

ABSTRACT

Patients nowadays start to request more autonomy on his/her medical care, which may cause conflicts during the interactions between service providers and patients, this situation may result in failures. To improve service quality and to reduce service failure, it is critical for hospitals to understand the needs and wants of the customers. In the least two decades, the technique of Quality Function Deployment (QFD) has been used widely in manufacturing firms to develop different items with different criteria. Under multiple criteria selection, Analytical Hierarchy Process (AHP) is also very helpful to assist decision makers in analyzing the multiple criteria of solutions and finding out the importance of each weight. However, rare of these studies have focused on service firms, especially for the hospital. Therefore, this study intends to concentrate an effort on evaluating the needs and weights of the customer concerned items as well as determining the correct recovery strategies using QFD and AHP. Forty five frontline employees including nurses, supervisors, and technicians from different departments of three hospitals were invited to become the respondents of this study. The findings indicate that among the five dimension of service failure in hospitals, the most important ranking was “Service Attitude and Responsiveness Failure”, followed by “Customer Perception Failure”, “Customer Attitude Failure”, “Professionalism Failure” and “Hospital Environment Failure”. For effective hospitals to design service recovery, the most effective strategies to deal with service failures were “Communication”, followed by “Apology and appeasement”, “Give health education and correct medical knowledge”, “Suggestion box”, and “Fulfill customers' requests immediately”. This study may contribute to the current literature for academics and professionals, particularly for those in the hospitality industry since it identified the major elements of hospital service failure through interviewing hospital experts and determined the most effective recovery strategies to better satisfying customers' needs and expectations.

Keywords: Service quality, service failure, service recovery, quality function deployment, analytic hierarchy process.

1. Introduction

With the development of the economy and technology, we are at the beginning of an unprecedented era of innovation in the provision of health services in both developed and emerging countries. Hospitals have been pushed into competitive market structures, and the management team of hospital has been vigorously searching for managerial solutions to streamline their operations in order to reduce costs and yet to maintain a high quality of care (Bragato and Jacobs, 2003; Pai and Huang, 2011). Without doubt, the quality of management in hospitals plays an important role for the development of the sector.

The quality of the service is not only the key determinant to fulfill customer satisfaction, but also a strategic tool to improve operational efficiency and organization's performance (Yeh, 2010). Service organizations such as hospitals should well understand and manage the voice of customer and make plans to meet all the challenges from variety of customers. As globalization, association with stronger and stronger competition within healthcare industry, hospitals endeavor to change over healthcare service to more patient-oriented, making it more reliable, transparent and safe (Meesala and Paul, 2018). Medical treatment is not patients' unique concern anymore. Patients pay careful consideration on their safety and comfort as well. Therefore, through the process of service delivery from the providers, hospitals could build the reputation and image with their profession, accreditation and service quality, they may earn patients' trust and confidence. The focus of this study is to investigate customer requirements on the healthcare service quality based on the customer viewpoint.

To identify the weights of the items of customer requirements and technical skills service failures, and service recovery strategies, Analytical Hierarchy Process (AHP) and Quality Function Deployment (QFD) are adopted in this study. AHP analyzes the complex decision making process under the uncertainties (Saaty, 2008). AHP can assist decision makers in examining the multiple criteria of solutions and finding out the importance of each weights, so

that decision makers can avoid the risk to make wrong. QFD is a LEAN technique that is powerful to transfer customer requirements into service recovery strategies by applying Quality of House. QFD is not only a quality model tool but also a planning tool that allowed the consideration of “voice of customer” along with the development of service (Waterworth and Eldridge, 2010).

Despite the importance of the service delivery, there are several factors that may end in service failures such as high human involvement and uncertain marketplace (Vázquez-Casielles et al., 2010). However, as explained by the Double Deviation Paradox (Bitner et al., 1990), an effective service recovery strategy can help customers to regain their satisfaction. This study intends to develop a comprehensive understanding about customer requirements and the importance of each requirement through the literature review, AHP and QFD analysis. The study focus is how to use hospital internal resources to fit the requirement and satisfy customer.

The healthcare service quality of hospital has been widely discussed. However, the previous studies on discussing the quality of healthcare services through AHP and QFD to examine the relationship between customer and service recovery strategies are still rare (Wu et al., 2018). It is expected that the findings of this study can provide directions and suggestions for hospital managers to treat patients in a better way when service failures occur.

2. Literature Review

2.1 Service Failure.

Service encounters can be viewed as “moment of truth” indicating that the dyadic interaction between service provider and customer is one of the most important determinants of the customer satisfaction with the service (Fitzsimmons et al., 2008). Each customer would assume that the service pays for it unless will meet his or her expectations. The customer would be satisfied if the initial expectations are met, on the contrary, the customer would be

dissatisfied once the initial expectations are not met. Thus, a service failure happens when the delivery of service falls below customer expectations (Casid and Shin, 2015; Sivakumar et al., 2014). Lassar et al. (2000) indicated that the occurrence (or lack thereof) of an unsatisfactory service encounter (i.e. “service failure”) is thought to moderate the quality/satisfaction relationship. Once the delivery of service offering does not meet customer expectation, service failure occurs (Sivakumar et al., 2014).

2.1.1 Common Service Failures in Hospital.

According to Xu and Wang (2001), the common service failures in hospital consist of (1) Medical treatment failure including inaccurate diagnosis, delayed curing, malpractice of curing, and surgery failure; (2) Nursing issue involving the lack of observation on patient’s status, insufficient knowledge and skills on operating the medical equipment; (3) Miscommunication between patient and service provider, insufficient interpersonal skills and misunderstanding; (4) Accidents such as falling down or infection occur within hospital; (5) Bad attitude of patients or the incitation of other patients or patient family within hospital.

To verify the common service failures, this study have interviewed three senior experts from three hospitals in Taiwan, and confirmed most of the factors mentioned above such as professionalism, service attitude, hospital environment, customer participation, and customer attitude.

1. Professionalism Failure.

Medicine doctor is a key person with medical degree whose job is to treat ill people. Therefore, a doctor should have sufficient professional knowledge and competence to fulfill his/her job. When a doctor wrongly diagnoses, gives wrong treatment methods, has unsuccessful surgery, these would cause professionalism failure. Poor professionalism would bring poor medical care and the absence of professionalism is harmful for patients. Sometimes professionalism failure may cause severe negative outcome like death or a complication from

the main disease. Professionalism is usually referred as a basis of medical performance (Arnold, 2002; Joyner and Vemulakonda, 2007; Tsai et al., 2007). Healthcare providers must prove their professionalism by attitudes, knowledge and behaviors that follow a various approach to the regulations, principles and standards underlying successful clinical practices (Cornett, 2006).

2. Service Attitude and Responsiveness Failure.

Attitude of service provider is another key factor that influences the quality of service. Taylor et al. (2002) demonstrated that most of failures in hospital were related to communication, including staff's attitude, discourtesy and disrespect. Nursing service is also a critical factor determining the quality of care in hospitals. Nurse's task is very interdependent. Wageman (1995) implied that nurses' ability to perform their duties depends on a wide variety of other professionals completing their tasks properly. Elayan and Ahmad (2017) argued that patients consider nurses' caring, interpersonal interaction, and professionalism as the quality of nursing care. Therefore, when patients or patient's family do not perceive the attention and support, the complaint will then happen.

3. Hospital Environment Failure.

Hospital environment or setting can also cause service failure, for example, patient falls down in the restroom or patient's family gets lost following the unclear instruction in hospital. Severe hospital environment failure may cause infection within hospital since the environmental surface of hospital may be contaminated by other patients or staffs. A report from WHO (Ducel et al., 2002) stated that hospital is a place both infected persons and persons at increased risk of infection congregate. Apart from this, physical environment and cleanliness of hospitals had higher rating on customer's perception of service quality (Mohebifar et al., 2016). Therefore, maintaining and improving the physical environment would make patients stay comfortable and offer a satisfying experience.

4. Customer Perception Failure.

Customer service is an individual's perception and expectation of a service encounter (Green, 2014). Perception is an emotional and cognitive procedure of an individual's perspective, which an individual assesses and interprets by developing a sense of reality (Burkitt, 2013). Nowadays, customers are more knowledgeable, discerning and demanding for healthcare service thanks to the convenient access and usage of Internet. An individual's social and physical environment and education level affect his/her perception and emotions (Lin and Hsieh, 2011). Patient's perception of care can vary immensely across different service lines within a hospital (O'malley et al., 2005).

Before the consultation from doctor, patient would expect that the doctor would be able to help and cure the illness (Mercer et al., 2012). When customers' expectations are met or exceeded, customers are satisfied, conversely, when customers' expectation are not met, customers are not satisfied (Tahir et al., 2013). Therefore, the ability of service provider to meet customers' expectations is the key factor that customers use to rate the service experience (Hellén and Sääksjärvi, 2011).

5. Customer Attitude Failure.

Patient's attitude is of critical importance to the success of healthcare service delivery. Indeed, patient's attitude and behavior are the powerful factors influencing the relationships between service providers and patients. With patient engagement, there will be better health outcomes and experiences of health care during the whole treatment (Mishra et al., 2016). However, patients have their own attitude towards to hospital staffs, their attitude, and behavior are main dimensions during the service delivery (Sharma, 2016). Cheng et al. (2005) stated that patients judge the hospital staffs' performance through the clinical cure, not through the technology employed. Kindy et al. (2005) found that patients' disruptive complaints and behaviors would cause occupational stress among nurses.

2.2 Service Recovery Strategy.

Service recovery is defined as strategic actions that the service organizations take in response to a service failure (Steyn et al., 2011) or a process of dealing with mistakes (Hu et al., 2013). This also refers to the steps that service organizations take after a service failure with endeavor to reverse customer's loss (Fang et al., 2013). However, in the service industry, service failures occur on a daily basis, through implementing service recovery efforts and effectively handle the failures. Even if the organizations cannot completely recover the failures, they still can retain and possibly even increase customer satisfaction and loyalty in the future (Steyn et al., 2011). Offering a satisfactory service recovery is quite critical since a satisfactory service recovery can initially ease customer's sense of uncomfortableness (Van Vaerenbergh et al., 2014).

McDougall and Levesque (1998) showed that there are two types of recovery actions, compensation and assistance. The former one focuses on monetary reimbursement and latter one focuses on the interactions between service provider and customer. The effect of them were similar and could be influenced by contextual factors. Lee et al. (2013) also found that the common service recovery efforts include compensation, upgrading, explanation, apology, and management team involvement. A hospital is a healthcare institution providing patient treatment with specialized medical and nursing staff and medical equipment. Its service recovery strategies are mainly classified as psychological and intangible efforts to improve and alter the situations.

Following Warden et al. (2008) and Lee et al. (2013), the collected service recovery strategies were classified into 3 categories: Improvement, Assistance and Psychological compensation. The actions under the improvement are to improve and alter the situations and incidents, and correct the failures as well. The steps of assistance are to provide the assistance to customers and fulfill their needs in time. Psychological compensation is the strategy that

hospital uses to relieve customer's dissatisfaction and build communication channel with patients and patient's family.

3. Research Design and Methodology

3.1 Research Design

The main purpose of this research is to determine the factors applicable to improve the service quality of hospital based on the integration of QFD and AHP. To conduct this research, the inputs of 45 employees from 3 hospitals are essential for both service failures and service recovery strategies. The research framework is shown in Figure 1.

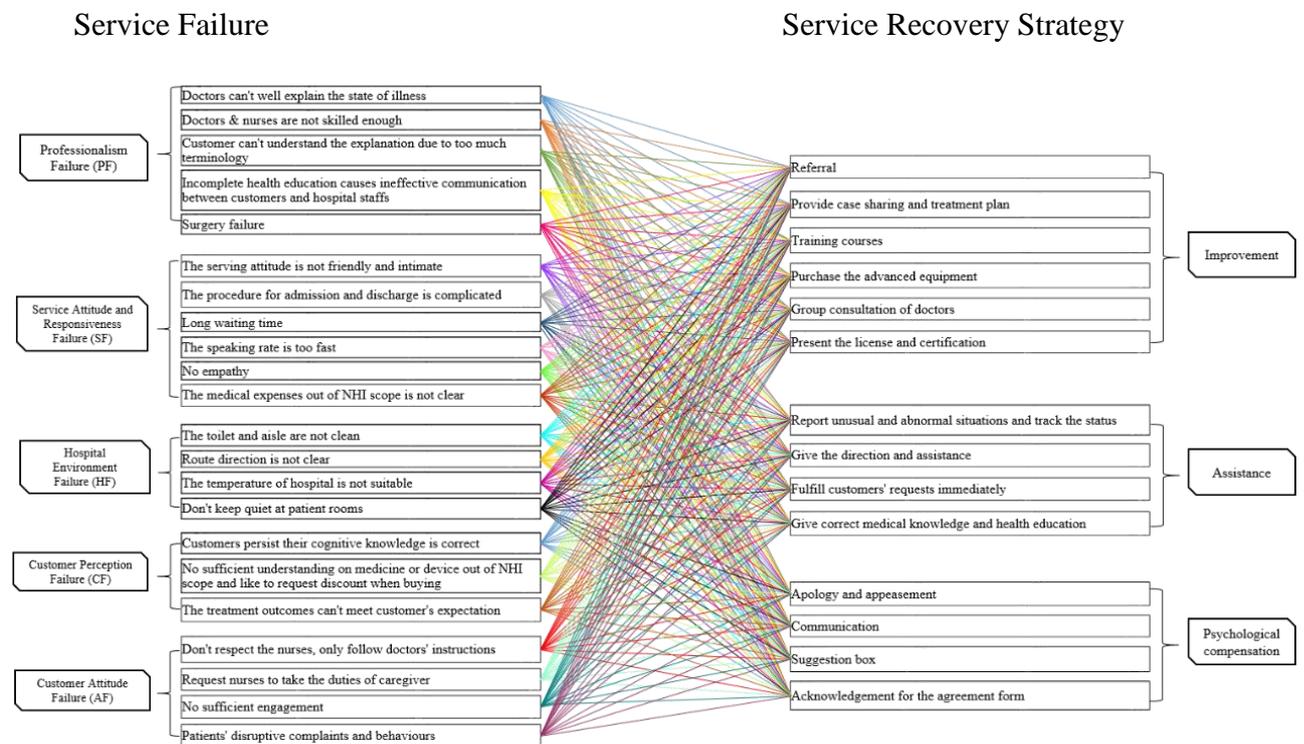


Figure 1. Research framework of this study

3.2 Sampling Plan

This study interviewed 45 respondents in a total of 3 hospitals located in Kaohsiung, Tainan, and Taipei, Taiwan. Specifically, the study selected the frontline employees as the respondents. Following Huang and Li (2010), this study recruited the frontline employees in hospital including doctors, respiratory therapists, nurses, operation technicians and

administrative staffs. The frontline healthcare employees directly provide the services to patients and their relations, hence, they may know the problems and potential solutions well. Respondents were interviewed to identify the most common service failures in the hospital and the most applicable service recovery strategies they have used to respond to the failures. Second, following Denzin and Lincoln (1994) who suggested sample size of qualitative research should be 30 – 50 participants, 45 frontline employees of hospitals were interviewed in this study to obtain their inputs related to service failures and service recovery strategies in the hospital. The title of these frontline employees are shown in Table 1.

[Insert Table 1 Here]

3.3 Analytical Hierarchy Process (AHP)

AHP is a method of “assessment through pairwise comparisons and depends on the experts’ judgments to derive priority scales” (Saaty, 2008). Service quality in healthcare sector is very complicated and may vary in different hospitals, which therefore involves multiple threshold, ambiguous and subjective factors that are hard to measure. Due to the complicated process of decision-making in healthcare sector, we have selected AHP to define the importance and the priority of hospital service in this study. AHP decomposes a complicated decision problem into different hierarchical levels. The weight for every standard and option are judged in pairwise examinations and needs are computed by the Eigenvector strategy. The method is the foot for estimating the best application for each decision situation and reflecting each customer’s viewpoint correctly (Danner et al., 2011).

In this study, after interviewing 45 frontline employees, 18 items of service failure was found and categories into 1) Professionalism failure (5 items); 2) Service attitude and responsiveness failure (6 items); 3) Hospital environment failure (4 items); 4) Customer perception failure (3 items), and 5) Customer attitude failure (4 items). The weights for each category and each item were provided by 45 respondents. The results are shown in Table 2.

[Insert Table 2 Here]

Table 2 presents the results of the dimension priority weights based on the responses from our respondents. The weight is used to compute the principle eigenvectors (EV), which shows the priority of each criterion. λ_{max} equals 5.231 and CR is 0.051, which tells that both of them have fulfilled the requirements of the consistency and the respondents reach a reasonable consensus. The highest eigenvector value 0.2412 shows that “Service Attitude and Responsiveness Failure” has the first priority, indicating that hospital staffs consider the failures of this category as the most important items of service failures to be solved primarily, followed by “Customer Perception Failure” with an eigenvector of 0.2354, “Customer Attitude Failure” with an eigenvector of 0.2061, “Professionalism Failure” with an eigenvector of 0.1736 and “Hospital Environment Failure” with an eigenvector of 0.1437. Based on the results obtained, the hospital staffs should respond to customers when they have failures or complaints from customers. In addition, hospital management team should focus on reducing the number of service failure and reviewing customer complaints constantly, then and providing solution to patients and their relatives to reduce their complaints.

The results discovered the top two priorities of the service failures which are dimension Customer Perception Failure and Customer Attitude Failure, which means that the failures caused by customer personal perception and attitude would have been more important than other failures. Therefore, hospital staffs should put more efforts to recover or mitigate the effect of failures.

3.4 Quality Function Deployment (QFD)

Following AHP, QFD was used to understand the exact requirements of customers and dig out the solutions that hospitals built to recover the service failure. QFD is the comprehensive decision making tools that could effectively interpret the dimensions of service

failures into service recovery strategies. The integration of QFD and AHP techniques is used to help decision makers to plan and to evaluate problems, so that management executives could design or improve the services to fulfill or surpass customer requirements. The procedure of QFD can be explored through the following steps.

3.4.1 Step 1: Identify customer requirements.

A series of interviews were conducted and the respondents show five major type of service failures such as (1) Professionalism failure; (2) Service attitude and responsiveness failure; (3) Hospital environment failure; (4) Customer perception failure; and (5) Customer attitude failure.

3.4.2 Step 2: Identify service recovery strategies.

With the help of the respondents, the employment of QFD, the dimensions of service failures are transferred to functional solutions (service recovery strategies). During the interviews, this study asked the respondents about the effective service recovery strategies to compensate the loss of the customers from each service failure they encountered. Eventually, 16 items of service recovery strategies was concluded and categories into 1) Improvement (6 items); 2) Assistance (4 items); and 3) psychological compensation (4 items) as shown Figure 2.

Service Recovery Strategies		Rank	Importance rating	Improvement						Assistance		Psychological compensation					
				T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
				Referral	Treatment plan	Training courses	Purchase the advanced equipment	Group consultation of doctors	Present the license and certification	Report abnormal situations and track	Give the route direction	Fulfill customers' requests immediately	Give health education and medical knowledge	Apology and appeasement	Communication	Suggestion box	Acknowledgement for agreement form
Service Failures																	
Professionalism Failure (PF)	Doctors can't well explain the state of illness (PF1)																
	Doctors & nurses are not skilled enough (PF2)																
	Customer can't understand the explanation due to too much terminology (PF3)																
	Incomplete health education causes ineffective communication between customers and hospital staff (PF4)																
	Surgery failure (PF5)																
Service Attitude and Responsiveness Failure (SF)	The serving attitude is not friendly and intimate (SF1)																
	The procedure for admission and discharge is complicated (SF2)																
	Long waiting time (SF3)																
	The speaking rate is too fast (SF4)																
Hospital Environment Failure (HF)	No empathy (SF5)																
	The medical expenses out of NHI scope is not clear (SF6)																
	The toilet and aisle are not clean (HF1)																
	Route direction is not clear (HF2)																
Customer Perception Failure (CF)	The temperature of hospital is not suitable (HF3)																
	Don't keep quiet at patient rooms (HF4)																
	Customers persist their cognitive knowledge is correct (CF1)																
Customer Attitude Failure (AF)	No sufficient understanding on medicine or device out of NHI scope and like to request discount when buying (CF2)																
	The treatment outcomes can't meet customer's expectation (CF3)																
	Don't respect the nurses, only follow doctors' instructions (AF1)																
	Request nurses to take the duties of caregiver (AF2)																
	Don't follow doctors' instructions (AF3)																
	Patients' disruptive complaints and behaviours (AF4)																

Figure 2. QFD Conceptual Model

3.4.3 Step 3: Calculate the importance weight for customer requirements.

To calculate the importance weight for each element, experts' inputs are essential. The hospital experts' judgments and evaluations, following rule of AHP pairwise comparison, we can get the statistical results and rank the requirements as depicted in figure 3.

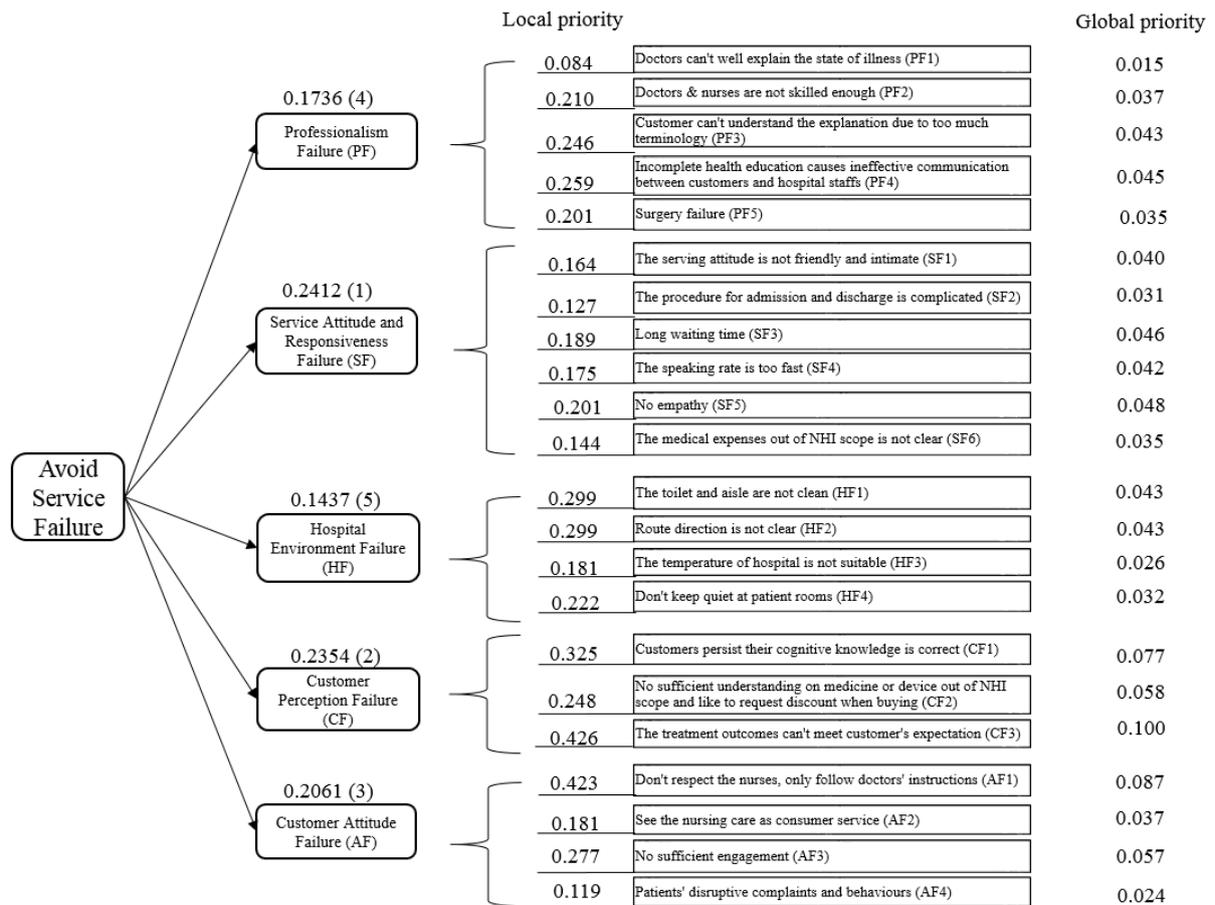


Figure 3. The weights and rank of service failures

3.4.4 Step 4: Define and calculate inter-relationships between service failures and service recovery strategies.

The relationships between service failure and recovery are then established, namely, for each of the relationship between the items of service failure and those of service recovery strategies, 10 meaning strong relationship, 5 meaning medium relationship, and 1 meaning weak relationship. The relationship between HOW service recovery and WHAT service failure is generally decided by examining to what degree the HOW could technically related to and influence the WHAT. The matrix of HOQ is to explain the inter-relationships among items of service recovery strategies. The interpretation between service failure and recovery is shown in later on. Figure 4 shows the dimensions of the service recovery strategy.

4. Results

4.1 *The Matrix of Interrelationships between Service Failures and Recovery Strategies.*

Figure 4 shows the interrelationships between service failures and service recovery strategies. Each failure should have a matching to service recovery strategies. The weight in the matrix is obtained from experts' rating on how much the specific items of recovery strategy responds to specific item of service failures. There are 4 colors existing in this matrix, color blue means the strategy is very effective to respond to the failures, color yellow indicates moderate effective whereas color orange and pink means slightly effective when hospital staffs use to respond the failures. In addition, figure 4 contains the weight and rank of service recovery strategies.

Move on to the dimension of "Professionalism Failure", Figure 4 tells that, from the employee point of view, a single recovery strategy is not sufficient to satisfy the failures. Based on the data collected, the sequence of failures in this dimension is "Incomplete health education causes ineffective communication between customers and hospital staffs (PF4)", "Customer cannot understand the explanation due to too much terminology (PF3)", "Doctors & nurses are not skilled enough (PF2)", "Surgery failure (PF5)" and "Doctors can't well explain the state of illness (PF1)". The purpose of these strategies is to let patients understand their illness through constant communication, explanation, education and ease their complaints concurrently. Therefore, a combination of recovery strategies is very practical and useful during the process of recovering the failures.

In addition, there is an interesting finding. Because the failures of Service Attitude and Responsiveness Failure are about the hospital staffs themselves, the action recommended is to adopt "Psychological compensation", followed by "Assistance". Without doubt, "Communication (T12)" is the most utilized recovery strategy to respond to the failures, an association with T9, T11 and T13 which are "fulfill customers' requests immediately",

“apology and appeasement”, and suggestion box”, respectively, would be the better solutions to satisfy customers.

Regarding to the interrelationships between Hospital Environment Failures and recovery strategies, Hospital Environment Failures are the failures relative simple and easy compared to the other failure dimensions. The computed weight illustrates that the service recovery strategies have relatively lower influence on satisfying the customer needs. Additionally, to satisfy the failures of Customer Perception Failures dimension, “Communication (T12)” is the most suitable strategy, associated with T10, T2 and T14 which are “Give correct medical knowledge and health education”, “Communication”, and “Acknowledgement for the agreement form”, respectively, at the same time could have better recovery effect.

Finally, an association with T10 and T2 could better satisfy different type of failures in the Customer Attitude Failure dimension. For example, when a doctor finishes the diagnosis or physician office visit, nurses would give some precautions to patients and their relatives, these would become severe issues if patients ignore these precautions. Therefore, hospital staffs should adopt strategy the “Give correct medical knowledge and health education (T10)” and “Case sharing and treatment plan (T2)” timely to prevent unwanted outcome.

Service Recovery Strategies		Rank	Importance rating	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
				Improvement				Assistance				Psychological compensation					
				Referral	Case sharing and treatment plan	Training courses	Purchase the advanced equipment	Group consultation of doctors	Present the license and certification	Report abnormal situations and track	Give the direction and assistance	Fulfill customer's requests immediately	Give correct medical knowledge and health education	Apology and appeasement	Communication	Suggestion box	Acknowledgment for the treatment form
Service Failures																	
Professionalism Failure (PF)	Doctors can't well explain the state of illness (PF1)	22	0.015	4.43	6.40	1.40	1.46	5.17	1.63	3.31	0.49	3.63	6.97	5.20	7.51	3.51	6.00
	Doctors & nurses are not skilled enough (PF2)	15	0.037	1.17	3.43	3.60	2.60	2.74	3.77	1.83	0.11	2.00	3.66	4.83	4.74	2.94	2.60
	Customer can't understand the explanation due to too much terminology (PF3)	11	0.043	1.80	5.83	3.31	0.97	4.23	2.77	3.69	0.83	4.29	6.97	4.57	7.37	3.91	4.26
	Incomplete health education causes ineffective communication between customers and hospital staffs (PF4)	8	0.045	2.49	6.03	3.71	2.00	4.89	2.26	3.89	0.89	4.17	6.97	4.91	7.34	3.69	5.20
Service Attitude and Responsiveness Failure (SF)	Surgery failure (PF5)	16	0.035	4.29	5.57	0.97	3.40	5.29	1.83	4.54	1.00	3.86	4.89	5.09	6.77	3.80	4.43
	The serving attitude is not friendly and intimate (SF1)	13	0.040	2.74	2.97	3.29	0.23	3.80	1.20	2.91	4.37	5.20	2.86	5.63	5.94	5.03	1.71
	The procedure for admission and discharge is complicated (SF2)	19	0.031	2.69	2.03	0.97	0.09	2.09	0.57	4.66	4.26	3.00	4.03	5.34	4.09	1.40	
	Long waiting time (SF3)	7	0.046	3.69	2.31	0.94	0.29	1.69	0.26	1.91	4.11	4.31	2.97	4.63	5.46	4.40	1.17
	The speaking rate is too fast (SF4)	12	0.042	3.17	2.54	0.91	0.03	2.34	0.83	2.77	3.43	4.69	3.77	4.94	6.06	4.54	2.74
	No empathy (SF5)	6	0.048	2.60	2.29	1.14	0.26	2.11	1.00	2.40	2.80	4.09	3.17	4.26	5.69	4.14	1.51
Hospital Environment Failure (HF)	The medical expenses out of NHI scope is not clear (SF6)	17	0.035	1.80	1.97	0.40	1.31	1.26	0.23	1.26	1.60	2.69	2.57	3.23	4.91	3.91	4.63
	The toilet and aisle are not clean (HF1)	9	0.043	1.51	0.94	1.23	0.14	0.86	0.11	0.74	2.14	3.60	1.54	3.26	3.94	3.94	0.71
	Route direction is not clear (HF2)	9	0.043	1.49	0.97	0.57	0.31	0.97	0.37	0.89	6.60	3.37	1.40	2.89	4.51	4.34	0.97
	The temperature of hospital is not suitable (HF3)	20	0.026	0.69	0.97	0.66	0.31	0.97	0.11	0.80	2.09	3.86	1.57	2.69	3.71	4.29	0.43
Customer Perception Failure (CF)	Don't keep quiet at patient rooms (HF4)	18	0.032	1.40	1.20	0.66	0.40	1.09	0.23	1.46	2.11	4.06	2.06	3.03	4.00	3.77	0.57
	Customers persist their cognitive knowledge is correct (CF1)	3	0.077	3.06	4.09	1.17	1.94	2.46	1.34	1.37	1.37	3.26	4.94	3.37	5.97	2.54	2.29
	No sufficient understanding on medicine or device out of NHI scope and like to request discount when buying (CF2)	4	0.058	2.14	2.49	0.77	2.46	1.37	0.97	0.17	0.31	2.49	3.23	2.66	5.34	2.80	4.34
Customer Attitude Failure (AF)	The treatment outcomes can't meet customer's expectation (CF3)	1	0.100	3.20	4.91	1.91	2.11	3.26	2.09	1.34	0.80	3.43	5.20	4.00	6.74	3.23	4.31
	Don't respect the nurses, only follow doctors' instructions (AF1)	2	0.087	1.89	4.11	1.37	0.91	2.66	3.03	0.80	0.71	2.20	4.49	3.46	6.20	2.89	1.69
	Request nurses to take the duties of caregivers (AF2)	14	0.037	3.03	2.80	1.51	1.11	2.43	3.29	0.91	1.26	2.86	3.14	3.46	4.91	3.09	1.66
	No sufficient engagement (AF3)	5	0.057	2.74	3.86	1.29	1.14	2.86	3.17	0.86	1.46	2.40	4.40	3.51	5.71	2.66	2.11
Weights Percentage Rank	Patients' disruptive complaints and behaviours (AF4)	21	0.024	2.20	2.57	0.51	0.14	1.46	1.60	0.40	0.31	1.37	3.14	1.60	5.74	1.63	1.69
				54.20	70.29	32.31	23.63	55.97	32.66	38.83	43.46	76.06	82.91	85.23	123.94	79.14	56.43
				6.34%	8.22%	3.78%	2.76%	6.53%	3.82%	4.54%	5.08%	8.89%	9.70%	9.97%	14.50%	9.26%	6.60%
				9	6	13	14	8	12	11	10	5	3	2	1	4	7

Figure 4. The matrix of interrelationships between service failures and recovery strategies

4.2 The Matrix of Correlation among Service Recovery Strategies.

Figure 5 illustrates the correlation between service recovery strategies that appear in the roof of HOQ. The computed weight is obtained from the experts' comments from the interviews on the correlation among items of each service recovery strategies. The ++ indicates a strong correlation engagement between two recovery strategies and + means positive correlation between two recovery strategies. Positive correlation illustrates when one strategy is being adopted, the effect would be more effective to combine with the other strategy at the same time. As shown in the figure, only the relations between T8 and T9, T8 and T12, and T8 and T10 have a weight greater than 3 (they are 3.743, 3.343 and 3.086, respectively). This proves that there's no significant effect on the association of the service recovery strategies T8 and T9, T8 and T12, and T8 and T10.

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
T1														
T2	4.486													
T3	1.143	+ 5.229												
T4	2.029	4.714	2.943											
T5	+ 5.057	++ 7.629	4.714	3.314										
T6	0.971	4.371	2.914	2.800	2.914									
T7	3.914	4.743	3.543	1.800	3.857	2.114								
T8	2.486	0.657	0.771	0.943	1.686	0.457	0.314							
T9	+ 5.086	+ 5.686	2.914	2.771	4.200	2.457	4.400	3.743						
T10	+ 6.743	++ 7.029	+ 5.343	2.971	+ 5.400	4.600	+ 5.514	3.086	+ 6.743					
T11	4.371	+ 6.514	2.343	1.457	4.343	4.000	4.657	2.343	+ 6.343	+ 6.514				
T12	+ 6.200	++ 7.600	3.571	2.800	+ 6.571	4.886	+ 6.686	3.343	++ 7.371	++ 7.971	++ 7.229			
T13	2.771	3.457	1.114	1.000	2.143	1.657	2.371	2.029	+ 6.114	4.886	+ 5.429	++ 7.371		
T14	3.600	3.343	2.057	1.543	1.657	1.600	2.943	1.514	3.743	3.600	3.086	++ 7.029	2.029	

Figure 5. The matrix of correlation among service recovery strategies

4.3 Overall Score and Ranking of House of Quality.

The overall score and ranking of service failure and service recovery strategy are combined in the House of Quality, as shown in Figure 6. From hospital expert's standpoint, "Communication (T12)" (14.5%) is ranked the first priority, followed by "Apology and appeasement (T11)" (9.97%), and so on.

Service Recovery Strategies		Rank	Importance	Correlation Matrix													
				T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
Service Failures	Doctors can't well explain the state of illness (PF1)	22	0.015	4.43	6.40	1.40	1.46	5.17	1.63	3.31	0.49	3.63	6.37	5.20	7.51	3.51	6.00
	Doctors & nurses are not skilled enough (PF2)	15	0.037	1.17	3.43	3.60	2.60	2.74	3.77	1.83	0.11	2.00	3.66	4.83	4.74	2.94	2.60
	Customer can't understand the explanation due to too much terminology (PF3)	11	0.043	1.80	5.83	3.31	0.97	4.23	2.77	3.69	0.83	4.29	6.37	4.57	7.37	3.91	4.26
	Incomplete health education causes ineffective communication between customers and hospital staffs (PF4)	8	0.045	2.49	6.03	3.71	2.00	4.89	2.26	3.89	0.89	4.17	6.37	4.91	7.34	3.69	5.20
	Surgeon failure (PF5)	16	0.035	4.29	5.57	0.97	3.40	5.29	1.83	4.54	1.00	3.86	4.89	5.09	6.77	3.80	4.43
	The serving attitude is not friendly and intimate (SF1)	13	0.040	2.74	2.97	3.29	0.23	3.80	1.20	2.91	4.37	5.20	2.86	5.63	5.94	5.03	1.71
	The procedure for admission and discharge is complicated (SF2)	19	0.031	2.69	2.03	0.97	0.09	2.09	0.57	0.57	4.66	4.26	3.00	4.03	5.34	4.03	1.40
	Long waiting time (SF3)	7	0.046	3.69	2.31	0.94	0.29	1.69	0.26	1.91	4.11	4.31	2.97	4.63	5.46	4.40	1.17
	The speaking rate is too fast (SF4)	12	0.042	3.17	2.54	0.91	0.03	2.34	0.83	2.77	3.43	4.69	3.77	4.94	6.06	4.54	2.74
	No empathy (SF5)	6	0.048	2.60	2.29	1.14	0.26	2.11	1.00	2.40	2.80	4.09	3.17	4.26	5.69	4.14	1.51
	The medical expenses out of NHl scope is not clear (SF6)	17	0.035	1.80	1.97	0.40	1.31	1.26	0.23	1.26	1.60	2.89	2.57	3.23	4.91	3.91	4.63
	The toilet and aisle are not clean (HF1)	9	0.043	1.51	0.94	1.23	0.14	0.86	0.11	0.74	2.14	3.60	1.54	3.26	3.94	3.94	0.71
	Route direction is not clear (HF2)	9	0.043	1.49	0.97	0.57	0.31	0.97	0.37	0.89	6.80	3.37	1.40	2.89	4.57	4.34	0.97
	The temperature of hospital is not suitable (HF3)	20	0.026	0.69	0.97	0.86	0.31	0.97	0.11	0.80	2.09	3.86	1.57	2.63	3.71	4.23	0.43
Don't keep quiet at patient rooms (HF4)	18	0.032	1.40	1.20	0.68	0.40	1.09	0.23	1.46	2.11	4.06	2.06	3.03	4.00	3.77	0.57	
Customer Perception Failure (CF)	3	0.077	3.06	4.09	1.17	1.94	2.46	1.94	1.37	1.37	3.28	4.94	3.37	5.97	2.54	2.29	
No sufficient understanding on medicine or device out of NHl scope and like to request discount when buying (CF2)	4	0.058	2.14	2.49	0.77	2.46	1.37	0.97	0.17	0.31	2.49	3.23	2.66	5.34	2.80	4.34	
The treatment outcomes can't meet customer's expectation (CF3)	1	0.100	3.20	4.91	1.91	2.11	3.26	2.09	1.34	0.80	3.43	5.20	4.00	6.74	3.23	4.31	
Don't respect the nurses, only follow doctors' instructions (AF1)	2	0.087	1.89	4.11	1.37	0.91	2.66	3.03	0.80	0.71	2.20	4.49	3.46	6.20	2.89	1.69	
Request nurses to take the duties of caregiver (AF2)	14	0.037	3.03	2.80	1.51	1.11	2.43	3.29	0.91	1.26	2.86	3.14	3.46	4.91	3.09	1.66	
No sufficient engagement (AF3)	5	0.057	2.74	3.86	1.29	1.14	2.86	3.17	0.86	1.46	2.40	4.40	3.51	5.71	2.66	2.11	
Patients' disruptive complaints and behaviours (AF4)	21	0.024	2.20	2.57	0.51	0.14	1.46	1.60	0.40	0.31	1.37	3.14	1.60	5.74	1.63	1.69	
Weights			54.20	70.29	32.31	23.63	55.97	32.66	38.83	43.46	76.06	82.91	85.23	123.94	79.14	56.43	
Percentage			6.34%	8.22%	3.78%	2.76%	6.55%	3.82%	4.54%	5.08%	8.89%	9.70%	9.97%	14.50%	9.26%	6.80%	
Rank			9	6	13	14	8	12	11	10	5	3	2	1	4	7	

Figure 6. House of quality

5. Conclusions and Discussions

5.1 Academic Implications

The main objective of this study is to dig out the most common service failures in hospital through interviewing with hospital experts and then applying QFD and AHP to discover the effective recovery strategies for each service failure in the hospital. This study extends our understanding of service failure and service recovery solutions to the hospital by adding a new methodology. In addition, this study applies a comprehensive method matching service recovery to develop strategies to help hospital management team to adopt a most effective manner to respond to the service problems and customer's complaints.

From QFD and AHP analysis, the results show that, from hospital experts' standpoint, Service Attitude and Responsiveness Failure (24.12%) is the most critical failure to be solved immediately. The problems under this dimension are the most common and demanding failures in a hospital. This result is supported by prior researches of Taylor et al. (2002) and Elayan and Ahmad (2017). Followed by Customer Perception Failure (23.54%), Customer Attitude Failure (20.61%), Professionalism Failure (17.36%) and Hospital Environment Failure (14.37%). Previous findings also illustrate that the failures about customers themselves are usually crucial factors to determine a service failure happened or not, which is also supported by the previous researchers (Castro et al., 2016; Geum et al., 2011). Therefore hospital staffs need to always put lots of efforts to communicate, educate and explain the details of the illness to the patients and their relatives. The importance of Professionalism Failure is relative low, this is because that this kind of failure does not happen every day. Yet, once it occurs, the doctors and nurses would put the greatest effort to resolve the issue and reduce patients complaints.

For service recovery strategies, the five most helpful strategies are "Communication", "Apology and appeasement", "Give correct medical knowledge and health education", "Suggestion box" and "Fulfill customers' requests immediately". The findings here are

consistent with those of previous studies. “Communication”, “Apology and appeasement” and “Suggestion box” are the recovery strategies categorized into the dimension “Psychological compensation”, which is termed as strategy of human intervention to respond to the service failures (Warden et al., 2008). Miller et al. (2000) demonstrated that psychological recovery is the effort attempting to mitigate the situation through showing concern to customer needs. “Give correct medical knowledge and health education” and “Fulfill customers' requests immediately” are the recovery strategies categorized into the dimension “Assistance”, which means the recovery action “assistance” is kind of the interaction between service provider and customer helping to recover the failures (McDougall and Levesque, 1998). The only one thing different is “Suggestion box”. “Suggestion box” (physical box or hospital website) is a practical method for most of hospitals in Taiwan to listen to the voice of customers. Customers, namely patient and their relatives, can provide their comments through this way. This is kind of communication and interaction between hospital and patients. This means the current results well reflect the perspective of hospital staffs. Besides, based on the statistical data, the least effective recovery strategies to solve service failures are “Purchase the advanced equipment”, “Training courses” and “Present the license and certification”. From hospital staffs' point of view, the problems from Service Attitude and Responsiveness Failure are more important and need to be solved rapidly. For example, a patient complains about the waiting time is too long or the procedure of discharge is too complicated, if he or she can't receive assistance or appeasement from hospital staffs, he/she may not be satisfied with the service. They are thus the least effective strategies in service recovery.

Moving to the correlations among the items of service recovery strategies that appeared in the roof of HOQ, it is suggested to adopt two strategies in the meantime. The strategy of “Communication” is often accompanied by other recovery actions, particularly “Case sharing and treatment plan”, “Fulfill customers' requests immediately”, “Apology and appeasement”

and “Suggestion box”. Patients may not be so emotional and be more satisfied if they receive apologies and explanation from hospital staffs. In relation to the strategy of “Acknowledgement for agreement form”, only “Communication” can accompany this since hospital staffs should take the responsibility to let patient understands the comprehensive situation when acknowledging the agreement form. For example, if a failure is related to patient’s attitude, only “Acknowledgement for agreement form” can be used to respond to the failure, hospital staffs should effectively communicate with patients and their relatives and providing empowering patients by offering sufficient information in the decision making process (Elayan and Ahmad, 2017). Therefore, the roof of HOQ in this study can be adopted as a useful tool for hospital management team when building recovery strategies. It should not only consider presenting the recovery strategies, but trying to combine one effective strategy with another applicable one.

5.2 Managerial Implications

The findings here can assist hospital management team in developing better recovery strategies by understanding the integrated application of QFD and AHP. Precisely, service failures related to service attitude and responsiveness and hospital environment occur on a daily basis and can be solved in a timely manner because they are failures about hospital staffs themselves and hospital itself. Apart from this, service failures about customer perception and attitude and behavior are crucial to hospital staffs and bring them stress. Hospital management team should provide assistance to the staffs at the right time and provide training to improve for employees to improve their interpersonal skills.

5.3 Limitation and Further Research

As previous studies, this research has some limitations that may need to be investigated in the future research. First, the results and the implications are only targeted at 3 hospitals in Kaohsiung, Tainan, and Taipei, with two district hospitals and one medical center, respectively.

The results here cannot cover all levels of hospital in Taiwan. Second, very high percentage of the respondents are nurses, among them. Therefore, the inputs may not represent the real opinions of all employees. Third, the respondent diversity is not good enough because most of the doctors are super busy and refuse to answer the questionnaire. Future research can select more diversified samples or conduct questionnaire survey approach to compare the results with different studies.

Finally, for the dimensions of service failure and service recovery strategy, this study followed previous researches to categorize the failures and recovery strategies. Future research can introduce some contingency variables to test the above relationships with different contingency studies.

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