ORIGINAL ARTICLE

Measuring functional quality in the pediatric intensive care

Jeffrey B. Sussmane

Department of Pediatrics, Al Rahba Hospital, Abu Dhabi, United Arab Emirates

Correspondence: Jeffrey B. Sussmane. Chairman Department of Pediatrics, MD, MBA, FCCM, FAAP, FACCP. Address: P.O. Box 34555, Al Rahba Hospital, Abu Dhabi, UAE. E-mail: jsussmane@alrahba.ae

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Abstract

Defining, measuring and delivering quality is an important challenge facing Health Care. Health Care as a Service Industry may be described with two forms of quality: technical quality, and functional quality. (1) Our previously published technical study demonstrated a reproducible and scalable measure of the technical quality, without additional capital cost. (2) A technical study, and the application of any service or measurement of quality, may be sub optimal if pursued in isolation from the patient/family (customer) perception. This study measured the functional quality of a complex Health Care service from the patient/family perception, which is perhaps superior and more relevant. We have quantified and documented an excellent competitive franchise and competitive advantages for our services, in our market, as well as areas for improvement, without additional capital expense.

Key words

Quality, Functional quality, Technical quality, Customer perceptions, Servqual, Pediatric intensive care

1 Introduction

Quality is the cornerstone of all successful organizations. Defining, measuring, and delivering quality are some of the most important challenges facing Health Care. Health Care as a service industry may be described with two forms of quality; technical and functional [1]. Technical measurements of clinical activity, as a reference for service quality may be counterproductive if pursued in isolation from the patient's perception of the quality of service received, the functional quality [2]. The pressure on Health Care to deliver higher standards of care with reduced costs may lead to the sub-optimal implementation of management techniques to eliminate service waste when only measuring quality through clinical activity. The application of Therapeutic Apheresis (TA) is a complex clinical activity, in the PICU, involving multiple hospital services, and patient/families who are intimately involved with all aspects of care. We initially measured the technical quality of our TA service, and now present an evaluation of the patient/family perception of functional quality [3]. This is often more relevant and a superior method for building brand loyalty [2, 4-6]. We choose the servqual "gap" method to measure functional quality. It is a measurement of the "gap" between the individual's expectation of service and the individual's perception of the actual service received [7].

2 Methods

The study was done with the approval of the Western IRB. A blinded, 28 question servqual survey was given to families receiving TA in the PICU. Apheresis stems from the Greek verb aphaeresis meaning "to take away, withdraw or separate". TA separates blood components with a centrifuge or filter, with the goal of removing or depleting unique circulating cells or factors from the blood that may be responsible for a disease process [8-10]. The original concept of removing circulating "toxins or humours" is thousands of years old and has been shown to increase the chance of recovery for a variety of conditions [11-17].

Servqual is an instrument developed with the support of the Marketing Science Institute [4, 7]. It has been proven to be a reliable, valid and reproducible tool to assess customer perceptions of service quality, across a broad range of services [7, 18-21]. This tool relies on the definition of five dimensions of service, that have been verified as critical to measuring the customer's perception of service quality [20]. These dimensions have been validated and correlated to the primary values that shape the customers perceptions and decisions regarding a service [7, 18, 19, 21].

The definitions of the five dimensions of servqual are:

1) Tangibles: Appearance of physical facilities, equipment, personnel and communication materials.
2) Reliability: Ability to perform the promised service dependably and accurately.
3) Responsiveness: Willingness to help customers and provide prompt service.
4) Assurance: Knowledge and courtesy of employees and their ability to inspire trust and confidence.
5) Empathy: Caring, individualized attention the firm provides its customers.

Sixteen of the servqual questions in the survey are designed to provide quantifiable data in one of the Five Dimensions. The survey requests three responses per question:

1) What is the Minimum Service Level you consider acceptable?
2) What is the level of service you received?
3) What is the level of service you desire?

Each question requests a response to the, Minimum Acceptable Service, Perceived Service Received and Service Desired on a scale from 1-9 (see Figure 1). The response in each of the three (Minimum, Desired and Perceived) categories is totaled, averaged and graphed (see Table 1, Table 2).

The average value of the "Minimum Service Acceptable" is subtracted from the average value of the "Perceived Services Received", for each question. This is the value of the "Measure of Service Adequacy" (MSA), for each question. If the average value of the perceived service received is greater then the average value of the minimum acceptable service, then the MSA is positive for that question. The MSA is a measurement of any "gap" between the perception of the service received and the minimum level of service desired.

The average value of the "Desired level of Service" is subtracted from the average value of the "Perceived Services Received", for each question. This is the value of the "Measure of Service Superiority" (MSS), for each question. If the average value of Perceived Services received is higher than the average value of the Desired Services, than the MSS is positive for that question. The MSS is a measurement of any "gap" between the perception of service received and the level of desired service. These positive and negative values for MSA and MSS are plotted on a graph measuring "Service Adequacy and Superiority" (see Figure 2).

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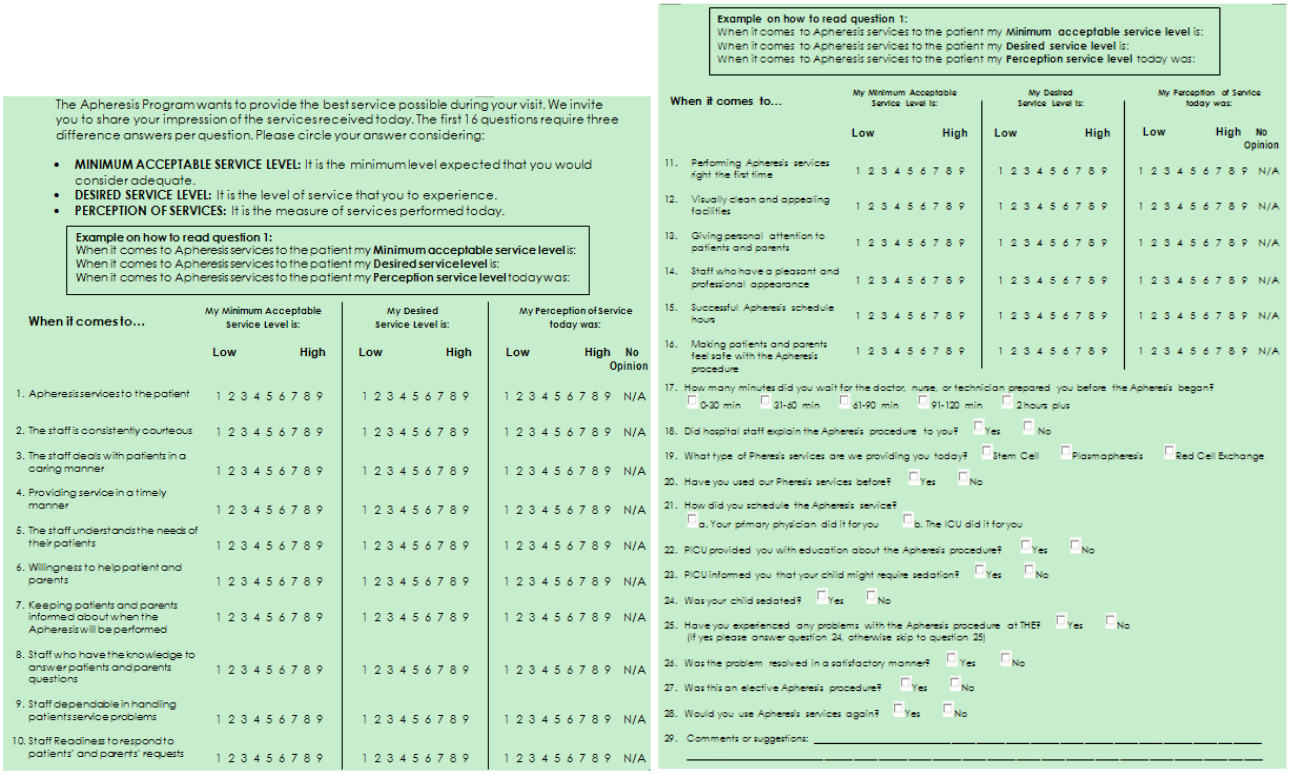

The Apheresis Program wants to provide the best service possible during your visit. We invite you to share your impression of the services received today. The first 16 questions require three difference answers per question. Please circle your answer considering:

- **MINIMUM ACCEPTABLE SERVICE LEVEL:** It is the minimum level expected that you would consider adequate.
- **DESIRED SERVICE LEVEL:** It is the level of service that you to experience.
- **PERCEPTION OF SERVICES:** It is the measure of services performed today.

Example on how to read question 1:
When it comes to Apheresis services to the patient my **Minimum acceptable service level** is:
When it comes to Apheresis services to the patient my **Desired service level** is:
When it comes to Apheresis services to the patient my **Perception service level** today was:

When it comes to...	My Minimum Acceptable Service Level is: Low	High	My Desired Service Level is: Low	High	My Perception of Service today was: Low	High	No Opinion
1. Apheresis services to the patient	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
2. The staff is consistently courteous	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
3. The staff deals with patients in a caring manner	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
4. Providing service in a timely manner	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
5. The staff understands the needs of their patients	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
6. Willingness to help patient and parents	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
7. Keeping patients and parents informed about when the Apheresis will be performed	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
8. Staff who have the knowledge to answer patients and parents questions	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
9. Staff dependable in handling patients service problems	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
10. Staff Readiness to respond to patients' and parents' requests	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A

Example on how to read question 1:
When it comes to Apheresis services to the patient my **Minimum acceptable service level** is:
When it comes to Apheresis services to the patient my **Desired service level** is:
When it comes to Apheresis services to the patient my **Perception service level** today was:

When it comes to...	My Minimum Acceptable Service Level is: Low	High	My Desired Service Level is: Low	High	My Perception of Service today was: Low	High	No Opinion
11. Performing Apheresis services right the first time	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
12. Visually clean and appealing facilities	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
13. Giving personal attention to patients and parents	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
14. Staff who have a pleasant and professional appearance	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
15. Successful Apheresis schedule hours	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A
16. Making patients and parents feel safe with the Apheresis procedure	1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		1 2 3 4 5 6 7 8 9		N/A

17. How many minutes did you wait for the doctor, nurse, or technician prepared you before the Apheresis began? ☐ 0-30 min ☐ 31-60 min ☐ 61-90 min ☐ 91-120 min ☐ 2 hours plus
18. Did hospital staff explain the Apheresis procedure to you? ☐ Yes ☐ No
19. What type of Pheresis services are we providing you today? ☐ Stem Cell ☐ Plasmapheresis ☐ Red Cell Exchange
20. Have you used our Pheresis services before? ☐ Yes ☐ No
21. How did you schedule the Apheresis service? ☐ a. Your primary physician did it for you ☐ b. The ICU did it for you
22. PICU provided you with education about the Apheresis procedure? ☐ Yes ☐ No
23. PICU informed you that your child might require sedation? ☐ Yes ☐ No
24. Was your child sedated? ☐ Yes ☐ No
25. Have you experienced any problems with the Apheresis procedure at THE? ☐ Yes ☐ No (if yes please answer question 24, otherwise skip to question 25)
26. Was the problem resolved in a satisfactory manner? ☐ Yes ☐ No
27. Was this an elective Apheresis procedure? ☐ Yes ☐ No
28. Would you use Apheresis services again? ☐ Yes ☐ No
29. Comments or suggestions: _____

Figure 1. Critical care apheresis service

Table 1. Average value of each question, plotted within the dimension

	Responsiveness			Assurance				Empathy	
9									
8.9									
8.8			X^{Φ}	$X^{\dagger}$	$X^{\dagger}$	X^{Φ}	$X^{\dagger}$		
8.7									
8.6	$X^{\dagger}$	$X^{\dagger}$							$X^{\dagger}$
8.5									
8.4								$X^{\dagger}$	
8.3									
8.2									
8.1									
8									
7.9									
7.8									
(1,7)									
	Q1	Q6	Q10	Q2	Q8	Q16	Q3	Q5	Q13

$X^{\dagger}$ = average value for each question
X^{Φ} - Within Zone of Tolerance = Competitive Advantage

The MSA and MSS values correlate to the competitive status of your service, in your marketplace [7]. If the MSA and MSS are negative then your service is at a "Competitive Disadvantage". If the MSA is positive and MSS is negative, then your service has a "Competitive Advantage." If both the MSA and MSS are positive then your service has the most successful categorization of "Customer Franchise" [7, 21] (see Figure 2).

Table 2. Average value of each question, plotted within the dimension

	Reliability				Tangibles		
9							
8.9							
8.8							
8.7					$X^{\dagger}$	$X^{\dagger}$	
8.6			$X^{\dagger}$	$X^{\dagger}$			
8.5							
8.4		$X^{\dagger}$					
8.3							
8.2							
8.1							
8							
7.9							$X^{\#}$
7.8	X^{Φ}						
(1,7)							
	Q4	Q7	Q9	Q11	Q12	Q14	Q15

$X^{\dagger}$ = average value for each question
X^{Φ} - Within Zone of Tolerance = Competitive Advantage
$X^{\#}$ - Below Zone of Tolerance = Competitive Disadvantage

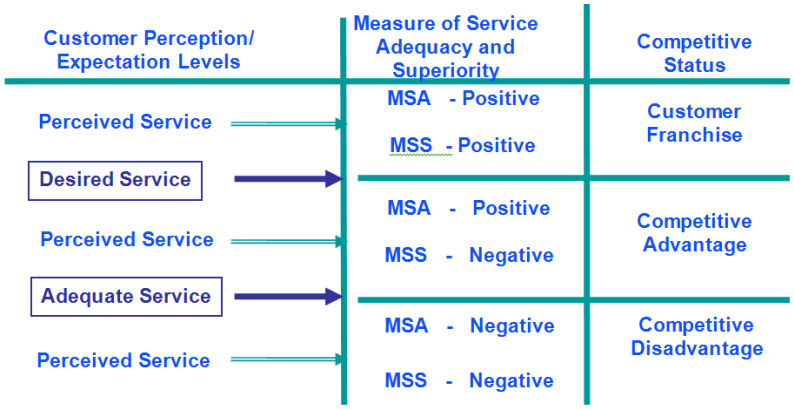

Figure 2. Relative competitive status defined by measures of service adequacy and superiority (reproduced with permission Dr. Parasuraman)

Figure 3. Competitive status based on performance relative to zone of tolerance (reproduced with permission Dr. Parasuraman)

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The "Zone of Tolerance" defines a range of customer expectations regarding the functional quality of your service. The MSA and MSS are plotted on a graph that also shows the adequate (minimum) and desired service expectations (*i.e.*, the zone of tolerance) to clarify the market position of your service [7, 21] (see Figure 3).

Questions 17-24 were designed to overlap the technical quality measurements previously taken, to capture validity and reliability for this study [3]. Questions 25 and 26 were specifically designed to capture errors in our service and the recovery from those errors. All surveys were available in English and Spanish and were collected and tabulated blindly by individuals not connected to the delivery of service.

3 Results

We systematically examined the patient/family perception of this service. We utilized the reliable, valid and reproducible servqual survey. Our results show a positive MSA and MSS in the Dimension of Assurance. This demonstrates our strongest area of service competency, and a Competitive Franchise. We have all positive MSA's and all negative MSS's for the remaining four Dimensions of Responsiveness, Reliability, Tangibles, and Empathy. This demonstrates a service competency and a Competitive Advantage (see Table 3). We have identified two important areas that require specific improvement: scheduling and time taken to perform procedure, (Dimensions of Tangible and Reliability). Questions 25 asked if there was any problem with the service provided. It was answered "yes" eight times. The next question #26 asked if the problem(s) had been successfully resolved. Question 26 was answered "yes" eight times. This measured our successful (100%) recovery by resolving any and all problems perceived by the patient/family. Questions 17-24 were reviewed and these responses were compatible with the technical quality previously reported [3].

Table 3. Consumer perception of position of service in marketplace

Dimension	MSA*	MSS**	Marketplace position
Assurance	Positive	Positive	Customer
Responsiveness	Positive	Negative	Competitive advantage
Reliability	Positive	Negative	Competitive advantage
Tangible	Positive	Negative	Competitive advantage
Empathy	Positive	Negative	Competitive advantage

* Measure of Service Adequacy - MSA

MSA = Average Perceived Service Received minus Average Minimum Level of Service Expected (MSA is positive within the "Zone of Tolerance")

** Measure of Service Superiority - MSS

MSS = Average Perceived Service Received minus Average Desired Level of Service (MSS is positive above the "Zone of Tolerance")

4 Discussion

Delivering superior quality is a prerequisite for success and has been directly linked to market share and return on investment [18, 22]. The retention of customers by building brand loyalty has been shown to be five times less expensive that attracting new customers [23]. Brand loyalty leads to the additional advantages of increasing referrals, increasing volume and the opportunity for a pricing premium [5, 23]. The perception of quality also reduces the risk of providing services and directly benefits the providers of the service [5].

The Health Care industry as a service industry has two methods of measuring quality; technical and functional [1]. The technical method of measuring quality with accuracy of diagnosis, procedures and outcomes is currently the most prominent [24-27]. The Donabedian theory of quality measures the structure, process and outcome of a process [2, 28]. The Institute of Medicine (IOM) provided a technical definition of quality that is "the degree in which health care services increases the likelihood of desired outcomes for individuals and populations, and is consistent with current professional knowledge" [29]. Technical information may not be readily available to the patient/family and what is available may not be

understood [25]. The IOM also provided a functional definition of quality patient-centered care in it's "Six Quality Aims for Improving Care" as; "care that is respectful of and responsive to individual preferences, needs and values, and ensuring that patient values guide all clinical decisions" [29]. Functional quality refers to the manner in which service is delivered and is determined by the people receiving the service [30-32]. The patient/family perception of the quality of the service received is the most important variable influencing the patient/family decision and economic behavior [1, 24, 31-33]. This has been shown to be valid throughout health care [22, 28-31].

The challenges of measuring functional quality objectively, through the delivery of services has been described with four unique factors; Intangibility, Heterogeneity, Inseparability of production and consumption and Perishability [20]. Health care services cannot be measured directly because they are intangible and heterogenic. The production and consumption of the service additionally cannot be separated and are perishable. This leaves us with the only option of measuring the perception of the services received. Perceived quality is the consumer's judgment about overall excellence or superiority, and results from a comparison of expectations with perceptions of performance [4, 21].

Today's patients are consumers of Health Care Services and expect to receive the same performance of service as from other service industries. Unlimited access to unexplained information provides a marketplace of alternative choices and there is no hesitation to change service providers in this environment. The patient/family inability to access or understand technical data also makes it important to understand the patient/family perception of services [20]. This is why a service marketing approach measuring the recipient's perception of service and quality is crucial [2, 5-7].

There may be also be a critical "gap" between the technical data measuring quality, (originating from the health care provider), and the patient/family perception of the service received [2, 4]. The "gap Model of Service Quality" brings together the customer's perspective and the company's perspective into a common framework. This model suggests that to improve service companies must identify and close the "gap" between customer expectations of service and customers perception of the service received [4, 21].

Balint (1969) coined the term "patient centered care" and the Picker Institute outlined family directed care as: "dignity and respect, information sharing, participation and collaboration" [35, 36]. We incorporated this family directed care model into this study by attempting to answer the specific questions; 1) How do our patient/families perceive and evaluate the service they received, 2) Can we compare the providers technical analysis of quality to this perceived evaluation, and combine it into a model of service quality, 3) How can we achieve measurable, affordable excellence with the most efficient use of our resources and develop the most success position in our marketplace?

Our results show that we have measured our patient/family perception of service and exceeded expectations within the Assurance Dimension. The Assurance Dimension is the most important Dimension in building brand loyalty [2]. We can improve our Dimensions of Responsiveness and Reliability by providing a better scheduling and a better expectation of scheduling and the initiation of service. We have correlated a comparison of our technical and functional data. These have no cost and will indirectly improve our fifth dimension Empathy.

5 Conclusion

Consumer/Patient perception of quality is paramount. A service industry's success depends on the delivery of this quality. Intelligent allocation of resources to delivery quality is the challenge. There are quantifiable costs of service quality to which further reductions will be detrimental to the service and the financial health of a company [37]. We have measured and validated functional quality of a complex Health Care Service from the consumer/patient perspective. We can improve our success, in our marketplace, with a perspective that places the consumers perspective of quality at the core. We have defined and achievable goals, to improve our service quality, at no additional capital expense.

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