logistics and administrative activities so as to devote more time to patients (Landry & Beaulieu, 2013). Studies have estimated that a nurse spends between 30% and 34% of her time performing logistics and administrative activities (Lerebours, Saltel, Béthune-volters, Nallet, Bourdat, Vesin-etterlen et al., 2015). According to WHO, a rational division of tasks among health workers is an effective strategy for enhancing care accessibility and quality (WHO, 2012). For example, freeing caregivers from logistics activities would allow them to focus on their mission of providing healthcare and consequently giving more time to patients (Beaulieu, 2019).

*Hospital hotel services (HHS)*: these cover the conditions under which patients are accommodated in hospitals, including catering, cleanliness, hotel comfort, etc. All of these conditions significantly affect the PS level (Chougrani & Ouhadji, 2014; Halsdorfer, Blasquez, Bensoussan, Gentile, Collado, Viton et al., 2011; Marama, Bayu, Merga & Binu, 2018). Thus, it is necessary to pay great attention to these hotel services. For instance, the catering activity requires an adapted supply system to guarantee fresh meals, as well as better coordination between the catering department and the health care teams to take into account the nutritional specificities of each patient. The cleaning activity is responsible for the cleanliness of the premises. It requires that cleaning articles are available in the right quantities and at the right places, as well as appropriate management of hospital waste. The hospital laundry provides services such as the cleaning of linen, towels and staff uniforms, which ensures the comfort and hygiene to hospitalized patients. For this reason, well-adapted logistics circuits are required for the definition of clean and dirty linen storage areas, transportation, operation scheduling (disinfection, washing, rinsing, and drying) (WHO, 2008).

*Administrative procedures (AP)*: they include administrative formalities and procedures relating to patient admission, medical treatment, and discharge processes. The clarity and simplicity of AP are fundamental to PS (Duggirala, Rajendran & Anantharaman, 2008; Mohamed & Azizan, 2015). In contrast, complex and repetitive AP have been identified as one of the main causes of waiting times (Ahmad, Khairatul & Farnaza, 2017). Information flows, in particular, AP can be optimized and simplified through the use of hospital information systems, which have a



decisive effect on information availability and reliability (Benamirouche, 2015). The use of information systems allows the collection, sharing and use of patient data for better health care delivery (Parks, Wigand, Bennani Othmani, Serhier & Bouhaddou, 2019).

All of the above PS factors fall within the scope of HL. Based on these facts, our research hypotheses state that HL impacts both PS and QC (Figure 1):

*H2: Hospital logistics (HL) has a positive impact on quality of care (QC);*

*H3: Hospital logistics (HL) has a positive impact on patient satisfaction (PS).*

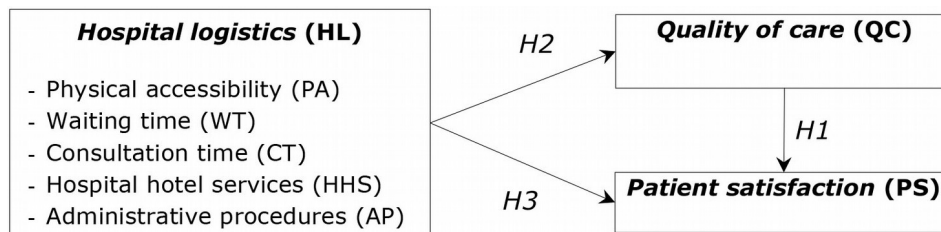


Figure 1. Hypothetical model

The hypotheses of the model in Figure 1 were supported and consolidated in an exploratory qualitative study in the form of semi-structured interviews with healthcare professionals and patients in the Moroccan context (Frichi, Jawab & Boutahari, 2019a). The objective of the present study is to confirm empirically the hypothetical model with quantitative data.

In order to reduce the complexity of the model in Figure 1 and to test assumptions about the influence of HL on QC and PS, we modeled the variable HL as a second-order hierarchical reflective latent variable composed and measured by five first-order latent variables: PA, WT, CT, HHS and AP (Figure 2).

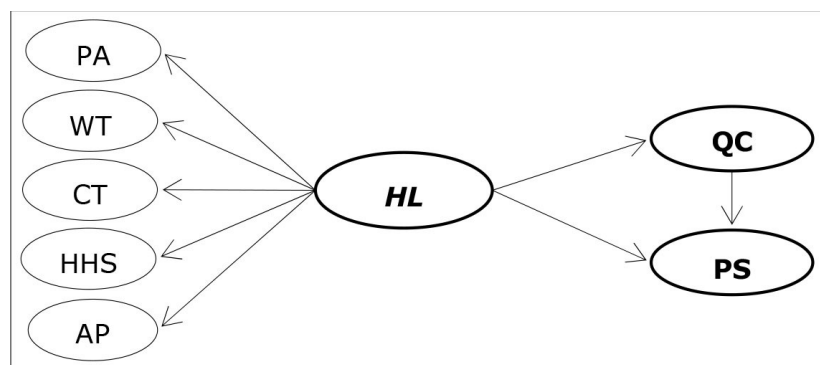


Figure 2. Theoretical model

The adopted method for hypotheses confirmation and validation is the Structural Equation Modelling (SEM), which tests statistically hypothetical correlation and causality relationships (Roussel & Wacheux, 2005). This choice is justified by the objective of this research, which is to prove the correlation between HL, QC, and PS. Indeed, SEM is appropriate for modeling relationship systems, where correlations are hypothesized between a set of independent variables and dependent variables. In particular, SEM is recommended when key concepts are complex, multi-faceted, and difficult to measure (Kline, 2011). Also, SEM has known a wide application in the health and logistics sectors (Frichi et al., 2019b). As an indication, in the health sector, we cite (Schmalbach & Avila, 2018; Al-Mhasnah, Salleh, Afthanorhan & Ghazali, 2018; Jang & Jang, 2017) and in the logistics sector (Moufad & Jawab, 2019; Errassafi, Abbar & Benabbou, 2019; De Carvalho, Kalid & Rodriguez, 2019).

### 3. Methods

#### 3.1. Settings

This study was conducted in three public healthcare facilities in Fez-Morocco. These facilities account for almost all the public hospital care supply in the city of Fez. The characteristics of these healthcare facilities are described in Table 1.

Healthcare facility	Functional bedding capacity	Population served
Prefectural Hospital	282	1 427 917
Regional Hospital	250	4 412 905
University Hospital	950	5 961 868

Table 1. Study settings' characteristics

#### 3.2. Participants

The study participants are patients who had been hospitalized for at least 48 hours in one of the three healthcare facilities listed in Table 1. Thus, only patients who had experienced the entire process of the healthcare service and its related logistics activities are included in the survey. On the other hand, were excluded patients who had only benefited from outpatient care, patients under 18 years of age, and patients with acute physical and mental disabilities. The questionnaire was administered face-to-face to patients who met the inclusion criteria during the discharge process. The survey period was spread over 3 months from November 2019 to January 2020.

#### 3.3. Questionnaire Development

The confirmation and validation of the theoretical model in Figure 1 consist of testing it with empirical data. For this reason, it is essential to have an instrument for measuring the model variables. To establish the measurement instrument, we have drawn inspiration from the paradigm suggested by Churchill (1979). The first step of the paradigm is to generate a sample of items capable to measure the variables. Through literature research, 56 items were generated. The second step deals with content validity, which assesses the degree to which the generated items capture the research constructs and are suitable for use in a survey. This step was carried out in two focus groups conducted sequentially. The first is made up of healthcare professionals from the Regional Hospital. It included the quality manager, the head of the medical affairs unit, the head of the nursing unit, and the head of the social care unit. The second focus group was organized with healthcare professionals of the Prefectural Hospital. It was composed of two nurses and a doctor. Focus groups participants were chosen based mainly on their experience and availability. At the end of the two focus groups, some items were judged inadequate and therefore deleted, or poorly formulated and therefore reformulated, while other items were grouped into a single item because they referred to similar aspects. On the other hand, some items were added by the participants.

It was noticed that some items are appropriate only for patients admitted through the emergency department, such as ambulance availability, while other items are more appropriate for scheduled patients, such as appointment delays. Accordingly, we decided to consider two patient circuits: Urgent Patients Circuit (UPC) and Scheduled Patients Circuit (SPC). Thus, the questionnaire questions are adapted according to the circuit type. The final results of the selected items are presented in Table 2. Constructs of PA, WT, and AP for the UPC were measured using items PAE1 to PAE15, WT1 to WT5 and APE1 to APE4 respectively. Similarly, the same constructs for the SPC were measured using items PAS1 to PAS12, WTS1 to WTS7 and APS1 to APS5. For the other model's constructs CT, HHS, QC, and PS, they were measured by items CT1, CT2, HHS1 to HHS13, QC1 to QC4, and SP1 to SP5 for both circuits UPC and SPC (Table 2).

The measurement scale adopted in this study is the Likert scale. Roussel and Wacheux (2005) recommended 5-point scales when questionnaires are long (more than 60 items), and 7 or 9-point scales in the opposite case. Following these recommendations, we opted for a 7-point Likert scale ranging from “strongly agree (7)” to “strongly disagree (1)”.

Variables	Items			Sources
PA	PAE1	PAS1	Time to reach the hospital	(Derebe et al., 2017)
	PAE2	PAS2	Hospital geographic location	(Lobo, Duarte, Carvalho, Rodrigues, Monteiro & Alves, 2014)
	PAE3		Ambulance access	(Schmalbach & Avila, 2018)
	PAE4		Adequate number of ambulances	(Schmalbach & Avila, 2018)
	PAE5	PAS3	Availability of adequate parking	(Badri, Dodeen, Al Khaili & Abdulla, 2005)
	PAE6		Ease of access to the emergency department	Focus group results
	PAE7	PAS4	Availability of support and guidance staff	Focus group results
	PAE8	PAS5	Lighting and clarity of patient lanes and passageways	Focus group results
	PAE9	PAS6	Signs and orientation panels	(Lobo et al., 2014)
	PAE10	PAS7	Ease of access for persons with disabilities	Focus group results
	PAE11	PAS8	Availability of qualified and specialized doctors and nurses	(Bautista & Tangsac, 2016)
	PAE12	PAS9	Availability and accessibility of technical equipment and facilities	(Schmalbach & Avila, 2018)
	PAE13	PAS10	Availability of prescribed drug	(Marama et al., 2018)
	PAE14	PAS11	Blood Availability	(Duggirala et al., 2008)
	PAE15	PAS12	Overall physical accessibility of care	(Schmalbach & Avila, 2018)
WT		WTS1	Appointment delays	(Dagger & Sweeney, 2007)
		WTS2	Waiting time for registration	(Nottingham, Johnson & Russell, 2018)
		WTS3	Waiting time for medical consultation	(Nottingham et al., 2018)
	WT1		Waiting time in the emergency department	Focus group results
	WT2	WTS4	Waiting time for medical tests and radiological examinations	(Duggirala et al., 2008)
	WT3	WTS5	Delays between discharge decision and effective discharge	(Soares, Marinho, Fernandes, Moreira Gonçalves, Camila-Dias, Gonçalves et al., 2015)
	WT4	WTS6	Information about any delays	(Nottingham et al., 2018)
	WT5	WTS7	Overall assessment of waiting times	(Derebe et al., 2017)
CT	CT1		Amount of time the physicians spent with you	(Verulava et al., 2018)
	CT2		Amount of time the nursing staff spent with you	(Duggirala et al., 2008)
HHS	HHS1		Cleanliness of waiting and consultation rooms	(Assefa et al., 2011)
	HHS2		Comfort of waiting and consultation rooms: air conditioning, availability of chairs, etc.	(Abu-Odah et al., 2018)
	HHS3		Availability of in-patient rooms and beds	Focus group results
	HHS4		Cleanliness of patient rooms	(Marama et al., 2018)
	HHS5		Patient rooms are well equipped: TV, shower, clean towels, pillows, etc.	Focus group results
	HHS6		Comfort of the patients' rooms: air conditioning, calm, beds in good repair, etc.	(Dagger & Sweeney, 2007)
	HHS7		Number of toilets and their accessibility	Focus group results



Variables	Items		Sources	
	HHS8	Cleanliness of toilets: availability of toilet paper, disinfectants, etc.	(Marama et al., 2018)	
	HHS9	The smell in the hospital	Focus group results	
	HHS10	Quality of meals	(Halsdorfer et al., 2011)	
	HHS11	Quantity of meals	Focus group results	
	HHS12	Freshness and hygiene of meals	Focus group results	
	HHS13	Respect for meal delivery times	Focus group results	
AP		APS1	Ease of getting appointments	(Verulava et al., 2018)
	APE1	APS2	Clarity and ease of the admission administrative process	(Marama et al., 2018)
	APE2	APS3	Clarity and ease of payment procedure	(Badri et al., 2005)
	APE3	APS4	Clarity and ease of discharge procedure	(Dagger & Sweeney, 2007)
	APE4	APS5	Overall hospital administrative procedure	(Um & Lau, 2018)
QC	QC1		Excellence of care provided	(Soares et al., 2015)
	QC2		Extent to which the care provided is of high standards	(Um & Lau, 2018)
	QC3		Extent to which the quality of care at this hospital is good in comparison with other hospitals	(Duggirala et al., 2008)
	QC4		Overall quality of care	(Schmalbach & Avila, 2018)
PS	PS1		Fulfillment of needs and expectations	(Aljaberi, Juni, Al-Maqtari, Lye, Saeed, Al-Dubai et al., 2018)
	PS2		Likelihood of recommending this hospital	(Johnson & Russell, 2015)
	PS3		Likelihood of choosing the same hospital	(Badri, Attia & Ustadi, 2009)
	PS4		Proximity of this hospital to an ideal hospital	(Kashkoli, Zarei, Daneshkohan & Khodakarim, 2017)
	PS5		Overall satisfaction	(Aljaberi et al., 2018)

Table 2. Questionnaire items

### 3.4. Data Analysis

For the evaluation and validation of the proposed model, we used the SEM. There are two SEM approaches for estimating model parameters: PLS-SEM and CB-SEM. The PLS-SEM technique can be used in explanatory and predictive research. It is suitable for complex models for which the theory is not sufficiently developed. Also, PLS-SEM does not make any data distributional assumptions and can be used for a small sample size. As for the CB-SEM technique, it is used in explanatory research. It requires a normal data distribution and a large sample size (Hair, Hult, Ringle & Sarstedt, 2017). Schmalbach and Avila (2018) used the two approaches PLS-SEM and CB-SEM for validating their model on the evaluation of citizens' satisfaction regarding healthcare services' quality. The authors validated the applicability of the two approaches to their research model. Nevertheless, they favored the PLS-SEM approach, since it presented advantages over the CB-SEM approach, notably the flexibility in its application in the social science area, where data are usually not normally distributed, and the sample size is small. Hence, and following the recommendations of Hair et al. (2017), we opted for the PLS-SEM approach for the estimation of the model parameters. The data collected through the survey were processed using SmartPLS3 software.

### 3.5. Sample

The sample size for this study was calculated based on the rule of thumb for PLS-SEM model estimation parameters proposed by Barclay, Higgins and Thompson (1995). The rule of thumb specified that the minimum

sample size is 10 times the maximum number of manifest variables of any latent variable in the measurement model, and 10 times the maximum number of paths aiming at any latent variable.

In the UPC model, the latent variable with the largest number of manifest variables is the PA, which has 15 manifest variables. For the SPC model, the largest number of manifest variables is 13 corresponding to the HHS. According to the rule of Barclay et al. (1995), a minimum of 150 participants for the first circuit and 130 for the second are required.

### 3.6. Ethical Approval

The conduct of this study in the above-mentioned hospitals was approved by the decision of the Fez-Meknes Regional Health Directorate No. 7579/SRHC/UGC3.

## 4. Results

### 4.1. Participants Characteristics

Four hundred thirty-seven patients were approached, 53 of them refused to participate because of a lack of time or unwillingness to take part in the study. Thus, 384 patients were included in the study, of which 242 (63%) were women and 142 (37%) men. The number of patients admitted through the emergency department was 235 (61.20%) and 149 (38.80%) were scheduled patients. Most of the participants (45.57%) were young people between 25 and 34 years of age. Residents of cities represented 61.20% of the respondents, those living in villages and remote areas represented 21.87% and 16.93% respectively. Nearly 50% of the surveyed population had a lower level of education. 26% of surveyed patients were hospitalized in the Prefectural Hospital, 37.24% in the Regional Hospital and 36.72% in the University Hospital. In terms of monthly income, 45.31% earned less than 260 USD, 24% had an income between 260 and 600 USD, and 17.54% between 600 and 1000 USD per month. As for the type of medical coverage, 35.42% had RAMED assurance, 25.52% CNOPS, 14.06% CNSS, 3.65% other types, and 21.35% had no coverage (Table 3).

Data normal distribution was checked by skewness and kurtosis tests. For normally distributed data, skewness values should be between +1 and -1, and kurtosis values should be less than +1 (Hair et al., 2017). The application of these tests revealed that our data distribution was not normal.

Variable	Type	Frequency	%
Sex	Women	242	63.02
	Men	142	36.98
Type of admission	Emergency department	235	61.20
	Scheduled patient	149	38.80
Age (year)	[18 – 24]	82	21.35
	[25 – 34]	175	45.57
	[35 – 44]	68	17.70
	[45 – 59]	33	8.59
	Above 60	26	6.77
Residence area	City	235	61.20
	Village	84	21.87
	Remote region	65	16.93
Level of education	Primary	191	49.74
	Secondary	98	25.52
	Bac and Bac+5	60	15.62
	bac+5 and above	35	9.11

Variable	Type	Frequency	%
Income (USD)	Less than 260	174	45.31
	[260 – 600]	92	23.96
	]600 – 1000]	67	17.45
	]1000 – 1500]	39	10.15
	Above 1500	12	3.12
Healthcare facility	Prefectural hospital	100	26.04
	Regional hospital	143	37.24
	University hospital	141	36.72
Healthcare coverage	RAMED	136	35.42
	CNOPS	98	25.52
	CNSS	54	14.06
	Other	14	3.65
	None	82	21.35

Table 3. Participants' socio-demographic characteristics

## 4.2. Model Assessment and Validation

As indicated earlier, we distinguished between two types of patient circuits depending on the admission type. Thus, we have considered two models: the UPC model and the SPC model. The two models were evaluated separately following guidelines and criteria recommended by Hair, Risher, Sarstedt and Ringle (2019).

### 4.2.1. Measurement Model

The assessment of the measurement model with reflective indicators consisted of checking indicators reliability, internal consistency reliability, convergent validity, and discriminant validity (Sarstedt & Cheah, 2019).

*Indicators reliability:* The first step in evaluating the measurement model is to check the reliability of each manifest variable by examining its factor loading in the latent variable. It is recommended that only items with factor loadings greater than 0.708 be retained (Hair et al., 2019). Therefore, in the UPC model, 8 items of the latent variable PA and 5 items of the variable HHS, as well as one item of the variable WT, were eliminated. Similarly, in the SPC model, 7 items of the variable PA, 6 items of the variable HHS and one item of the variable WT were removed, because their loadings were lower than 0.708. Also, these items did not show significant factorial contributions with any of the other latent variables. Furthermore, it was observed that the elimination of these items increased the Average Variance Extracted (AVE) values. Retained items are reported in Table 4.

*Internal consistency reliability:* constructs internal consistency was assessed using Cronbach's alpha and composite reliability (CR). Higher values of Cronbach's alpha and CR, above 0.7 or 0.8, generally indicate a high level of reliability (Meena & Sarmah, 2012), but they should not be greater than the limit of 0.95 as recommended by Hair et al. (2017). The results of Cronbach's alpha and CR are satisfactory (Table 4).

*Convergent and discriminant validity:* the convergent validity of each bloc of items was examined using the AVE values, which must be greater than 0.5 (Table 4). Discriminant validity indicates the extent to which a construct is different from all the model other constructs (Raposo, Alves & Duarte, 2009). It was evaluated by establishing the cross-loadings matrix, which consists of checking that the loading of each indicator in its latent variable is greater than all its loadings in the other latent variables of the model (Hair et al., 2017). Cross-loadings results are given in Table 5. All indicators did not show higher loadings in any other latent variable than in the one they intended to measure.

Variables	UPC model					SPC model				
	Item	Loading	Cronbach $\alpha$	CR	AVE	Item	Loading	Cronbach $\alpha$	CR	AVE
PA	PAE3	0.823	0.917	0.934	0.671	PAS4	0.787	0.887	0.918	0.692
	PAE4	0.855				PAS8	0.882			
	PAE7	0.763				PAS9	0.773			
	PAE11	0.770				PAS10	0.778			
	PAE12	0.835				PAS12	0.927			
	PAE13	0.729								
	PAE15	0.940								
WT	WT1	0.865	0.888	0.923	0.749	WTS1	0.779	0.918	0.936	0.710
	WT2	0.859				WTS2	0.868			
	WT4	0.824				WTS3	0.855			
	WT5	0.911				WTS4	0.863			
						WTS6	0.798			
						WTS7	0.889			
CT	CT1	0.900	0.799	0.908	0.832	CT1	0.905	0.806	0.911	0.837
	CT2	0.924				CT2	0.924			
HHS	HHS3	0.796	0.921	0.936	0.646	HHS1	0.763	0.898	0.920	0.621
	HHS4	0.854				HHS3	0.740			
	HHS5	0.733				HHS4	0.840			
	HHS6	0.842				HHS6	0.776			
	HHS9	0.812				HHS7	0.769			
	HHS10	0.838				HHS9	0.836			
	HHS11	0.722				HHS10	0.788			
	HHS12	0.822								
AP	APE1	0.913	0.918	0.942	0.803	APS1	0.761	0.888	0.918	0.691
	APE2	0.877				APS2	0.875			
	APE3	0.896				APS3	0.771			
	APE4	0.899				APS4	0.833			
						APS5	0.907			
QC	QC1	0.910	0.913	0.938	0.792	QC1	0.877	0.872	0.913	0.723
	QC2	0.887				QC2	0.836			
	QC3	0.854				QC3	0.799			
	QC4	0.908				QC4	0.887			
PS	PS1	0.857	0.927	0.945	0.777	PS1	0.827	0.898	0.925	0.711
	PS2	0.937				PS2	0.843			
	PS3	0.884				PS3	0.807			
	PS4	0.769				PS4	0.823			
	PS5	0.947				PS5	0.913			

Table 4. Individual item loadings, Cronbach  $\alpha$ , Composite reliability, and AVE

	PA	WT	CT	HHS	AP	QC	PS
UPC model							
PAE3	<b>0.823</b>	0.640	0.481	0.492	0.661	0.511	0.552
PAE4	<b>0.855</b>	0.647	0.518	0.496	0.674	0.541	0.572
PAE7	<b>0.763</b>	0.647	0.422	0.490	0.584	0.522	0.569
PAE11	<b>0.770</b>	0.678	0.584	0.608	0.557	0.565	0.658
PAE12	<b>0.835</b>	0.710	0.513	0.599	0.679	0.563	0.571
PAE13	<b>0.729</b>	0.572	0.474	0.624	0.599	0.485	0.519
PAE15	<b>0.940</b>	0.788	0.639	0.651	0.745	0.689	0.732
WT1	0.648	<b>0.865</b>	0.437	0.514	0.571	0.476	0.553

	PA	WT	CT	HHS	AP	QC	PS
WT2	0.741	<b>0.859</b>	0.520	0.588	0.694	0.490	0.547
WT4	0.656	<b>0.824</b>	0.409	0.501	0.612	0.466	0.503
WT5	0.783	<b>0.911</b>	0.482	0.552	0.655	0.535	0.606
CT1	0.517	0.440	<b>0.900</b>	0.602	0.448	0.674	0.617
CT2	0.639	0.533	<b>0.924</b>	0.621	0.538	0.648	0.648
HHS3	0.617	0.590	0.534	<b>0.796</b>	0.559	0.549	0.590
HHS4	0.570	0.506	0.630	<b>0.854</b>	0.475	0.637	0.634
HHS5	0.487	0.406	0.405	<b>0.733</b>	0.426	0.441	0.426
HHS6	0.682	0.642	0.564	<b>0.842</b>	0.615	0.588	0.618
HHS9	0.587	0.537	0.489	<b>0.812</b>	0.560	0.550	0.610
HHS10	0.519	0.470	0.571	<b>0.838</b>	0.506	0.642	0.657
HHS11	0.432	0.352	0.507	<b>0.722</b>	0.429	0.574	0.560
HHS12	0.520	0.459	0.597	<b>0.822</b>	0.463	0.642	0.617
APE1	0.723	0.678	0.447	0.533	<b>0.913</b>	0.472	0.480
APE2	0.623	0.581	0.435	0.553	<b>0.877</b>	0.538	0.485
APE3	0.648	0.605	0.503	0.562	<b>0.896</b>	0.566	0.507
APE4	0.812	0.750	0.555	0.613	<b>0.899</b>	0.578	0.584
QC1	0.586	0.474	0.674	0.619	0.526	<b>0.910</b>	0.747
QC2	0.555	0.456	0.589	0.564	0.479	<b>0.887</b>	0.740
QC3	0.574	0.490	0.574	0.656	0.521	<b>0.854</b>	0.713
QC4	0.692	0.592	0.724	0.713	0.604	<b>0.908</b>	0.850
PS1	0.641	0.531	0.649	0.616	0.511	0.835	<b>0.859</b>
PS2	0.694	0.619	0.608	0.688	0.560	0.791	<b>0.937</b>
PS3	0.646	0.580	0.578	0.650	0.543	0.697	<b>0.883</b>
PS4	0.563	0.506	0.484	0.559	0.377	0.561	<b>0.767</b>
PS5	0.671	0.582	0.710	0.720	0.525	0.845	<b>0.948</b>
SPC model							
PAS4	<b>0.787</b>	0.577	0.635	0.446	0.527	0.540	0.536
PAS8	<b>0.882</b>	0.710	0.711	0.594	0.607	0.676	0.685
PAS9	<b>0.773</b>	0.600	0.542	0.504	0.497	0.492	0.540
PAS10	<b>0.778</b>	0.620	0.538	0.517	0.499	0.466	0.544
PAS12	<b>0.927</b>	0.724	0.680	0.554	0.630	0.699	0.711
WTS1	0.590	<b>0.779</b>	0.420	0.364	0.526	0.450	0.446
WTS2	0.622	<b>0.868</b>	0.467	0.507	0.644	0.497	0.561
WTS3	0.623	<b>0.855</b>	0.444	0.430	0.614	0.428	0.507
WTS4	0.708	<b>0.863</b>	0.488	0.481	0.542	0.514	0.550
WTS6	0.617	<b>0.798</b>	0.445	0.493	0.542	0.363	0.437
WTS7	0.771	<b>0.889</b>	0.538	0.560	0.648	0.550	0.650
CT1	0.651	0.483	<b>0.905</b>	0.509	0.473	0.552	0.536
CT2	0.718	0.532	<b>0.924</b>	0.585	0.558	0.623	0.618
HHS1	0.576	0.493	0.543	<b>0.763</b>	0.497	0.511	0.593
HHS3	0.591	0.519	0.494	<b>0.740</b>	0.564	0.502	0.552
HHS4	0.543	0.470	0.525	<b>0.840</b>	0.437	0.508	0.605
HHS6	0.440	0.455	0.381	<b>0.776</b>	0.306	0.366	0.504



	PA	WT	CT	HHS	AP	QC	PS
HHS7	0.380	0.348	0.419	<b>0.769</b>	0.214	0.405	0.493
HHS9	0.442	0.456	0.456	<b>0.836</b>	0.339	0.445	0.550
HHS10	0.455	0.327	0.459	<b>0.788</b>	0.385	0.477	0.554
APS1	0.558	0.701	0.468	0.443	<b>0.761</b>	0.475	0.495
APS2	0.606	0.573	0.506	0.463	<b>0.875</b>	0.532	0.522
APS3	0.421	0.434	0.381	0.338	<b>0.771</b>	0.321	0.377
APS4	0.439	0.445	0.377	0.335	<b>0.833</b>	0.332	0.367
APS5	0.689	0.684	0.577	0.504	<b>0.907</b>	0.561	0.606
QC1	0.593	0.442	0.531	0.458	0.489	<b>0.877</b>	0.718
QC2	0.577	0.489	0.518	0.461	0.492	<b>0.836</b>	0.659
QC3	0.481	0.321	0.485	0.454	0.331	<b>0.799</b>	0.641
QC4	0.695	0.603	0.638	0.608	0.532	<b>0.887</b>	0.830
PS1	0.608	0.520	0.561	0.591	0.501	0.714	<b>0.827</b>
PS2	0.598	0.542	0.566	0.603	0.488	0.694	<b>0.843</b>
PS3	0.560	0.469	0.480	0.562	0.453	0.637	<b>0.807</b>
PS4	0.610	0.505	0.462	0.540	0.447	0.652	<b>0.823</b>
PS5	0.696	0.600	0.588	0.658	0.557	0.840	<b>0.913</b>

Table 5. Cross-loadings results

Discriminant validity is also examined by comparing the square root of the AVE with correlations among constructs. The objective is to make sure that the square root of the AVE of each construct is greater than its correlations with other constructs (Fornell & Larcker, 1981). The results are reported in Table 6. For all the latent variables the squares root of the AVE (diagonal values) were greater than the correlations with other latent variables. Therefore, the measurement model has adequate indicators' reliability, internal consistency, convergent validity, and discriminant validity.

	PA	WT	CT	HHS	AP	QC	PS
<b>UPC model</b>							
PA	<b>0.819</b>						
WT	0.798	<b>0.865</b>					
CT	0.637	0.536	<b>0.912</b>				
HHS	0.693	0.624	0.671	<b>0.804</b>			
AP	0.788	0.733	0.543	0.632	<b>0.896</b>		
QC	0.680	0.569	0.723	0.720	0.601	<b>0.890</b>	
PS	0.732	0.639	0.694	0.736	0.576	0.863	<b>0.881</b>
<b>SPC model</b>							
PA	<b>0.832</b>						
WT	0.781	<b>0.843</b>					
CT	0.750	0.556	<b>0.915</b>				
HHS	0.631	0.564	0.600	<b>0.788</b>			
AP	0.667	0.697	0.566	0.511	<b>0.831</b>		
QC	0.698	0.557	0.644	0.589	0.549	<b>0.850</b>	
PS	0.731	0.628	0.633	0.702	0.583	0.839	<b>0.843</b>

Table 6. Discriminant validity results

#### 4.2.2. Hierarchical Model

In this study, HL was specified as a second-order hierarchical reflective latent variable, comprising five first-order latent variables (PA, WT, CT, HHS, and AP). The HL variable received all the first-order latent variables' items. Table 7 presents the hierarchical structure of HL and the explained variance in its components.

	Indices	PA	WT	CT	HHS	AP
UPC model	R <sup>2</sup>	0.866	0.744	0.549	0.757	0.737
	$\beta$	0.931	0.863	0.741	0.870	0.858
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001
SPC model	R <sup>2</sup>	0.827	0.778	0.599	0.640	0.667
	$\beta$	0.909	0.882	0.774	0.800	0.817
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001

Table 7. HL Hierarchical model

#### 4.2.3. Structural Model

The structural model was assessed by checking a set of indices as described by Hair et al. (2019): significance and relevance of the structural model relationships, coefficient of determination R<sup>2</sup>, effect size f<sup>2</sup>, and predictive relevance of the model Q<sup>2</sup>. The final two models UPC and SPC are provided in Figures 3 and 4 respectively.

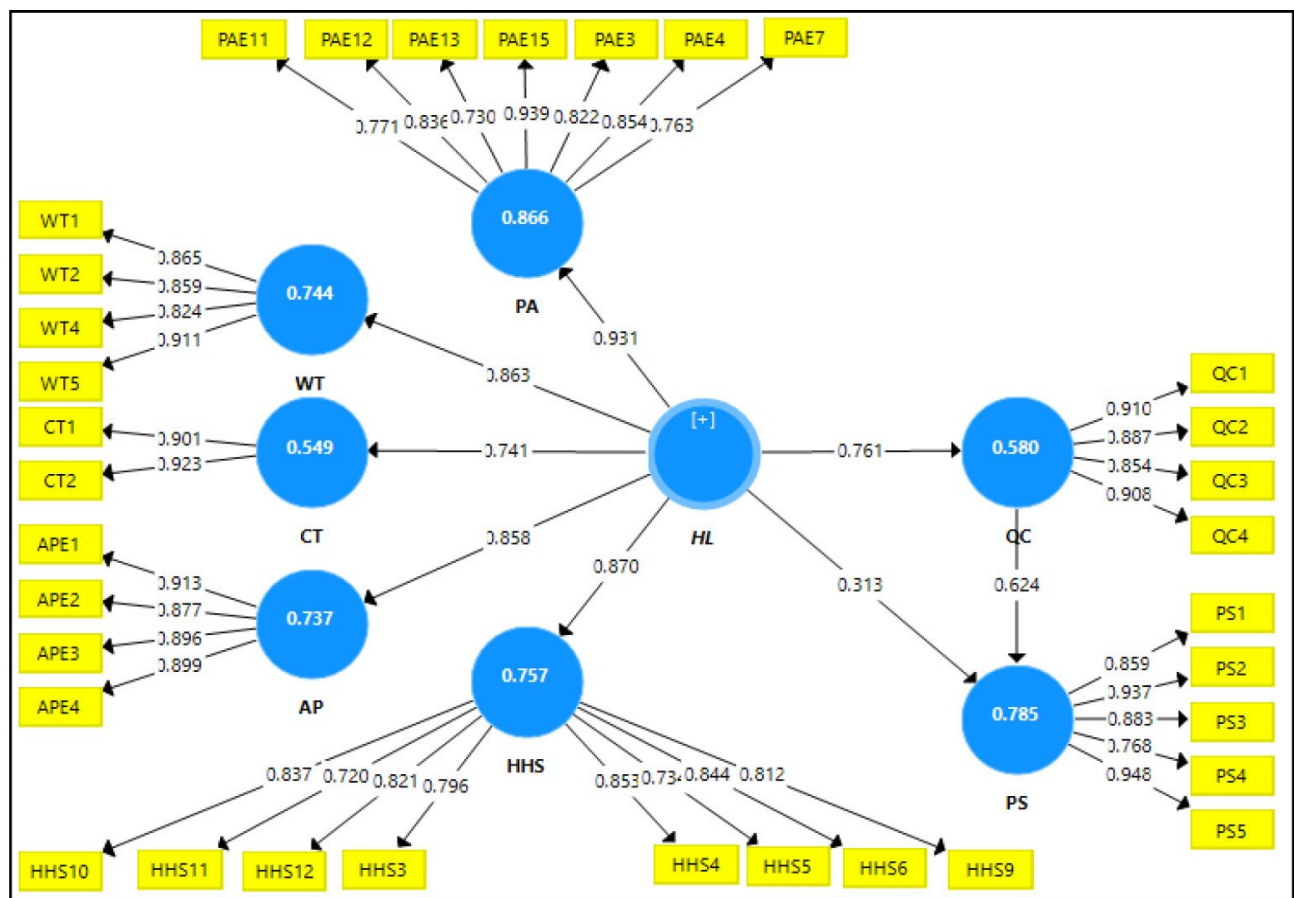


Figure 3. UPC final SEM-PLS model

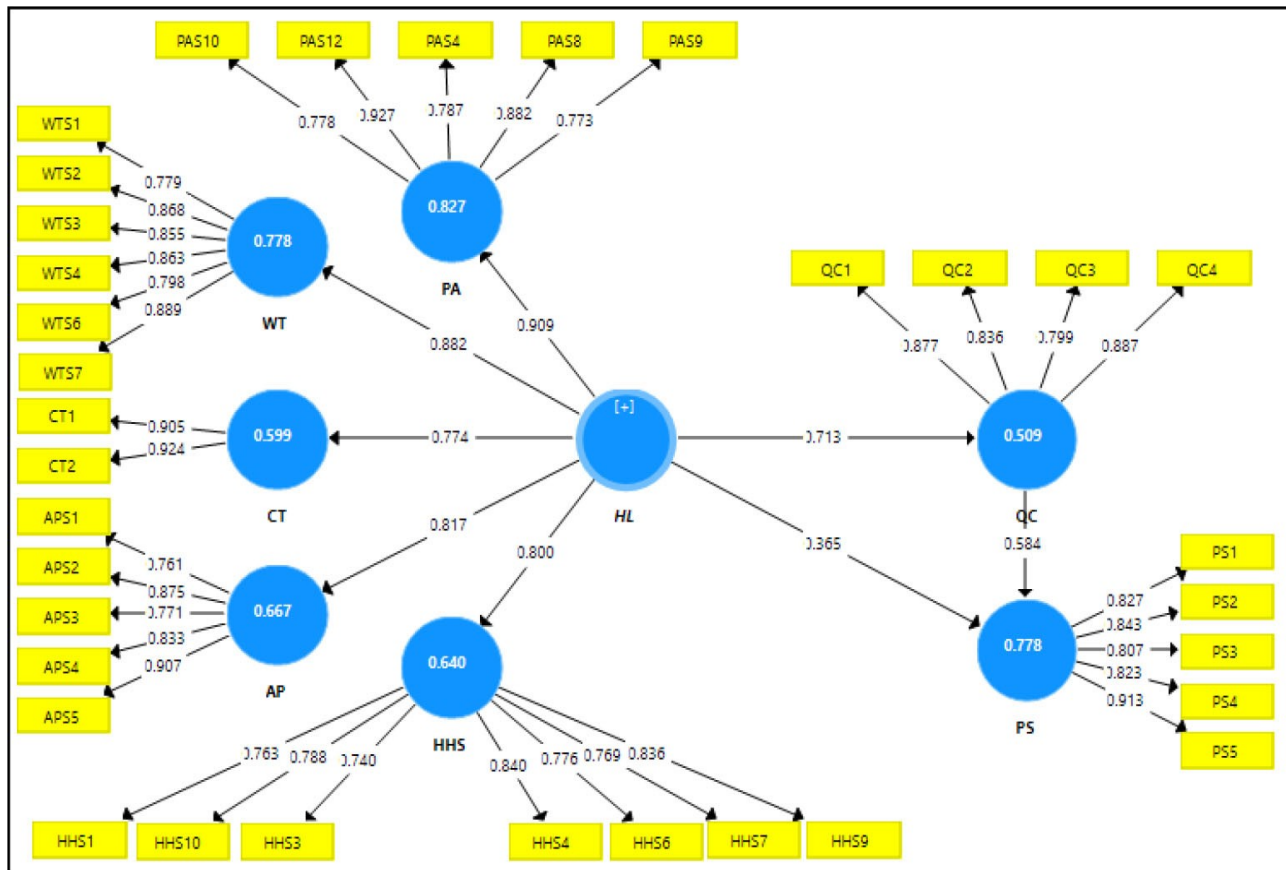


Figure 4. SPC final SEM-PLS model

*Statistical significance and relevance of path coefficients:* The execution of the PLS-SEM algorithm allows the estimation of the structural model path coefficients, and test the research hypotheses. However, the significance of a path coefficient ultimately depends on its standard deviation obtained by bootstrapping. Thus, a bootstrap of 5000 subsamples was performed (Hair et al., 2017). Table 8 presents the path coefficients of the three hypotheses and their standard deviations.

Hypotheses	Path	UCP model				SPC model				Conclusion
		Standard Beta	Standard Error	t-value	p-value	Standard Beta	Standard Error	t-value	p-value	
H1	QC → PS	0.624	0.050	12.552	<0.001	0.584	0.062	9.424	<0.001	Accepted**
H2	HL → QC	0.761	0.029	26.052	<0.001	0.713	0.043	16.485	<0.001	Accepted**
H3	HL → PS	0.313	0.052	6.028	<0.001	0.365	0.064	5.685	<0.001	Accepted**

\*\* significant at p-value<0.001

Table 8. Bootstrapping results for hypotheses test

*Coefficient of determination  $R^2$ :* The coefficient of determination  $R^2$  is a commonly used measure for evaluating the structural model (Hüttinger, Schiele & Schröer, 2014). It measures the explained variance in endogenous variables and is, therefore, a measure of the explanatory power of the model (Hair et al., 2019). Nevertheless, the  $R^2$  value depends on the number of exogenous variables. When the number of exogenous variables increases the  $R^2$  value of the endogenous variable automatically increases. For this reason, it is recommended to use the adjusted  $R^2$  ( $R^2_{adj}$ ) for endogenous variables with two or more exogenous latent variables (Hair et al., 2017).  $R^2$  values of 0.75, 0.50 or 0.25 are considered substantial, moderate and weak respectively (Hair et al., 2019). Table 9 reports the  $R^2$  and  $R^2_{adj}$  values of the endogenous variables of the two models. In the UCP model, 58% and 78.4% of the respective

variances of the variables QC and PS are explained by the exogenous variable HL. These values are 50.9% and 77.5% for the SPC model.

*Effect size  $f^2$* : As underlined above the  $R^2$  value increases as the number of exogenous variables increases, it is then suggested to evaluate the impact of the removal of each exogenous variable on the endogenous variable using the effect size  $f^2$ . This parameter allows specifying if the removal of an exogenous variable has an impact on the endogenous latent variable.  $f^2$  values of 0.02, 0.15 and 0.35 Indicate, respectively, small, medium and large effect of the exogenous variable (Hair et al., 2019). Models in Figures 3 and 4 show that the endogenous variable PS has two exogenous variables: HL and QC. Table 10 presents the effect size of the removal of each of these two exogenous variables on the endogenous variable.

*Blindfolding and predictive relevance  $Q^2$* : The  $Q^2$  is another mean to assess the model's predictive accuracy. It is based on the blindfolding procedure, which consists of deleting individual data points of latent variables' indicators and estimating the model parameters based on the remaining data. Using these estimates as inputs, the blindfolding procedure predicts the original values of data points that have been deleted. The differences between the predicted values and the original values are used to calculate the  $Q^2$  value. As a rule of thumb  $Q^2$  values greater than 0, 0.25 and 0.50 illustrate small, medium and large predictive relevance of the model (Hair et al., 2019). The  $Q^2$  values of the two endogenous variables QC and PS, using an omitted distance  $D=7$ , are given in Table 11. These results support the predictive power of the model.

Endogenous variables	UPC model		SPC model		Results
	$R^2$	$R^2_{adj}$	$R^2$	$R^2_{adj}$	
QC	0.580	-	0.509	-	Moderate
PS	0.785	0.784	0.778	0.775	Substantial

Table 9. Coefficients of determination  $R^2$  and  $R^2_{adj}$

Exogenous variables	UPC model	SPC model	Results
	$f^2$	$f^2$	
HL	0.192	0.295	Medium effect size
QC	0.764	0.754	Large effect size

Table 10. Effect size  $f^2$  of the exogenous variables

Endogenous variables	UPC model			SPC model			Results
	SSO	SSE	$Q^2$	SSO	SSE	$Q^2$	
QC	940.000	516.179	0.451	596.000	382.137	0.359	Medium predictive relevance
PS	1175.000	473.764	0.597	745.000	339.168	0.545	Large predictive relevance

SSO: the sum of the squared observations, SSE: the sum of the squared prediction errors

Table 11. Blindfolding results

#### 4.2.4. Mediating Effect

In the developed model, HL and PS are connected by two paths (Figure 5): direct path HL→PS and indirect path HL→QC→PS. In the indirect path, the variable QC is considered as a mediator variable. Hence, it is necessary to test the relevance of this mediation. In this regard, we followed steps described by Hair, Hult, Ringle, and Sarstedt (2014). First, we checked the significance of the direct effect HL→PS, without the introduction of the mediator variable QC. Second, we included the mediator variable QC and examined the significance of the indirect effect. Finally, we assessed the strength of the mediation by calculating the variance accounted for (VAF) value. All of these steps were performed by applying a bootstrapping of 5000 subsamples (Hair et al., 2014).

The results, for the UPC model, showed that the direct effect HL→PS has a coefficient  $\beta=0.787$  ( $t=29.715$ ), and therefore it is a significant effect. After the introduction of the mediator variable QC, we obtained a coefficient  $\beta_2=0.761$  ( $t=25.929$ ) for the effect HL→QC and  $\beta_3=0.624$  ( $t=12.321$ ) for the effect QC→PS. Consequently, the indirect effect HL→QC→PS has a coefficient  $\beta_2 \times \beta_3=0.475$  ( $t=11.688$ ), which is significant. The inclusion of the mediator variable QC has increased the  $R^2$  value of the endogenous variable PS from 0.619 ( $t=14.955$ ) to 0.785 ( $t=33.573$ ). Also, the coefficient of the direct effect HL→PS decreased from  $\beta=0.787$  ( $t=29.715$ ) to  $\beta_1=0.313$  ( $t=6.028$ ). Thus, the mediator effect absorbed some of the direct effects. The absorbed proportion is calculated by the VAF value, which indicates the size of the indirect effect in relation to the total effect. The VAF value is 0.603, which leads to the conclusion that the indirect effect explained 60.3% of the total effect (Figure 5). Therefore, the mediating effect of QC is partial as the VAF score is between 20% and 80% (Hair et al., 2014). It is a complementary mediation since the product of the three path coefficients  $\beta_1$ ,  $\beta_2$  and  $\beta_3$  is positive (Hair et al., 2014). For the SPC model, the same analysis was conducted. The results are shown in Figure 5.

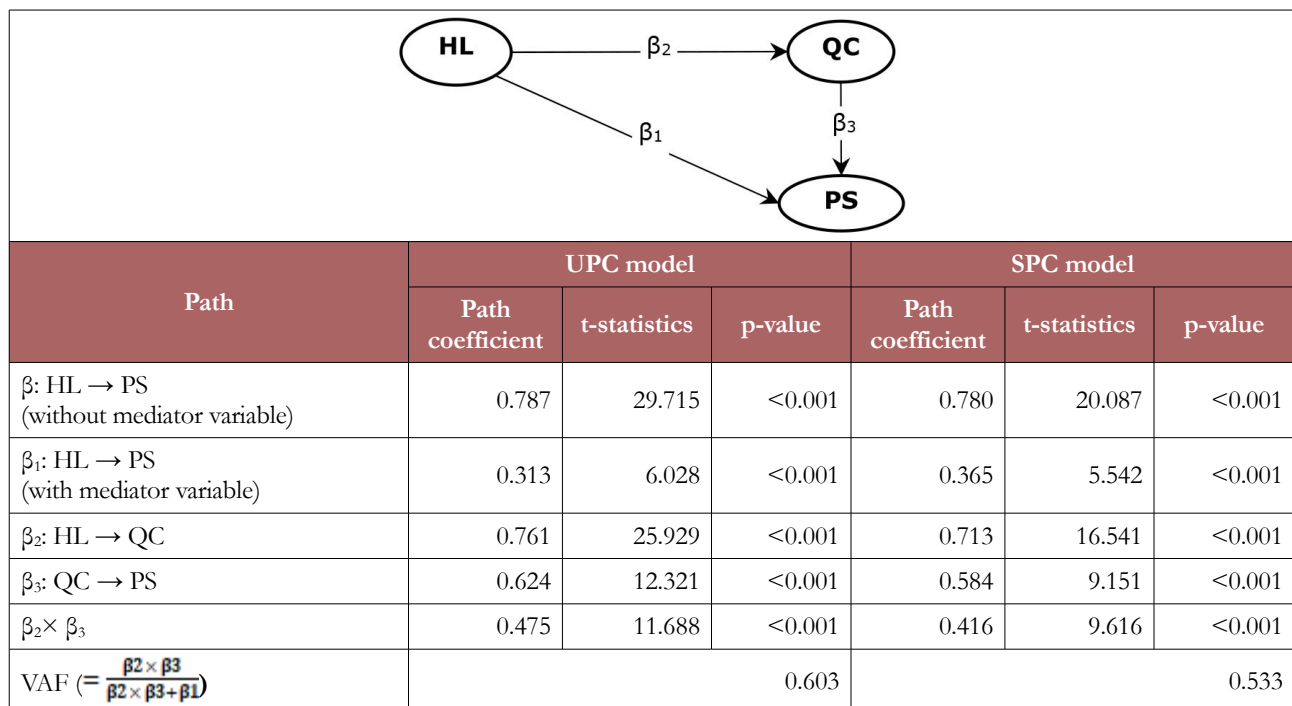


Figure 5. Mediating effect analysis

## 5. Discussion

This study reports the results of the first study concerning the examination of the relationship between HL, QC, and PS. It represents one of the first attempts to develop a structured model to empirically examine the effect of HL on both QC and PS. Up to now, there has been little in-depth analysis especially quantitative studies in this research area; therefore, our study helps to partially fill this knowledge gap.

In order to test the research's hypotheses, which stipulate the existence of an influential relationship between HL, QC, and PS, a survey was conducted among hospitalized patients in three public healthcare facilities located in the city of Fez-Morocco. Collected data were analyzed using the SEM method, which remains the most widely used method for testing and validating research hypotheses in the social sciences area. Results revealed a significant influence of HL on QC and PS. Thus, the research hypotheses are all confirmed and validated. Further, the proposed model leads to the conclusion that HL contributes to explaining more than 50% and 70% respectively of the variance in the QC and PS. In the proposed model, HL was specified as a second-order latent variable, composed of first-order latent variables, namely: PA, WT, CT, HHS, and AP.

Statistical analysis showed that the variable PA is the most preponderant component of HL. Its path coefficient is the highest exceeding 0.900:  $\beta=0.931$  ( $p\text{-value}<0.001$ ) for the UPC model and  $\beta=0.909$  ( $p\text{-value}<0.001$ ) for the



SPC model. In the Moroccan context, this result is far from being surprising. Health officials and researchers recognize that accessibility of care and particularly PA remains the major concern of the health system (Bouhaddou et al., 2013). Indeed, the household panel survey indicated that only 76.1% of sick people seek healthcare. In other words, one sick person out of four did not use healthcare services (ONDH, 2015). Also, the National Population and Family Health Survey denoted that almost 14% of women did not use healthcare services for childbirth (Ministry of Health, 2018). The same survey revealed that about 15% of elderly people requiring medical examinations did not seek healthcare because of PA difficulties. This was explained by many factors, including geographical remoteness, insufficient human resources, problems with the supply of medicines, under-equipment of healthcare facilities, inadequate medical transportation, etc. (Ministry of Health, 2018; The World Bank, 2015).

According to the UPC model results, special attention should be paid to the accessibility of medical transportation and the availability of technical equipment/facilities, as these elements showed strong correlations with the PA. These findings are in line with other studies and official reports that have reported the issue of medical transportation in Morocco (Frichi, Ben Kacem, Jawab, Kamach & Chafik, 2020; Hssain & Hssain, 2013; Tachfouti, Bhatti, Nejari, Kanjaa & Salmi, 2011), and the low availability of technical facilities (CESE, 2013).

As for the SPC model, two elements showed strong correlations with the PA. The first is the availability of medical and nursing staff. This can be explained by the critical shortage of physicians and nurses in Morocco (Ministry of Health, 2012). Moreover, the health workforce shortfall is exacerbated by the unbalanced distribution of physicians and nurses across the country, which highlights the shortcomings of the human resources management system (CESE, 2013). The second element is the availability of support and guidance staff, whose role is to guide, assist and help patients moving smoothly between care units. This is in accordance with the findings of previous research, which indicated that difficulties in patient movements inside healthcare facilities caused patient dissatisfaction (Obtel, El Achhab, Bendahhou, Benider, Errihani, Zidouh et al., 2012).

The second and third components of HL with high path coefficients are different depending on the admission mode. In the UCP model, for patients admitted through the emergency department, the second component is HHS ( $\beta=0.870$ ;  $p\text{-value}<0.001$ ) and the third is WT ( $\beta=0.863$ ;  $p\text{-value}<0.001$ ). In the SPC model, for scheduled patients, the second component is WT ( $\beta=0.882$ ;  $p\text{-value}<0.001$ ) followed by AP ( $\beta=0.817$ ;  $p\text{-value}<0.001$ ). This difference is explained by the hospital admission type. In fact, urgent patients wait less than scheduled patients to receive care; they are prioritized because they require rapid medical intervention. In addition, the preparation and constitution of administrative files are carried out downstream of the care process. In contrast, planned patients are required to complete the administrative procedures upstream of the admission process, and therefore they experience delays. Regarding the HHS, scheduled patients are admitted in prepared conditions: rooms and hospital beds are available, waiting areas and examination rooms are less crowded and therefore cleaner, etc. In general, HHS are not a major concern for scheduled patients comparing to difficulties related to WT and AP. On the other hand, urgent patients are often confronted with a lack of resources, particularly in terms of places (hospital rooms and beds), as their admission is not planned and therefore takes place without preparation. Likewise, waiting areas and examination rooms are overcrowded, resulting in a lack of cleanliness, available chairs in waiting areas, etc.

Several patient satisfaction surveys conducted in Morocco support the results of this study. Damghi, Belayachi, Armel, Zekraoui, Madani, Abidi et al. (2013), in their survey in an emergency department of a public hospital in Morocco, found a significant correlation between WT and PS. Their results also indicated that urgent patients perceived the WT more favorably than non-urgent patients. WT, as a predictor of dissatisfaction, was also reported by Kasouati, Bouti, Zidouh, Abd El Hamid, Boufaresse and Mrabet (2015). A study by Amazian, Toughrai, Benmansour, Laalim, El Alami and Mazaz, (2013) conducted in Fez University Hospital revealed high satisfaction rates, explained in particular by the hotel comfort. Nevertheless, almost half of the surveyed patients made negative judgments concerning AP. Another more recent survey at Fez University Hospital showed that a significant proportion of surveyed patients complained about appointment delays, WT, HHS and the complexity of AP (El Marnissi et al., 2019).

## 6. Conclusion

Healthcare facilities are called upon to find new strategies to improve the quality of their services and patient satisfaction. There is general agreement that quality of care and patient satisfaction depend to a large extent on the performance of support activities. Indeed, medical acts can only be of high quality if the related logistics activities are managed and performed effectively. Thus, hospital logistics enhances healthcare accessibility and quality.

The objective of this study was to empirically examine the influence of hospital logistics on quality of care and patient satisfaction using the PLS-SEM method. The results showed a significant impact of hospital logistics on both quality of care and patient satisfaction. More specifically, among the five investigated components of hospital logistics, physical accessibility emerged as the most preponderant factor in both UPC and SPC models. Hence, improvement of physical accessibility would result in a significant increase in quality and satisfaction. It implies the availability and accessibility of medical transportation, support and guidance staff, medical and nursing staff, medical facilities and equipment, drug, etc. The coming together of all of these elements is a challenging issue. It requires optimal resources planning and management, effective synchronization of the various flows both within (between care units) and outside (with providers and stakeholders) healthcare facilities, etc.

Hospital logistics, as a performance lever, aims to rethink the entire health system by putting the patient at the center of activities. To ensure this, health policymakers and hospital managers should pay more interest and attention to logistics activities within hospitals.

Like most studies, this research has some limitations. First, its results cannot be generalized since the survey only concerned patients from three public healthcare facilities in the city of Fez. It didn't include patients from other Moroccan cities. Second, the components of hospital logistics in the model are restricted. They should be adapted and extended depending on the research scope and context. Third, the sample size is reduced because it was divided into two models. Therefore, the generalization of the results may be limited by these limitations.

Further studies in this area are encouraged. They should consider, in addition to the research limitations mentioned above, cultural and context specifics. The analysis of results may be used on some classification, such as providing information about the hospital type, number of beds, patients categories, etc.

## Declaration of Conflicting Interests

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