Evaluation of healthcare management from a patient's perspective using factor analysis of primary data

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Healthcare is an industry known for the emergence of unique elements and issues, hence rendering its management a continuously challenging role of growing importance. Amongst many others, there are two major stakeholder perspectives of interest on the matter: the healthcare organization's one and the patient's one. The present paper concentrates its focus on the perspective acquired by the patient as a customer. In terms with this context, an anonymous questionnaire was developed and distributed, where participants provided quantified information regarding their patient experience, the satisfaction this service generated, followed by the evaluation of any potential indications regarding the development of managerial competencies within the healthcare organization. The results were statistically processed; descriptive statistics and factor analysis were employed. The outcome of the process was the identification of three major components-clustering of named factors-directly affecting the evaluation of the management of a healthcare facility from the patient's perspective.

Keywords: *Healthcare management; Patient awareness; Managerial competency; Inferential statistics; Factor analysis*

INTRODUCTION

When someone refers to healthcare management, he/she practically refers to the management of hospitals or healthcare systems, while another potential reference could be to health administration. Some of its primary and more important roles include-but are not limited to-ensuring the attainment of the desired outcomes, the smooth operation of the various partitions within a healthcare organization, the effective definition and assessment of jobs and duties, along with the efficient utilization of the available resources [1]. With this being the common perspective on the matter, one of the challenges lies within the successful evaluation of healthcare management from the perspective of the patient/customer. Significant and notable research has already taken place regarding the evaluation of the perceived quality of care received from the patient's perspective, in both qualitative [2] and quantitative approaches. Moreover, the importance of continuity in management from a patient's perspective has also been studied; however, the results showed that the patients corresponded modestly, since their primary focus was on evaluating the physician, without taking into notice the system as a whole [3]. This indicated lack of awareness by the patient regarding the various aspects of healthcare management, led to the identification of a need to study the potential of healthcare management's evaluation-in its main aspects-from the patient's perspective.

Within a healthcare setting, the patient has been argued to act as a customer; since the patient is defined as an individual receiving medical care and/or treatment, while the customer is a person who purchases a service [4], a relatively clear separation between the two meanings in indicated. Studies on the matter conclude that the "patient" characterization is the least objectionable [5] hence it was selected as the "label of choice" for the present paper.

The establishment of patient awareness as far as healthcare management aspects are concerned, along with the increase of his/her knowledge on his/her leverage as a customer, in accordance with the expected quality of the care received, were the primary objectives of the present study; the quantified results and their statistical significance underlined the importance of the outcomes of the study presented below.

METHODOLOGY

When it comes to the evaluation of healthcare management practices, it is the author's belief that an all-around approach should be applied. More specifically, since the primary objective was to evaluate the customer's perspective, a compilation of thematic sections was incorporated to a single questionnaire. The selection of closed format questions was deemed as the appropriate one [6], since when combined with the providing of an arithmetic scale and the assignment of grades as a choice of answer, it allowed the immediate quantification of the primary data collected [7].

At this point, it should be noted that the participation in the present study was at all points voluntary and anonymous. No participant had access to previous answers; hence the assurance of unbiased answers was-up to a point-achieved. Moreover, the origin of the majority of inputs was from individuals employed within the healthcare sector, hence rendering the outcome of the analysis even more valid and reliable.

The first section was compiled by questions addressing demographic characteristics; more specifically, the aim was to collect some general information regarding the participants in the survey, like their age range, their level of education and their perceived health status [8].

The second section of the questionnaire focused on the basic characteristics of both the hospital and the patient; the governance type of the hospital, its number of beds and the patient status were the points addressed towards gathering valuable information on the matter [9].

The third section aimed towards evaluating patient satisfaction, which is included and plays a vital role in the customer experience as a whole. This includes the ease of the appointment making process [10], the treatment received and the equipment used [11], the personnel numbers, their availability and overall stance towards the patient, and the obtaining of follow-up information [12]. All the aspects of patient satisfaction mentioned above, were capped by a summation question, regarding whether there was a perceived improvement of the patient's overall health status following the treatment or not [13]. The fourth section was focused on the evaluation of the managerial competencies indicated within the healthcare setting at hand, along with any potential development accompanying them [14]. The personnel's self-management abilities, the overall strategic planning and its implementation, the organization of tasks

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and duties, the management of the human resources available, any financial management potential indications, the information management and delegation combined with the decision making process, and the quality management currently taking place as a whole [15], are all parts of the cluster labeled as “managerial competencies development”.

The completion of the survey came with a single-yet highly important-question, addressing the most vital part of the customer’s experience: the matching of the expectations which arose prior to the treatment received [16].

Statistical analysis

By making the survey viral using Google Forms and after keeping it public for a time frame of approximately one month, 205 complete inputs were acquired. Those inputs were afterwards used as a source of primary data for a thorough statistical analysis, leading to an output which allowed the author to exclude valuable conclusions on the evaluation of healthcare management as a whole, from the patient’s perspective. The aforementioned analysis took place in two stages; the first stage was focused on the use of descriptive statistics [17] aiming towards providing the author with the ability to perform a primary evaluation of the data at hand; the second stage of the analysis employed inferential statistics-factor analysis [18] to be more precise-aiming towards a deeper and more meaningful analysis of the data collected, while leading to results indicating statistical significance. In order for the analysis to take place, the SPSS 22 statistical package was used.

Descriptive statistics

When the data collection phase came to an end, the primary data at hand had to be both described and summarized in an easily comprehensible manner. In order to render those possible, pie charts were employed in order to describe the answers to the questions included within the first two sections of the survey. The depiction part of the study was completed by the use of bar charts, in order to efficiently depict and describe the data collected from the questions included within the remaining three sections of the survey [19].

The output of the charts employed as described above, along with the calculation of the mean, the standard deviation and the overall number of inputs per question included at the remaining three parts of the survey, allowed the author to acquire a first impression regarding the data available, along with its suitability and the ability to group the inputs into clusters. The clusters formed contributed significantly to the factor analysis presented below.

Inferential statistics-factor analysis

In order to create a statistical model of a predictive nature, factor analysis will be employed. Factor analysis is a statistical method which focuses its aim to the formation of factors. Its prime hypothesis is that the variables available can be clustered based on high correlations between them; however, there is a possibility of a lower correlation between variables of different clusters. As a result, every cluster of variables represent a potentially hidden factor, which is primarily responsible for the correlations observed [20]. Since the whole model is based on correlation testing between the variables at hand, Bartlett’s test of sphericity was used towards that end. This sphericity control is applied upon the table of data as a whole and not on isolated data inputs.

Moreover, the mean employed towards the comparison of the relative size of the correlation coefficients with the relative correlation coefficients, is the Kaiser-Meyer-Olkin test, also known as KMO test. This test acts as a practical measure of the suitability of the data available for factor analysis; the higher the KMO test return value-on a scale of 0 to 1-the more suitable our data are for factor analysis.

Another means towards examining our variables and their suitability, is the Measure of Sampling Adequacy (MSA). Values around 1 act as indicators that the variable is suitable for inclusion in the analysis, while values at the lower bound indicate that the variable should be excluded.

At this point, it should be noted that while the KMO test includes all data available, the MSA is calculated for every variable separately [21].

A very important question to be answered during a factor analysis is the definition of the number of variables to be included. Towards that end, the Varimax method of rotation [22] will be employed, since it minimizes the number of variables having significant burdening for every factor.

RESULTS

Data analysis

The variables selected to be included in the analysis are presented below in Figure 1; they have been divided into two major categories: The variables relevant to the patient's experience and the ones relevant to the healthcare facility management (Table 1).

TABLE 1 The table includes the variables presented in the analysis

Patient Satisfaction	Healthcare Management Competencies Development	Overall Customer’s Experience
The appointment-making process and coming to direct contact with the health provider was relatively easy.	Self-management indicated by the hospital personnel.	Were your expectations matched?
The medical treatment received came in a quick and efficient manner	Overall strategic planning of the hospital and assessment of services provided.	0
The hospital equipment and tangibles seemed up-to-date and efficient from a technological perspective	Organization of duties and supervision of tasks performed within the hospital premises.	0
The number of nurses available in the clinic seemed enough to cover the needs of the patients under treatment	Human resources management of the personnel currently employed within the hospital.	0
The nurses were approachable, friendly and overall professional in their behavior towards me.	Financial management of the funds available.	0
The healthcare providers treated patients with courtesy and respect.	Information management and decision making processes potential indications throughout your experience within the hospital.	0

The healthcare providers indicated empathy towards the patient, while communicating the health issue at hand, in an explanatory way.	Quality management, monitoring and evaluation of the procedures implemented throughout the hospital premises.	0
Obtaining follow-up information regarding a treatment and potential care, came with relative ease.	0	0
According to my personal opinion and evaluation, I believe I saw an improvement of my health status following the treatment.	0	0

Suitability of data

The descriptive statistics employed towards the assessment of the available data suitability include calculations of the mean, the standard deviation and the number of inputs for every variable participating in the analysis. The results are presented in Table 2 below.

TABLE 2 Descriptive statistics

0	Mean	Std. Deviation	Analysis N
Appointments	2.63	0.923	189
Medical treatment	2.78	0.845	189
Medical equipment	2.51	1.019	189
Adequacy of nursing personnel	2.43	1.017	189
Professional behavior of nursing personnel	3.03	0.853	189
Overall stance of nursing personnel	2.97	0.872	189
Healthcare providers behavior	2.7	0.915	189
Patient monitoring	2.72	0.862	189
Health status improvement	3.06	0.783	189
Personnel's ability for self-management	2.59	0.785	189
Strategic planning	2.34	0.845	189
Allocation and supervision of duties	2.44	0.827	189
Human resources management	2.41	0.881	189
Financial management	2.3	0.881	189
Data management for decision making	2.46	0.789	189
Quality management - quality assurance	2.43	0.852	189
Overall experience according to expectations	2.57	0.889	189

As far as the correlation between variables is concerned, the Pearson's correlation coefficient r can be used. The Pearson test values range between -1 and 1; positive values imply positive correlation and negative values imply a negative correlation between the variables. Table 3 presented below is symmetrical; correlation values are presented for each pair of variables. Under every correlation is the p-value (Sig.), in order to perform a control for the null hypothesis; its purpose is to define whether the correlation between the variables indicates statistical significance.

One star next to the correlation value signifies the indication of importance at an importance level (a=5%), while two stars indicate that the correlation value is statistically significant at an importance level (a=1%).

By examining the table of correlations presented below, a significant correlation between the variables has been rendered obvious. It should be noted that in the majority of inputs, the value of Sig. is lower than 0.01, hence rendering the correlations of statistical significance.

TABLE 3 KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**0.941**
Bartlett's test of sphericity	Approx. Chi-Square	2,208.98
	df	136
	Sig.	0

The KMO value calculated is significantly high (0.941). This result acts as an indication that the correlations between the available data are sufficiently high. Moreover, the Bartlett's test of sphericity rejects the null hypothesis (likelihood ratio test value 2208.980, degrees of freedom 136, p-value <0.001).

TABLE 4 Measurement system analysis

Appointments	0.91
medical treatment	0.929
medical equipment	0.954
adequacy of nursing personnel	0.953
professional behavior of nursing personnel	0.903
overall stance of nursing personnel	0.924
healthcare providers behavior	0.95
patient monitoring	0.944
health status improvement	0.946
personnel's ability for self-management	0.968
strategic planning	0.958
allocation and supervision of duties	0.931
human resources management	0.932
financial management	0.943
data management for decision making	0.959
quality management-quality assurance	0.926
overall experience according to expectations	0.963

At this point, a test of the suitability of the total number of the variables to be used in the analysis needs to take place. This will be achieved by employing the MSA values, presented in Table 4 below. It can be deemed as obvious that all the values are at a satisfactory level, hence there is no need for any exclusion [23].

Number of factors

Selecting the number of factors is a process which requires repeatedly both the estimation and evaluation of the model. As a result, we could employ the Kaiser's rule, the percentage of variance explained or the Scree plot [24].

With the contribution of the Scree plot as in Figure 1, a visual criterion of the graphical depiction of the number of components along with their eigenvalues can be achieved. When the slope of the curve ceases to be sudden and smoother, the criterion suggests we reject the components located after the point of the slope's change.

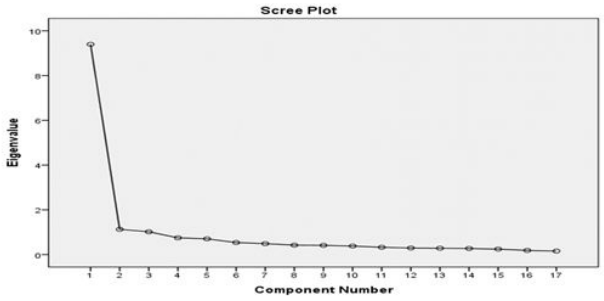

Figure 1) *Scree plot*

Table 5 Total variance explained- extraction method: principal component analysis

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.399	55.286	55.286	9.399	55.286	55.286	4.79	28.174	28.174
2	1.128	6.637	61.923	1.128	6.637	61.923	4.181	24.595	52.77
3	1.019	5.993	67.917	1.019	5.993	67.917	2.575	15.147	67.917
4	0.748	4.401	72.318	0	0	0	0	0	0
5	0.705	4.146	76.464	0	0	0	0	0	0
6	0.538	3.162	79.625	0	0	0	0	0	0
7	0.488	2.872	82.497	0	0	0	0	0	0
8	0.422	2.482	84.979	0	0	0	0	0	0
9	0.412	2.423	87.402	0	0	0	0	0	0
10	0.381	2.239	89.642	0	0	0	0	0	0
11	0.326	1.915	91.556	0	0	0	0	0	0
12	0.293	1.721	93.277	0	0	0	0	0	0
13	0.284	1.671	94.948	0	0	0	0	0	0
14	0.272	1.601	96.55	0	0	0	0	0	0
15	0.244	1.435	97.984	0	0	0	0	0	0
16	0.186	1.091	99.076	0	0	0	0	0	0
17	0.157	0.924	100	0	0	0	0	0	0

Table 5 includes the eigenvalues along with the percentage of variance each eigenvalue interprets. By employing the first three (3) theoretical factors which came as a result of the factor analysis' application, and applying them to the principal coordinate method-built in the SPSS statistical package-we succeed in interpreting close to the 67.917% of the total variability; this percentage increases along with an increase to the number of factors employed. Since we aim towards the simplification of the data available, there is no point in moving forward with a solution that suggests more than three (3) factors.

In Table 6 presented below, the communalities-the variances interpreted by the adapted factors-are presented. This is a number between 0 and 1 and it depicts the variance's percentage for each variable explained by the number of factors adapted [23].

TABLE 6 Communalities the variances interpreted by the adapted factors

0	Initial	Extraction
Appointments	1	0.769
Medical treatment	1	0.689
Medical equipment	1	0.568
Adequacy of nursing personnel	1	0.515
Professional behavior of nursing personnel	1	0.784

Overall stance of nursing personnel	1	0.794
Healthcare providers behavior	1	0.724
Patient monitoring	1	0.634
Health status improvement	1	0.565
Personnel's ability for self-management	1	0.606
Strategic planning	1	0.697
Allocation and supervision of duties	1	0.728
Human resources management	1	0.721
Financial management	1	0.702
Data management for decision making	1	0.663
Quality management-quality assurance	1	0.724
Overall experience according to expectations	1	0.664

Rotation

By looking at Table 7, we can see the exact weight each variable has on the factors. From the Rotated Component Matrix table, the values of weights with an absolute value smaller than 0.3 have been removed, in order to simplify the interpretation of the factors (Field, 2005). Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. 'a' is Rotation converged in 5 iterations.

TABLE 7 Rotated Component Matrix[a]

0	Component		
	1	2	3
Financial management	0.774	0	0
Allocation and supervision of duties	0.763	0.356	0
Quality management-quality assurance	0.743	0.325	0
Human resource management	0.731	0	0.331
Strategic planning	0.722	0.31	0
Data management for decision making	0.721	0	0
Personnel's ability for self-management	0.645	0.416	0
Professional behavior of nursing personnel		0.853	0
Overall stance of nursing personnel	0.317	0.814	0
Healthcare providers behavior	0.359	0.728	0
Patient monitoring	0.364	0.637	0.308
Adequacy of nursing personnel	0.361	0.584	0
Health status improvement	0.321	0.564	0.379
Overall experience according to expectations	0.454	0.541	0.406
Appointments	0	0	0.821
Medical treatment	0	0	0.779
Medical equipment	0.345	0.353	0.57

TABLE 8 Clustering of the theoretical factors

Competencies Development	Patient Satisfaction	Efficiency and Effectiveness
Financial management	Professional behavior of nursing personnel	Appointments
Allocation and supervision of duties	Overall stance of nursing personnel	Medical treatment
Quality management-quality assurance	Healthcare providers behavior	Medical equipment
Human resources management	Patient monitoring	0
Strategic planning	Adequacy of nursing personnel	0
Data management for decision making	Health status improvement	0
Personnel's ability for self-management	Overall experience according to expectations	0

Based on the values acquired from Table 7 presented above, the clustering and naming of the theoretical factors can now take place [24]. The outcome is presented in Table 8 provided.

As an outcome of the factor analysis' completion, we can conclude to the fact that there are three major components directly affecting the evaluation of the management of a healthcare facility from the patient's perspective: the continuous development of core managerial competencies, the parameters that directly affect patient satisfaction throughout his/her stay at the healthcare facility, along with both the efficiency and effectiveness indicated as far as broad aspects of the treatment process are concerned.

CONCLUSION

By looking at the Rotated Component Matrix.The results of the rotation process, along with the factors in their final form are presented. It can be observed that a simple structure was achieved, since seven variables indicate a high correlation with the first factor, a different set of also seven variables are highly correlated to the second factor, while the remaining three to the third factor.

To summarize, the evaluation of healthcare management from a patient's perspective, based on a thorough statistical analysis of the primary data gathered through a customized patient survey, is highly dependable from three factors: the development of core managerial competencies, the overall patient satisfaction throughout the various stages of the treatment process, along with the efficiency and effectiveness indicated in major aspects by the system as a whole.

REFERENCES

1. Fotiadis D, Handbook of research on trends in the diagnosis and treatment of chronic conditions. IGI Global, Hershey PA, USA. 2016.
2. Grondahl VA, Wilde-Larsson B, Karlsson I, et al. Patients' experiences of care quality and satisfaction during hospital stay: a qualitative study. Eur J Pers Cent Healthc. 2013;1:185.
3. Haggerty J, Burge F, Pineault R, et al. Management continuity from the patient perspective: comparison of primary healthcare evaluation instruments. Health Policy. 2011;7:139-53.
4. MerriamWebster's Online Dictionary. 2004
5. Deber R, Kraetschmer N, Urowitz S, et al. Patient, consumer, client, or customer: what do people want to be called? Health Expect. 2005;8:345-51.
6. Reja U, Manfreda K L, Hlebec V, et al. Open-ended vs. close-ended questions in web questionnaires. Dev Appl Stat. 2003
7. Steckler A, McLeroy K, Goodman R, et al. Toward integrating qualitative and quantitative methods: an introduction. Health Educ Behav. 1992;19:1-8.
8. Montazeri A, Harirchi AM, Shariati M, et al. General health questionnaire-12--iranian version. Health Qual Life. 2003;1:66
9. Kuhn E, Hartz A, Gottlieb M, et al. The relationship of hospital characteristics and the reults of peer review in six large states. Medical Care.1991;29:1028-38.
10. Moyer G. Patient satisfaction as an indicator of quality care? Orthopaedic Nursing 1988;7:68.
11. Wickizer T, Franklin G, Fulton-Kehoe D, et al. Patient satisfaction, treatment experience, and disability outcomes in a population-based cohort of injured workers in washington state: implications for quality improvement. Health Serv Res. 2004; 39:727-48.
12. Robbins C, Coulter A, Bruster S. The picker patient experience questionnaire: development and validation using data from in-patient surveys in five countries. Int J Qual Health Care. 2002;14:353-58.
13. Aharony L, Strasser S. Patient satisfaction: what we know about and what we still need to explore. Med Care Res Rev 1993;50:49 -79.
14. Stefl M. Common competencies for all healthcare managers: the Healthcare Leadership Alliance model. J Healthc Manag. 2008;53:360-73.
15. Robbins C, Bradley E, Spicer M, et al. Developing leadership in healthcare administration: A competency assessment tool. Journal of Healthcare Management. 2001;46:188-202.
16. Ross C, Frommelt G, Hazelwood L, et al. The role of expectations in patient satisfaction with medical care. J Health Care Mark. 1987;7:16-26.
17. Peat J, Barton B. Medical statistics: a guide to data analysis and critical appraisal. ISBN: 978-0-470-75520-4. 2008
18. Pett M, Lackey N, Sullivan J. Making sense of factor analysis. Sage Research methods. 2003
19. Bunge M, Mühlhauser I, Steckelberg A. What constitutes evidence-based patient information? Overview of discussed criteria. Patient Education and Counseling. 2010;78:316-28.
20. Garrett-Mayer E. Statistics in Psychosocial Research Lecture 8: Factor Analysis I. Johns Hopkins Bloomberg School of Public Health.
21. Bartlett's sphericity test and the KMO index (Kaiser-Mayer-Olkin).
22. Abdi H. Factor Rotations in Factor Analyses. 2003.
23. Yong AG, Pearce S. A beginner's guide to factor analysis: focusing on exploratory factor analysis. Tutorials in Quantitative Methods for Psychology. 2013;9:79-94.
24. Field A. Factor Analysis Using SPSS. 2005.