



Using Exploratory Factor Analysis with Principal Component Analysis to Identify Factors Influencing Customer Satisfaction with Private Pharmacy Services in Al-Marj City

Hanan Younis Al-Juwaili¹, Fatima Salem Aquider^{2*}

^{1,2} Department of Statistics, Faculty of Science-Al-Marj, University of Benghazi, Al-Marj, Libya

استخدام التحليل العاملي الاستكشافي بطريقة المكونات الأساسية لتحديد عوامل رضا الزبائن عن خدمات الصيدليات الخاصة في مدينة المرج

حنان يونس اجويلي¹، فاطمة سالم اقويدر^{2*}
^{2,1} قسم الإحصاء، كلية العلوم-المرج، جامعة بنغازي، المرج، ليبيا

*Corresponding author: fatimaekwder@gmail.com

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Abstract:

This study aims to identify the underlying dimensions and latent factors explaining customer satisfaction with private pharmacy services using Exploratory Factor Analysis (EFA) based on Principal Component Analysis (PCA). The study utilized data collected through a questionnaire comprising 20 variables designed to measure customer satisfaction, administered to a sample of 139 respondents. To assess the suitability of the data for factor analysis, the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were employed. The KMO value was 0.924, indicating a high level of sampling adequacy and the suitability of the data for factor analysis. Bartlett's test also revealed statistically significant correlations among the variables, supporting the appropriateness of conducting factor analysis.

Following the application of Principal Component Analysis (PCA) and Varimax rotation, three principal factors representing the underlying dimensions of customer satisfaction were identified. The first factor, Service Efficiency, comprised variables Y9–Y16. The second factor, Trust in the Pharmacist, included variables Y1–Y8. The third factor, Customer Care and Responsiveness to Customer Needs, comprised variables Y17–Y20. These findings indicate that customer satisfaction with private pharmacy services can be explained by three main dimensions: service efficiency, trust in the pharmacist, and customer care and responsiveness to customer needs. These dimensions provide a statistical basis for developing a more concise and clearly structured scale for assessing customer satisfaction with pharmaceutical services and identifying key areas for service quality improvement.

Keywords: Exploratory Factor Analysis (EFA), Principal Component Analysis (PCA), Customer Satisfaction.

المخلص

تهدف هذه الدراسة إلى تحديد الأبعاد والعوامل الكامنة المفسرة لرضا الزبائن عن خدمات الصيدليات الخاصة في مدينة المرج، وذلك باستخدام أسلوب التحليل العاملي الاستكشافي باستخدام طريقة المكونات الأساسية، واعتمدت الدراسة على بيانات استبيان يتضمن (20) متغيراً لقياس رضا الزبائن، طُبِّق على عينة مكونة من (139) مفردة، وللتحقق من ملاءمة البيانات لإجراء التحليل العاملي، تم استخدام اختبار (Kaiser–Meyer–Olkin, KMO) واختبار بارتليت للكروية (Bartlett's Test of Sphericity) وقد بلغت قيمة معامل (KMO) نحو (0.924)، مما يشير إلى ارتفاع مستوى كفاية حجم العينة وملاءمة البيانات للتحليل العاملي، كما أظهر اختبار بارتليت وجود ارتباطات ذات دلالة إحصائية بين المتغيرات، بما يدعم إمكانية إجراء التحليل العاملي.

وبعد تطبيق طريقة المكونات الرئيسية (Principal Component Analysis, PCA) وإجراء التدوير بطريقة فاريمكس (Varimax Rotation)، توصلت النتائج إلى استخراج ثلاثة عوامل رئيسية تفسر الأبعاد الكامنة لرضا الزبائن، تمثل العامل الأول في كفاءة الخدمة، وضم المتغيرات من (Y9) إلى (Y16)، بينما تمثل العامل الثاني الثقة في التعامل مع الصيدلي، واشتمل على المتغيرات من (Y1) إلى (Y8) أما العامل الثالث، فقد عرّ عن الاهتمام بالزبائن والاستجابة لاحتياجاته، وضم المتغيرات من (Y17) إلى (Y20) وتشير هذه النتائج إلى إمكانية تفسير رضا الزبائن عن خدمات الصيدليات الخاصة من خلال ثلاثة أبعاد رئيسية هي كفاءة الخدمة، والثقة في التعامل مع الصيدلي، والاهتمام بالزبون والاستجابة لاحتياجاته وتوفر هذه الأبعاد أساساً إحصائياً لتطوير مقياس أكثر اختصاراً ووضوحاً لتقييم رضا الزبائن عن الخدمات الصيدلانية، بما يساهم في تحديد الجوانب التي يمكن التركيز عليها لتحسين جودة هذه الخدمات.

الكلمات المفتاحية: التحليل العاملي الاستكشافي (EFA)، تحليل المكونات الرئيسية (PCA)، رضا الزبائن.

Introduction

Customer satisfaction is an important indicator for evaluating the quality of services provided, particularly in the field of healthcare services, including private pharmacy services. Customer satisfaction is influenced by several variables related to service quality, such as the speed of service delivery, quality of interaction, availability of medications, and the provision of pharmaceutical information and guidance.

Given the multiplicity of these variables and the correlations among them, Exploratory Factor Analysis (EFA) is an appropriate statistical technique for identifying the underlying factors that explain the relationships among variables and for grouping them into a smaller number of more interpretable factors.

Accordingly, this study aims to conduct an exploratory analysis of customer satisfaction variables using Principal Component Analysis (PCA) with Varimax rotation to identify the underlying dimensions of customer satisfaction with private pharmacy services in Al-Marj City. The analysis may contribute to identifying the main dimensions represented by the observed variables and providing a more interpretable structure of customer satisfaction with private pharmacy services.

1. Study Problem

The problem of the study arises from the presence of 20 observed variables designed to measure different dimensions of customer satisfaction with private pharmacy services. These variables may be interrelated and may reflect overlapping aspects of customer satisfaction, making it difficult to determine the underlying dimensions represented by the observed measures. Therefore, the study employs Exploratory Factor Analysis (EFA) to identify the latent factors underlying these variables, determine the number of factors that can be extracted, and identify the observed variables associated with each factor based on their factor loadings.

The following research questions represent the study problem:

1. Are the statistical conditions required for applying factor analysis to the 20 variables satisfied?
2. How many underlying dimensions can be identified among the variables measuring customer satisfaction?
3. Which variables belong to each of the extracted factors?
4. How strong is the association between each variable and the factor to which it belongs?

2. Objectives of the Study

This study aims to:

1. Identify the underlying dimensions of customer satisfaction with private pharmacy services in Al-Marj City using exploratory analysis based on Principal Component Analysis (PCA).
2. Reduce the variables representing customer satisfaction into a smaller number of components that explain a substantial proportion of the total variance in the data.
3. Identify the variables associated with each component by examining the factor loadings after applying orthogonal Varimax rotation.
4. Determine the appropriate number of components to retain based on eigenvalues, the Scree Plot, and the interpretability of the extracted components.
5. Interpret and name the extracted components according to the content of the variables that load on each component, thereby providing a clearer representation of the main dimensions of customer satisfaction with private pharmacy services.
6. Assess the suitability of the data for multivariate analysis using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett’s Test of Sphericity.

3. Significance of the Study

The significance of this study lies in identifying the underlying dimensions of customer satisfaction with private pharmacy services by applying an exploratory statistical analysis based on Principal Component Analysis (PCA).

- The study demonstrates the usefulness of Principal Component Analysis in reducing a set of correlated customer satisfaction variables into a smaller number of components that explain a substantial proportion of the total variance and provide a clearer representation of the underlying structure of the data.
- The study provides a statistical framework that may be useful for future research on customer satisfaction and the quality of private pharmacy services through the application of multivariate statistical methods.
- The identified components may provide a clearer understanding of the main dimensions associated with customer satisfaction and may serve as a basis for developing and improving future measurement instruments related to private pharmacy services.

Theoretical Framework

Factor Analysis

Factor analysis refers to a group of statistical methods used to reduce a large number of variables or measurements related to a particular phenomenon by identifying a smaller set of underlying factors that explain the relationships among the observed variables. These factors are derived from the pattern of correlations among the variables, providing a more concise representation of the underlying structure of the data.

Types of Factor Analysis

Factor analysis is generally divided into two main types:

1. Exploratory Factor Analysis (EFA)
2. Confirmatory Factor Analysis (CFA)

Basic Concepts in Factor Analysis

Eigenvalue

An eigenvalue represents the amount of variance in the observed variables accounted for by a factor. According to the Kaiser criterion, factors with eigenvalues greater than 1.0 are generally retained for further analysis.

Communalities

Communalities represent the proportion of variance in each observed variable that is explained by the retained factors. They are calculated as the sum of the squared factor loadings of a variable across the retained factors.

Factor Extraction

Factor extraction is the process of identifying and extracting a smaller number of factors that account for a substantial proportion of the variance among the observed variables.

Factor Rotation

Factor rotation is a procedure used to obtain a simpler and more interpretable factor structure by redistributing the factor loadings across the extracted factors while maintaining the total amount of variance explained by the retained factors. Rotation may be orthogonal, such as Varimax, which assumes that the factors are uncorrelated, or oblique, such as Promax, which allows the factors to be correlated.

Factor Loading

A factor loading represents the strength of the relationship between an observed variable and a factor. Higher absolute values of factor loadings indicate a stronger association between the variable and the corresponding factor.

Definition of Customer Satisfaction

Customer satisfaction refers to the customer's perception or evaluation of a product or service after experiencing it. It reflects the extent to which the service provided meets or exceeds the customer's expectations and needs. The greater the extent to which the service meets or exceeds the customer's expectations and needs, the higher the level of customer satisfaction.

Definition of Service Quality

Service quality refers to the extent to which the service provided meets or exceeds the customer's expectations and requirements.

- Factor Analysis Model:
- We assume that the observed random vector X has p elements, with mean vector μ and variance-covariance matrix Σ . The factor model assumes that X depends linearly on a small number of unobserved random variables $F_1, F_2, \dots, F_m$ called Common Factors, and also on p sources of variation $\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p$ called errors. Specifically, the factor analysis model is:

$$\begin{aligned}
X_1 - \mu_1 &= l_{11}F_1 + l_{12}F_2 + \dots + L_{1m}F_m + \varepsilon_1 \\
X_2 - \mu_2 &= l_{21}F_1 + l_{22}F_2 + \dots + L_{2m}F_m + \varepsilon_2 \\
&\vdots \\
X_p - \mu_p &= l_{p1}F_1 + l_{p2}F_2 + \dots + L_{pm}F_m + \varepsilon_p
\end{aligned}$$

Or, using matrices, we obtain:

$$\begin{bmatrix} X_1 - \mu_1 \\ X_2 - \mu_2 \\ \vdots \\ X_p - \mu_p \end{bmatrix}_{p \times 1} = \begin{bmatrix} l_{11} & l_{12} & \dots & l_{1m} \\ l_{21} & l_{22} & \dots & l_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ l_{p1} & l_{p2} & \dots & l_{pm} \end{bmatrix}_{p \times m} \begin{bmatrix} F_1 \\ F_2 \\ \vdots \\ F_m \end{bmatrix}_{m \times 1} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_p \end{bmatrix}_{p \times 1}$$

$$[X - \mu]_{p \times 1} = L_{p \times m} F_{m \times 1} + \epsilon_{p \times 1}$$

Where:

- μ_i : Mean of variable i.
- ε_i : Specific factor number i
- F_j : Common factor number j
- l_{ij} : Factor loading of variable i on common factor j

Applied Aspect of the Study

The continuous increase in the number of private pharmacies, together with the growing reliance of the public on pharmacists for quick medical consultations before seeking specialized medical care, motivated us to conduct this study. The study aims to identify the main underlying dimensions of customer satisfaction with the services provided by a sample of private pharmacies in Al-Marj City, with a focus on customers' experiences as the primary beneficiaries of these services.

The study aims to identify the key underlying dimensions of customer satisfaction with the services provided by private pharmacies in Al-Marj City. Data were collected using a structured questionnaire through the following procedures.

A total of 200 questionnaires were distributed to customers visiting the selected pharmacies immediately after receiving the service. Of these, 150 questionnaires were retrieved, and 139 were deemed valid for data entry and statistical analysis. The responses were then coded using a five-point Likert scale, with the following numerical weights assigned to the response categories:

1. **Strongly Agree:** 5
2. **Agree:** 4
3. **Neutral:** 3
4. **Disagree:** 2
5. **Strongly Disagree:** 1

The study questionnaire included a set of statements designed to measure customer satisfaction with pharmaceutical services. The questionnaire comprised **20 variables**, coded as **Y1–Y20**. After completing the data entry and reviewing the dataset to ensure its accuracy and integrity, the appropriate statistical analyses were performed. The following table presents the variables used to measure customer satisfaction with pharmaceutical services.

The table (1) presents the variables related to customer satisfaction with pharmaceutical services.

Numbering	Items
Y1	Pharmacy staff always meet your needs.
Y2	Pharmacy staff interact with you continuously.
Y3	You receive services that exceed your expectations.
Y4	You have a good relationship with pharmacy staff.
Y5	The prices of medicines and supplies available at the pharmacy are suitable for you.
Y6	Overall, you are satisfied with the services provided by pharmacy staff.
Y7	The pharmacy enjoys the trust and approval of its service users.
Y8	You believe that pharmacy staff always strive to provide the best service.
Y9	You find that pharmacy staff have the necessary competence.
Y10	All the staff you have encountered at the pharmacy are highly competent.

Numbering	Items
Y11	Pharmacy staff provide you with all the information you need.
Y12	You understand what the pharmacist tells you.
Y13	You are satisfied with the speed of service delivery.
Y14	The pharmacy's working hours are convenient for your available time.
Y15	You can reach the pharmacy staff member responsible for providing the service.
Y16	Pharmacy staff take customers' opinions and suggestions into consideration.
Y17	Pharmacy staff treat all customers fairly.
Y18	The waiting time at the pharmacy is short.
Y19	Pharmacy staff regularly ask about your needs.
Y20	You feel that you are known by the pharmacy staff.

Reliability of the Study Instrument

To assess the reliability of the study instrument, **Cronbach's alpha coefficient** was used to measure the internal consistency among the variables of the scale. A higher value of Cronbach's alpha indicates a higher level of internal consistency and reliability, while the reliability of the instrument may be affected by measurement errors resulting from misunderstanding the questions, responding hastily, or providing random responses.

Table (2) presents the value of Cronbach's alpha coefficient and the self-validity coefficient of the study instrument.

Number of Variables	Cronbach's Alpha	internal Consistency
20	0.97	0.98

The results presented in the table show that the Cronbach's alpha coefficient for the scale was 0.97 across 20 variables, indicating a very high level of internal consistency among the variables of the scale. The self-validity coefficient was 0.98, calculated as the square root of the Cronbach's alpha coefficient, indicating a high level of reliability and internal consistency of the study instrument.

After entering the data into SPSS, the frequencies and percentages of the respondents' demographic and personal characteristics were calculated, as presented in the following tables. **Table (3)** presents the characteristics of the study sample in terms of gender, age groups, educational level, the employee responsible for dispensing the medication, the number of pharmacy visits per month, and the waiting time before receiving the service.

Characteristics of the Study Sample:

Gender	Frequency	Percentage
Male	63	45%
Female	76	55%
Total	139	100%
Age Groups	Frequency	Percentage
Less than 30 years	23	17%
30 to less than 40 years	47	34%
40 to less than 50 years	51	37%
50 years and above	18	13%
Total	139	100%
Educational Level	Frequency	Percentage
Secondary School or Below	31	22%
University Education	71	51%
Postgraduate Education	37	27%
Total	139	100%
Person Dispensing the Medication	Frequency	Percentage
Pharmacist	97	70%
Pharmacy Assistant	26	19%
I Don't Know	16	11%
Total	139	100%
Number of Pharmacy Visits per Month	Frequency	Percentage
Once	59	42%
Fewer than 3 Times	48	35%
3 to 5 Times	24	17%
More than 5 Times	8	6%
Total	139	100%

Waiting Time at the Pharmacy	Frequency	Percentage
Less than 5 minutes	42	30%
5 to less than 10 minutes	72	52%
10 to less than 20 minutes	20	14%
20 to less than 30 minutes	5	4%
Total	139	100%

The results obtained show that the highest proportion of respondents were females, accounting for 55% of the study sample. In addition, 70% of the respondents were aged between 30 and 50 years. The highest proportion of respondents had a university-level education, accounting for 51%.

Furthermore, the majority of respondents indicated that the employee responsible for dispensing the medication was a pharmacist, accounting for 70%. Regarding the frequency of pharmacy visits per month, 42% and 35% of the respondents reported visiting the pharmacy once per month or fewer than three times per month, respectively. With respect to the waiting time to receive the service at the pharmacy, the highest proportion of respondents reported a waiting time of less than 10 minutes, accounting for 72% of the study sample.

Application of Factor Analysis to Customer Satisfaction Data

Customer satisfaction is an important indicator for evaluating the quality of services provided by pharmacies. Given the multiple aspects that contribute to customer satisfaction and the relationships among them, this study employed Exploratory Factor Analysis (EFA) to identify the underlying structure of a set of variables measuring customer satisfaction and to reduce them to a smaller number of factors representing the fundamental dimensions of satisfaction.

To analyze the data, Principal Component Analysis (PCA) was used to reduce a large number of correlated variables to a smaller number of components that explain a substantial proportion of the total variance in the data. To assess the suitability of the data for factor analysis, the Kaiser–Meyer–Olkin (KMO) measure was used. Higher KMO values indicate adequate sampling and suitability of the data for factor analysis, with values greater than 0.70 generally considered indicative of adequate suitability. In addition, Bartlett’s Test of Sphericity was used to assess the significance of the correlations among the variables and the suitability of the correlation matrix for factor analysis.

To determine the number of components to retain, the eigenvalue criterion was used. Components with eigenvalues greater than 1.0 were considered candidates for retention, whereas components with eigenvalues less than 1.0 were excluded. The Scree Plot and the percentage of total variance explained were also considered in determining the appropriate number of components.

Bartlett’s Test is calculated using the following equation:

$$\chi^2 = -(n - 1 - \frac{2P + 5}{6}) \ln|R|$$

where:

n = Sample size.

p = Number of variables.

R = Correlation matrix among the variables.

$Determinant (|R|)$ = Determinant of the correlation matrix.

$\ln$ = Natural logarithm.

χ^2 = Calculated chi-square value.

Degrees of freedom $df = \frac{P(P-1)}{2}$

The hypotheses are tested as follows:

H₀: The population correlation matrix is an identity matrix; that is, there are no statistically significant correlations among the variables.

H₁: The population correlation matrix is not an identity matrix; that is, at least one statistically significant correlation exists among the variables.

Afterward, the appropriate number of factors is determined based on the eigenvalues and the Scree Plot. This is followed by factor rotation and interpretation according to the statements with high factor loadings.

Note: A normality assumption is not required when using Principal Component Analysis (PCA) to extract components, as PCA can be applied without requiring the data to follow a normal distribution. In contrast, when using the Maximum Likelihood method in factor analysis, statistical inference relies on the assumption that the data follow a multivariate normal distribution.

Factor Analysis of the Data Using the Principal Component Method

Bartlett's Test of Sphericity is used to assess the suitability of the correlation matrix for conducting factor analysis by testing the statistical significance of the correlations among the variables. The data are considered suitable for factor analysis when the **p-value** is less than **0.05**, indicating the presence of statistically significant correlations among the variables and, consequently, supporting the use of factor analysis.

H₀: The population correlation matrix is an identity matrix; that is, there are no statistically significant correlations among the variables.

H₁: The population correlation matrix is not an identity matrix; that is, at least one statistically significant correlation exists among the variables.

Table (4): The Kaiser–Meyer–Olkin (KMO) measure and Bartlett's Test of Sphericity.

Measure	Statistic	
Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy	-	0.924
Bartlett's Test of Sphericity	Approx. chi-square	4176.89
	Df	190
	Sig <0.000	

The results of the factor analysis showed that the **Kaiser–Meyer–Olkin (KMO)** measure was 0.924, which is a high value indicating adequate sampling and the suitability of the data for conducting factor analysis. In addition, Bartlett's Test of Sphericity showed that the p-value was less than the significance level of 0.05, indicating the presence of statistically significant correlations among the variables. Accordingly, the null hypothesis stating that the correlation matrix among the variables is an identity matrix is rejected, while the alternative hypothesis indicating that the correlation matrix differs from an identity matrix is supported. This indicates the presence of statistically significant correlations among the variables. Therefore, the correlation matrix is considered suitable for conducting factor analysis.

Total (5) Variance Explained by the Principal Components

Component	Principal Components Before Rotation			Principal Components After Rotation		
	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)
1	13.460	67.300	67.300	6.537	32.684	32.684
2	2.066	10.331	77.631	6.514	32.571	65.255
3	1.591	7.955	85.586	4.066	20.330	85.586

It can be observed from Table (6) that, after conducting the Exploratory Factor Analysis (EFA) using the Principal Component Analysis (PCA) method, most of the variables loaded highly on the first factor before rotation. Therefore, the factors were rotated using the orthogonal Varimax rotation method to obtain a clearer and more interpretable factor structure. The Varimax method preserves the independence of the factors and aims to maximize the variance of the squared factor loadings within each factor, thereby providing a clearer distribution of the variables across the extracted factors.

This can be seen in Table (8), where variables with absolute factor loading values less than 0.50 were excluded. Accordingly, the variables belonging to each of the factors resulting from the factor analysis were identified.

After factor rotation, the eigenvalue of the first factor was 6.537, explaining 32.684% of the total variance. The second factor had an eigenvalue of 6.514, explaining 32.571% of the total variance. The third factor had an eigenvalue of 4.066, explaining 20.330% of the total variance.

Based on the eigenvalue criterion, three factors were retained, while the remaining factors were not retained because their eigenvalues were less than one. The three factors jointly explained 85.586% of the total variance. This indicates that the three extracted factors account for a substantial proportion of the total variance in the variables under study. The rotation did not change the total percentage of variance explained by the retained factors; rather, it redistributed the explained variance among the factors in a clearer and more interpretable manner.

Figure (1) illustrates the eigenvalues of the extracted components.

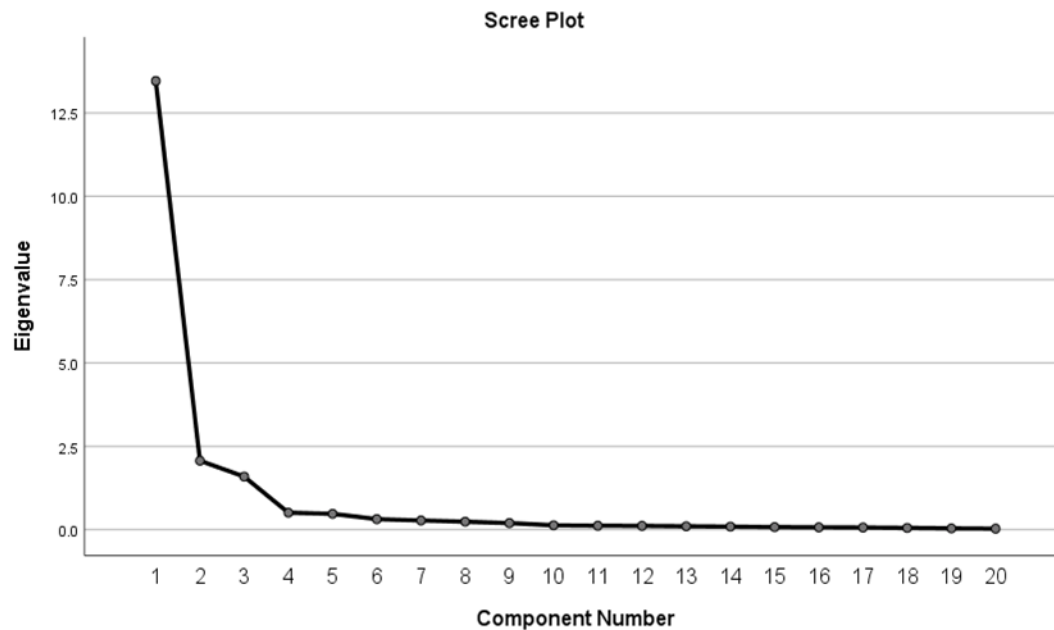


Figure (1): Eigenvalues

The vertical axis represents the eigenvalues, while the horizontal axis represents the factor or component number. The figure shows a clear decrease in the eigenvalues from the first factor to the second factor, followed by another decrease up to the third factor. After the third factor, the curve begins to level off and becomes relatively flat. This pattern indicates that the first three factors account for the main portion of the variance in the data, whereas the subsequent factors contribute relatively little. This finding supports the retention of three

Table (6): Communalities

	Initial	Extraction
y1	1.000	0.719
y2	1.000	0.854
y3	1.000	0.782
y4	1.000	0.854
y5	1.000	0.851
y6	1.000	0.845
y7	1.000	0.869
y8	1.000	0.818
y9	1.000	0.768
y10	1.000	0.858
y11	1.000	0.831
y12	1.000	0.900
y13	1.000	0.922
y14	1.000	0.806
y15	1.000	0.885
y16	1.000	0.873
y17	1.000	0.910
y18	1.000	0.915
y19	1.000	0.919
y20	1.000	0.937

Extraction Method: Principal Component Analysis.

The results presented in Table (6) show that the communalities explain proportions of the variance in the variables ranging from 0.719 to 0.937, corresponding to 71.9% and 93.7%, respectively. The variable y20 recorded the highest communality, at 93.7%, whereas the variable y1 recorded the lowest communality, at 71.9%. These results indicate that the extracted factors explain a high proportion of the variance in most of the variables included in the analysis.

Table (7) presents the factor loadings before rotation.

Variables	Factors		
	1	2	3
y1	0.761	0.366	0.080
y2	0.807	0.438	-0.104
y3	0.844	0.255	-0.070
y4	0.826	0.386	-0.154
y5	0.835	0.393	-0.009
y6	0.816	0.423	-0.010
y7	0.833	0.417	0.035
y8	0.804	0.414	0.001
y9	0.824	-0.196	-0.226
y10	0.836	-0.250	-0.312
y11	0.820	-0.216	-0.336
y12	0.861	-0.349	-0.193
y13	0.857	-0.390	-0.188
y14	0.846	-0.208	-0.218
y15	0.846	-0.378	-0.163
y16	0.875	-0.317	-0.089
y17	0.805	-0.160	0.486
y18	0.772	-0.144	0.545
y19	0.771	-0.254	0.511
y20	0.758	-0.169	0.578

Before performing the rotation, it can be observed that most of the variables had high factor loadings on the first factor, while their loadings on the other factors were relatively low. Therefore, factor rotation was performed to obtain a clearer and simpler factor structure, thereby improving the interpretability of the factors and providing a clearer identification of the variables associated with each factor.

Table (8) presents the factor loadings after rotation.

Variables	Factors		
	1	2	3
y1	0.233	0.752	0.314
y2	0.317	0.854	0.160
y3	0.427	0.731	0.255
y4	0.384	0.829	0.140
y5	0.310	0.827	0.266
y6	0.281	0.839	0.248
y7	0.272	0.841	0.295
y8	0.274	0.824	0.255
y9	0.752	0.383	0.234
y10	0.836	0.357	0.181
y11	0.819	0.375	0.144
y12	0.846	0.284	0.320
y13	0.865	0.250	0.334
y14	0.770	0.387	0.254
y15	0.838	0.250	0.346
y16	0.783	0.309	0.406
y17	0.351	0.336	0.821
y18	0.290	0.322	0.853
y19	0.369	0.240	0.852
y20	0.278	0.291	0.880

After conducting the analysis using the Principal Component Analysis (PCA) method and rotating the factors using the orthogonal Varimax rotation method according to the Maximum Variance Criterion, three factors were obtained.

The first factor comprises eight variables: (y9, y10, y11, y12, y13, y14, y15, y16). The second factor comprises eight variables: (y1, y2, y3, y4, y5, y6, y7, y8). The third factor comprises four variables: (y17, y18, y19, y20). Thus, the 20 variables were distributed across the three factors according to their factor loading values after rotation, providing a clearer and more interpretable factor structure.

Table (9): Component Transformation Matrix

Component Transformation Matrix			
Component	1	2	3
1	0.635	0.625	0.453
2	-0.572	0.775	-0.268
3	-0.519	-0.089	0.850

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

The **Component Transformation Matrix** presents the transformation coefficients resulting from the rotation of the extracted components. The components were extracted using the Principal Component Analysis (PCA) method, followed by orthogonal rotation using the Varimax method with Kaiser normalization.

As shown in Table (9), the transformation matrix contains different coefficients for the three components. The transformation coefficients associated with the first component are 0.635, 0.625, and 0.453; those associated with the second component are -0.572, 0.775, and -0.268; and those associated with the third component are -0.519, -0.089, and 0.850. These values represent the transformation coefficients that determine how the axes of the components are reoriented during the rotation process.

The positive and negative values indicate the directions of the component axes after rotation and should not be interpreted as direct correlation coefficients between the components before and after rotation. The Varimax rotation contributed to obtaining a clearer and more interpretable component structure while preserving the total proportion of variance explained by the retained components.

Results

After applying Exploratory Factor Analysis (EFA) to the questionnaire data, which included 20 variables and a sample size of 139 respondents, the following results were obtained:

The results of the Kaiser–Meyer–Olkin (KMO) measure showed a value of 0.924, which is a high value indicating adequate sample size and the suitability of the data for conducting factor analysis. The results of Bartlett’s Test of Sphericity also showed that the statistical significance level (p-value) was less than the adopted significance level of 0.05, indicating the presence of statistically significant correlations among the variables and that the correlation matrix differs from an identity matrix. Accordingly, the correlation matrix was considered suitable for conducting factor analysis and extracting the underlying components.

After applying the Principal Component Analysis (PCA) method and performing orthogonal rotation using the Varimax method, three main factors were obtained. These factors and their constituent variables are presented below:

Factor 1: Service Efficiency, Competence, and Accessibility

The first factor was named Service Efficiency and comprises the variables (y9–y16):

1. The pharmacy employees have the necessary competence to perform their work.
2. All employees with whom you interacted at the pharmacy have a high level of competence.
3. The pharmacy employees provide you with all the information you need.
4. You understand the information and instructions provided by the pharmacist.
5. You are satisfied with the speed of service delivery.
6. The pharmacy’s working hours are convenient for your available time.
7. You can reach the pharmacy employee responsible for the service you need.
8. The pharmacy employees take customers’ opinions and suggestions into consideration.

Factor 2: Customer Trust and Satisfaction The second factor was named Trust in Dealing with the Pharmacist and comprises the variables (y1–y8):

1. The pharmacy employees always meet your needs.
2. The pharmacy employees interact with you continuously.
3. You receive services that exceed your expectations.
4. You have a good relationship with the pharmacy employees.
5. The prices of the medicines and supplies available at the pharmacy are appropriate for you.
6. You are generally satisfied with the services provided by the pharmacy employees.
7. The pharmacy enjoys the trust and approval of its beneficiaries.
8. You believe that the pharmacy employees always strive to provide the best service.

Factor 3: Customer Care and Responsiveness

The third factor was named Customer Care and Responsiveness to Their Needs and comprises the variables (y17–y20):

1. The pharmacy employees treat all customers fairly.
2. The waiting time at the pharmacy is short.
3. The pharmacy employees continuously inquire about your needs.
4. You feel that you are known to the pharmacy employees.

Thus, the factor analysis resulted in three main factors representing the underlying dimensions of customer satisfaction with the services provided by private pharmacies. The 20 variables were distributed across these factors according to their factor loading values after rotation.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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