ORIGINAL ARTICLE

UDC: 614.2:616.8-089
DOI: https://doi.org/10.2298/VSP250804007D

Evaluation of the quality of neurosurgical services using the SERVQUAL method

Procena kvaliteta neurohirurških usluga primenom SERVQUAL metode

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Abstract

Background/Aim. In an era of rapid technological innovation and growing patient expectations, healthcare systems worldwide face the need for continuous improvement in service quality. The Service Quality model (SERVQUAL) is a validated instrument for measuring service quality, based on comparing patients' expectations with their perceptions of the service provided. The difference (gap) between these two measures is assessed using a five-point Likert scale across five dimensions: tangibility, reliability, responsiveness, assurance, and empathy. The aim of this study was to measure and compare expectations and perceptions of patients undergoing neurosurgical services, and to examine whether the size of the gap differs between SERVQUAL dimensions. **Methods.** The study included a total of 60 patients who underwent surgery for degenerative lumbar and cervical spine diseases at the Clinic for Neurosurgery, University Clinical Center of Vojvodina, Novi Sad, Serbia, between June and September 2024. A modified SERVQUAL questionnaire was used for data collection. Data were collected on admission and before the patients' discharge. Data were analyzed using descriptive statistics, paired *t*-tests to compare expectations and perceptions, and analysis of variance to examine differences across sociodemographic groups. **Results.** Patients had positive perceptions of the provided services. The results indicated the existence of a gap between patients' expectations and their perceptions of the services received. Mean expectations were high across dimensions (overall 4.85; range 4.79–4.88), as were perceptions (overall 4.90; range 4.85–4.94). All gaps were positive (perceptions > expectations). Dimension-specific gaps were as follows: tangibility 0.06 (p = 0.196), reliability 0.05 (p = 0.132), responsiveness 0.04 (p = 0.249), assurance 0.06 (p = 0.107), empathy 0.06 (p = 0.039). Only the empathy dimension reached statistical significance. No significant differences emerged across sociodemographic subgroups. **Conclusion.** The SERVQUAL method provided clear insights into patients' perceptions of the quality of neurosurgical services. The findings from this study can contribute to improving service quality and increasing patient satisfaction, positively influencing clinical outcomes and the healthcare system as a whole.

Keywords:
neurosurgery; patient satisfaction; quality assurance, health care; spinal diseases; surveys and questionnaires.

Apstrakt

Uvod/Cilj. U eri brzih tehnoloških inovacija i rastućih očekivanja bolesnika, zdravstveni sistemi širom sveta suočavaju se sa potrebom za kontinuiranim unapređenjem kvaliteta usluga. Model *Service Quality* – SERVQUAL je validirani instrument za merenje kvaliteta usluge, koji se zasniva na poređenju očekivanja bolesnika sa njihovom percepcijom pružene usluge. Razlika (jaz) između ove dve mere procenjuje se primenom petostepene Likertove skale u okviru pet dimenzija: opipljivost, pouzdanost, odgovornost, sigurnost i empatija. Cilj rada bio je da se izmere i uporede očekivanja i percepcije bolesnika podvrgnutih neurohirurškim uslugama, kao i da se ispita da li se veličina jaza razlikuje između SERVQUAL dimenzija. **Metode.** Studija je obuhvatila 60 bolesnika koji su operisani zbog degenerativnih bolesti lumbalne i cervikalne kičme na Klinici za neurohirurgiju Univerzitetskog kliničkog centra Vojvodine, Novi Sad, Srbija, u periodu od juna do septembra 2024. godine. Za prikupljanje podataka korišćen je modifikovani upitnik SERVQUAL. Podaci su prikupljani na prijemu i pre otpusta bolesnika. Podaci su analizirani primenom deskriptivne statistike, uparenog *t*-testa za poređenje očekivanja i percepcija, i analize varijanse za ispitivanje razlika između sociodemografskih grupa. **Rezultati.** Bolesnici su imali pozitivne percepcije o

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pruženim uslugama. Rezultati ukazuju na postojanje jaza između očekivanja bolesnika i njihove percepcije primljenih usluga. Prosečna očekivanja bila su visoka u svim dimenzijama (ukupno 4,85; raspon 4,79–4,88), kao i percepcije (ukupno 4,90; raspon 4,85–4,94). U svim dimenzijama utvrđen je pozitivan jaz (percepcije > očekivanja). Jazovi specifični za pojedine dimenzije iznosili su: opipljivost 0.06 (p = 0,196), pouzdanost 0.05 (p = 0,132), odgovornost 0.04 (p = 0,249), sigurnost 0.06 (p = 0,107), empatija 0.06 (p = 0,039). Jedino je dimenzija empatije dostigla statističku značajnost. Nisu utvrđene statistički značajne razlike između sociodemografskih podgrupa. **Zaključak.** Metoda SERVQUAL omogućila je jasan uvid u percepciju bolesnika o kvalitetu neurohirurških usluga. Rezultati ove studije mogu doprineti unapređenju kvaliteta usluga i povećanju zadovoljstva bolesnika, čime se pozitivno utiče na kliničke ishode i zdravstveni sistem u celini.

Ključne reči:
neurohirurgija; bolesnik, zadovoljstvo; zdravstvena zaštita, ocena kvaliteta; kičma, bolesti; ankete i upitnici.

Introduction

The rapidly changing factors driven by globalization, mass customization, digitalization, and the implications of artificial intelligence are transforming the way companies, schools, and healthcare institutions perform their work [1]. These forces have given rise to a new generation of customers who expect the highest level of service quality [2]. In modern healthcare systems, the quality of healthcare services is one of the most critical factors for improving population health and disease prevention [3]. By adopting international healthcare standards, countries and healthcare institutions can ensure a consistent level of healthcare, focus on continuous improvement, and avoid variability in service provision that could compromise patient safety [4]. Healthcare service quality is evaluated through parameters such as patient satisfaction, service safety, resource use efficiency, and achievement of desired health outcomes [5]. Assessing healthcare quality is one of the most important aspects of modern hospital management, directly influencing treatment outcomes, patient satisfaction, and the efficiency of healthcare systems [6]. In modern healthcare, quality is broadly defined as care that is safe, effective, timely, efficient, equitable, and people-centered, as established by the World Health Organization (WHO) [7]. Although clinical outcomes remain essential, numerous studies have documented challenges in service-related dimensions such as waiting times, communication, coordination, and emotional support [8].

Over the past decades, several frameworks have been developed to assess these issues, including the Donabedian structure–process–outcome model and patient experience surveys. A major shift occurred in the second half of the 20th century, when healthcare institutions, inspired by global changes in quality management approaches from industry, began applying methodologies and tools that had proven effective in other sectors [9]. One such tool, developed in the late 1980s in response to the need for more precise measurement and management of service quality, is the Service Quality model (SERVQUAL) [10]. Originally designed to identify and quantify the gap between service users' expectations and their perceptions of delivered services, the SERVQUAL model quickly found application across various industries, including the healthcare sector [11]. Due to its specificity, neurosurgery is an ideal field for applying the SERVQUAL model, which enables detailed analysis and quantification of different service quality dimensions [12].

The SERVQUAL model evaluates five key dimensions of quality: tangibility, reliability, responsiveness, assurance, and empathy [13]. Each dimension reflects a different service aspect, allowing for a comprehensive quality assessment from the patient's perspective [11]. Tangibility relates to the physical aspects of services, including the appearance of hospital facilities, equipment, and hygiene conditions [14]. Reliability refers to the ability of healthcare providers and institutions to consistently and accurately deliver services as promised. Responsiveness denotes the willingness of staff to promptly and effectively respond to patient needs. Assurance includes the staff's competence and their ability to inspire confidence and a sense of safety in patients. Empathy refers to the individual attention and care provided to patients, which is especially important in neurosurgery, where patients often experience high levels of stress and anxiety [15].

The gap in the SERVQUAL method represents the difference between patient expectations before receiving the service and their actual perception afterward [11]. In healthcare, it is particularly important as it directly affects patient satisfaction and treatment outcomes [16]. Understanding this gap helps healthcare management identify improvement areas and develop strategies to reduce the difference between expected and delivered services, thereby increasing patient satisfaction and loyalty [10]. Moreover, in healthcare, most research traditionally focuses on clinical interventions and the technical aspects of service delivery [17]. These elements represent the technical quality that the customer actually receives from a service [18]. However, the functional quality, i.e., the way the service is delivered, especially the patient's perception of the interaction during care, remains relatively underexplored [19]. This interaction is a crucial component of overall service quality, particularly in high-stress, high-stakes fields such as neurosurgery [20].

The SERVQUAL instrument differs from previous methods by measuring both expectations before care and perceptions after care, allowing the identification of specific gaps in service delivery. Previous research has shown that SERVQUAL can support hospital improvement efforts, although cultural adaptation is sometimes required [21]. Evidence in neurosurgery remains limited, particularly for patients undergoing surgeries for degenerative lumbar and cervical spine diseases who face anxiety, pain, and functional limita-

tions that influence their perception of care. Therefore, applying SERVQUAL in this setting can provide useful insights into functional aspects of service quality that cannot be detected through clinical indicators alone.

The aim of this study was to explore patients' expectations and perceptions of neurosurgical services and determine whether there are significant gaps between expectations and perceptions for each SERVQUAL dimension.

Methods

The research was conducted at the Clinic for Neurosurgery of the University Clinical Center of Vojvodina, Novi Sad, Serbia, from June to September 2024. The research was conducted in accordance with the ethical standards, ensuring the anonymity and confidentiality of patient data. The study was approved by the Ethics Committee of the University Clinical Center of Vojvodina (No. 00-290, from August 26, 2024).

Inclusion criteria were as follows: age > 18 years; admission for elective neurosurgical treatment of degenerative diseases of the lumbar or cervical spine; the ability to provide informed consent and complete the questionnaire independently. Exclusion criteria were as follows: surgeries performed for spinal pathology other than degenerative disease (e.g., trauma, tumor, infection); emergency procedures; pediatric patients. All patients who met the inclusion criteria during the study period were consecutively recruited, resulting in a final sample of 60 patients with complete datasets. No eligible patient refused to participate, nor was any excluded due to missing data.

To collect data, a SERVQUAL questionnaire was used, modified to match the specifics of neurosurgical services [22]. Modifications included adapting item phrasing to reflect hospital care, perioperative communication, postoperative monitoring, and staff–patient interaction in neurosurgery, as well as adjusting terminology to the cultural and linguistic context of Serbia, consistent with previous research that recommends local adaptation of SERVQUAL instruments for each country [23]. The original SERVQUAL instrument was linguistically translated and adapted into Serbian using the forward–backward translation method, following the guidelines of the WHO for translation and adaptation of instruments [24]. Following translation, the content validity was reviewed by a panel of healthcare professionals and university researchers to ensure semantic, idiomatic, experiential, and conceptual equivalence with the original items. Furthermore, to confirm the construct validity and internal consistency of the instrument, a set of statistical analyses was conducted. The internal consistency of each SERVQUAL dimension was assessed using Cronbach's alpha coefficient, with all five dimensions exceeding the recommended reliability threshold ($\alpha > 0.85$), indicating a high level of internal consistency. Additionally, an exploratory factor analysis using principal axis factoring with Varimax rotation was performed. The Kaiser-Meyer-Olkin measure was 0.975, and Bartlett's test of sphericity was statistically significant (χ^2 = 16,000, df = 435, $p < 0.001$), confirming the suitability of the data for factor analysis. Three latent factors were extracted, aligning with core SERVQUAL domains while reflecting certain cultural and contextual nuances specific to the Serbian healthcare setting. The complete validation output is stored securely in accordance with institutional data protection procedures. As it contains individual response patterns, it cannot be published or shared in raw form. Nevertheless, the aggregated psychometric results provided in this study confirm strong internal consistency and adequate construct validity of the modified SERVQUAL instrument, fully compliant with current academic and ethical standards for questionnaire-based research.

The SERVQUAL questionnaire included items that cover the five key quality dimensions: tangibility, reliability, responsiveness, assurance, and empathy [19]. Each dimension was evaluated through a set of items relating to specific service aspects. In addition to standard SERVQUAL items, the questionnaire also included demographic questions such as gender, age, and education level [11]. The questionnaire was distributed to patients immediately after hospital admission for surgery and again before discharge to ensure that patients could accurately assess the quality of the services received during their hospital stay. The study's aim and the questionnaire completion process were explained to patients to ensure data accuracy and validity.

Statistical analysis

Data were analyzed using SPSS software for Windows (IBM Corp., Armonk, New York, USA). Descriptive statistics were used to examine basic indicators at the dimension level and for overall expectations and perceptions. Data were presented using means and standard deviations for continuous variables and numbers and proportions for categorical variables. Analysis of variance (ANOVA) was applied to analyze differences in average scores among SERVQUAL dimensions. Average scores were also examined in terms of patients' sociodemographic characteristics. In addition to ANOVA, the *t*-test was used for this purpose. Following the SERVQUAL methodology, differences between patient expectations and perceptions were also examined. The statistical significance of these differences was tested using paired *t*-tests. A *p*-value of 0.05 or less was considered statistically significant.

Results

This cohort study comprised 60 patients with complete data for analysis. Baseline demographic characteristics are presented in Table 1, and Figure 1 displays the income distribution stratification.

Examination waiting times were distributed as follows: < 1 week: 12 (20.0%) patients; 1–2 weeks: 18 (30.0%); 2–3 weeks: 8 (13.3%); 3–4 weeks: 13 (21.7%); 1–2 months: 6 (10.0%); and 3–6 months: 3 (5.0%). No patients reported waiting 2–3 months or > 6 months. Surgical treatment waiting times demonstrated this distribution: < 1 week: 10 (16.7%) patients; 1–2 weeks: 9 (15.0%); 2–3 weeks: 9

Table 1

Demographic and clinical characteristics of patients

Characteristics	Total (n = 60)
Age, years	56.04 ± 12.8
Gender, female	25 (41.7)
Education level	
primary school	11 (18.0)
three-year professional school	14 (23.0)
four-year professional school	21 (35.0)
high school	7 (12.0)
bachelor's degree	5 (9.0)
master's degree	2 (3.0)
Employment sector	
unemployed	10 (17.0)
retired	19 (32.0)
homemaker	2 (3.0)
entrepreneur	4 (7.0)
production sector	8 (13.0)
service sector	4 (7.0)
management	2 (3.0)
education	2 (3.0)
other	9 (15.0)
Marital status	
single	9 (15.0)
married	33 (55.0)
divorced	10 (17.0)
widowed	8 (13.0)

n – number of patients.
All values are given as numbers (percentages) or means ± standard deviations.

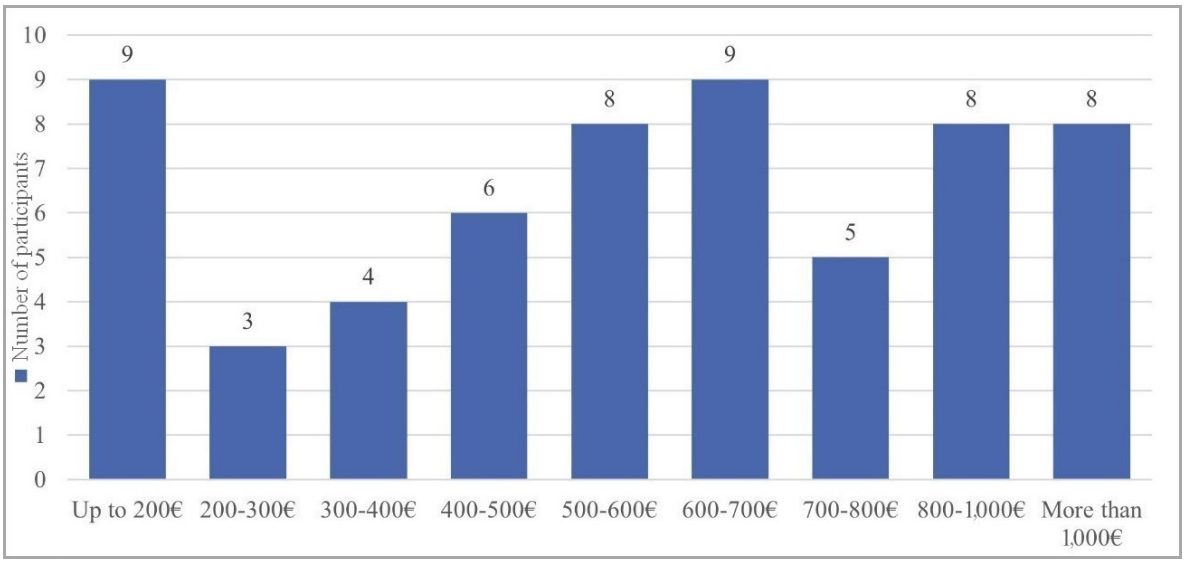

Fig. 1 – Distribution stratification among the patient cohort.

(15.0%); 3–4 weeks: 17 (28.3%); 1–2 months: 4 (6.7%); 2–3 months: 7 (11.7%); 3–6 months: 3 (5.0%); > 6 months: 1 (1.7%). The mean expectation scores across SERVQUAL dimensions are shown in Figure 2.

Reliability demonstrated the highest expectation (4.88), while tangibles yielded the lowest (4.79). The overall expectation mean was 4.85. Although a marginal difference emerged between females (4.89) and males (4.81), independent *t*-test analysis revealed non-significance ($p = 0.091$).

Perception measurements across dimensions are shown in Figure 3.

Mirroring expectation patterns, reliability achieved the highest perception score (4.94), while tangibility remained the lowest (4.85). Gender comparisons again showed non-significant differentials ($p = 0.566$) *via* an independent *t*-test. Statistically significant differences in average scores for expectations and perceptions were not identified concerning the other socio-demographic characteristics of respondents.

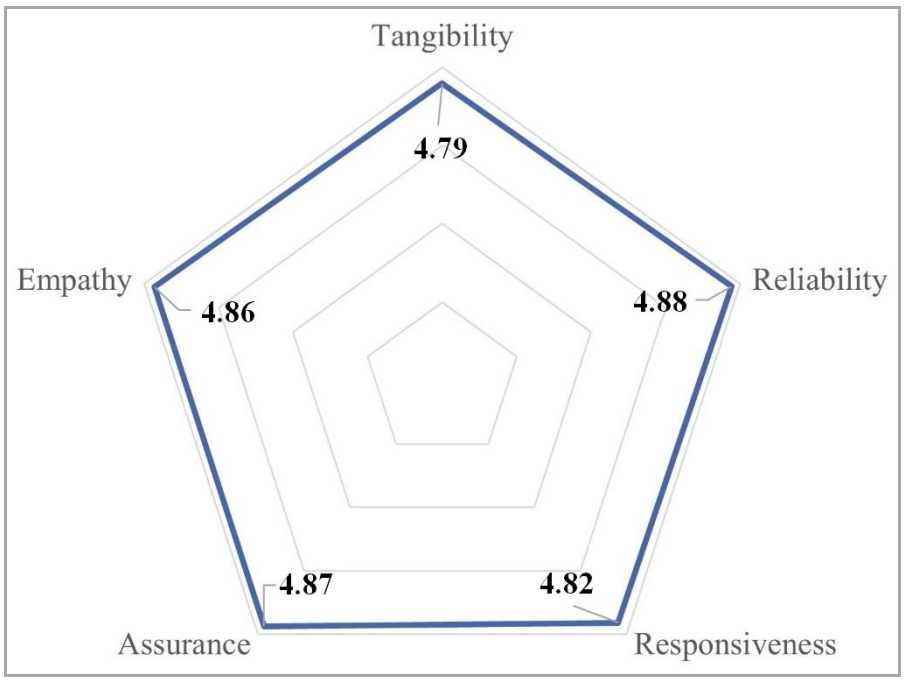

Fig. 2 – The mean expectation scores across SERVQUAL dimensions.

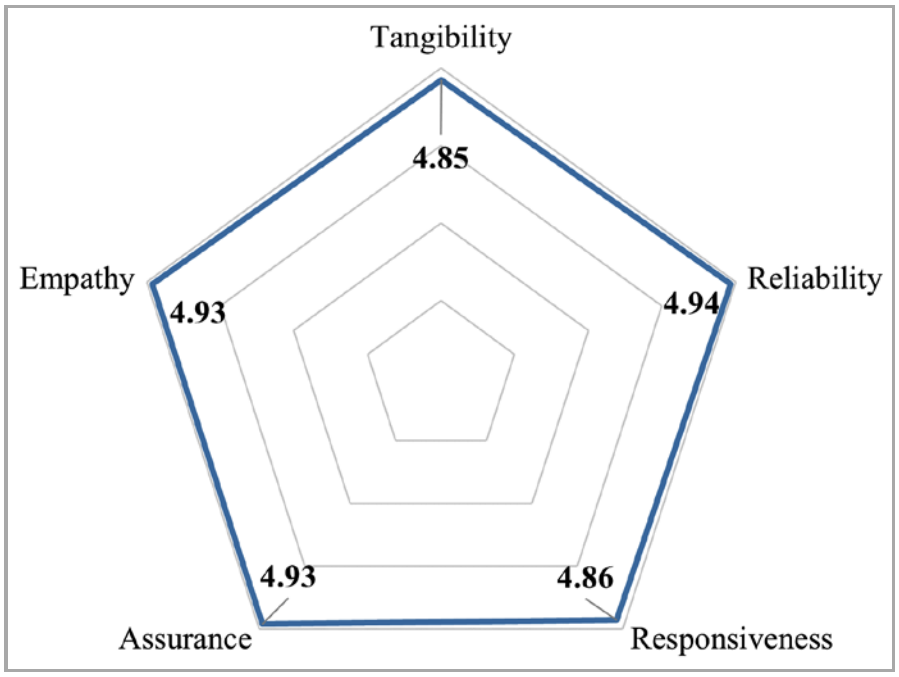

Fig. 3 – The mean perception measurement scores across SERVQUAL dimensions.

Gap analysis

When comparing expectation and perception dimensions, all dimensions showed higher ratings after service delivery (Table 2).

The largest difference, amounting to 0.5833, is observed in the tangibles and empathy dimensions. Before service delivery, patients rated the tangibles dimension at 4.79 and the empathy dimension at 4.86, while these dimensions received ratings of 4.85 (tangibles) and 4.93 (empathy) after service delivery.

Analysis of service quality dimensions revealed consistently positive gap scores (perception minus expectation) across all measured mean scores. As delineated in Table 2, expectations were highest for reliability (4.88 ± 0.32), followed sequentially by assurance (4.87 ± 0.34), empathy (4.86 ± 0.32), responsiveness (4.82 ± 0.37), and tangibility (4.79 ± 0.39). Post-service perceptions exhibited analogous hierarchical ordering, with reliability (4.94 ± 0.25) and assurance (4.93 ± 0.23) maintaining primacy.

Gap magnitudes ranged from 0.04 (responsiveness) to 0.06 (tangibility, reliability, assurance, empathy). Important-

ly, the paired-samples *t*-test demonstrated statistical significance exclusively for the empathy dimension (gap = 0.06, $p = 0.039$). Non-significant differences were observed in tangibility ($p = 0.196$), reliability ($p = 0.132$), responsiveness ($p = 0.249$), and assurance ($p = 0.107$).

To assess whether gender influenced the evaluation of service quality, mean SERVQUAL scores were stratified by gender and compared across all five dimensions. Figure 4 presents the average expectation scores for male and female patients, while Figure 5 shows the corresponding perception scores.

Table 2

Patients' expectations and perceptions of the quality of provided services

Characteristics	Expectations	Perception	Gap scores	*p*-value
Tangibility	4.79 ± 0.39	4.85 ± 0.32	0.06	0.196
Reliability	4.88 ± 0.32	4.94 ± 0.25	0.05	0.132
Responsiveness	4.82 ± 0.37	4.86 ± 0.34	0.04	0.249
Assurance	4.87 ± 0.34	4.93 ± 0.23	0.06	0.107
Empathy	4.86 ± 0.32	4.92 ± 0.20	0.06	**0.039**

All values are given as mean ± standard deviation.
The bold value indicates significant difference ($p < 0.05$).

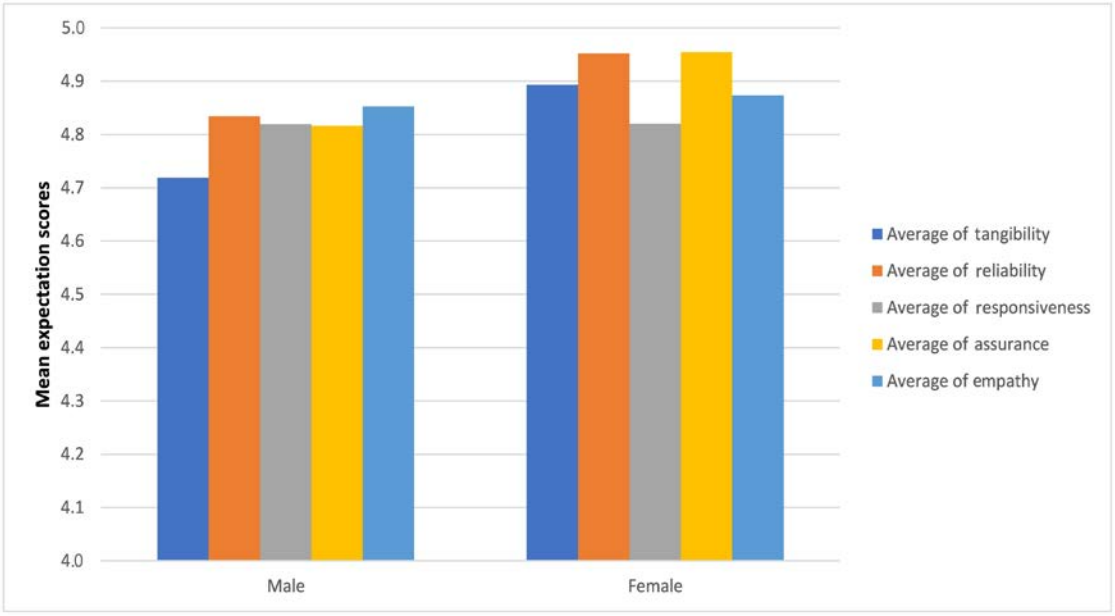

Fig. 4 – Mean expectation scores by gender across the five SERVQUAL dimensions.

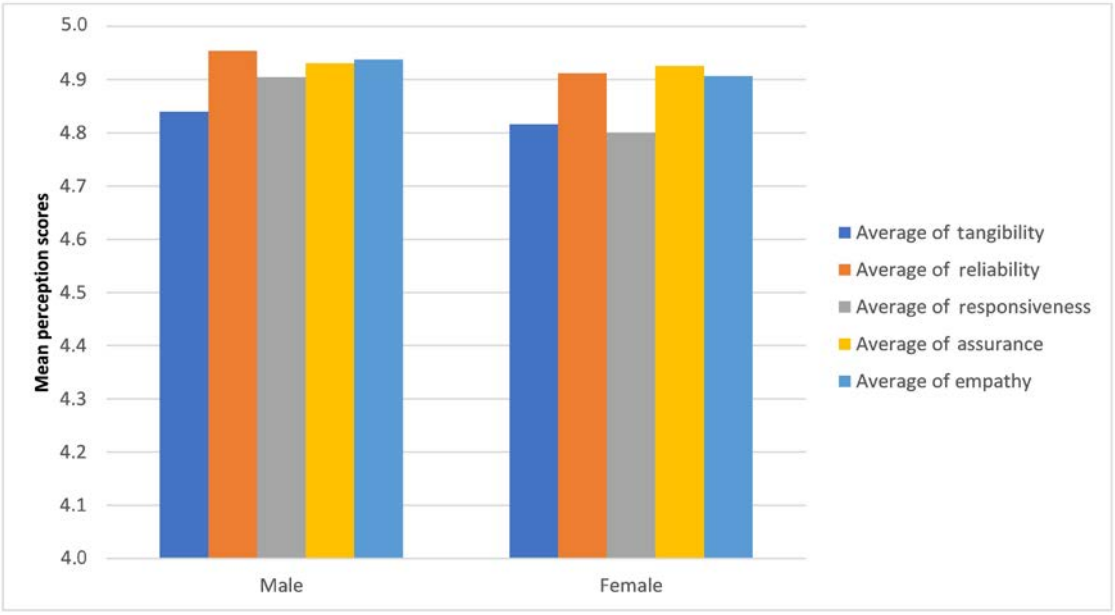

Fig. 5 – Mean perception scores by gender across the five SERVQUAL dimensions.

Both male and female patients reported very high expectations prior to treatment, with grand means ranging from 4.79 to 4.88. Female patients expressed slightly higher expectations in tangibility (4.89 vs. 4.72), reliability (4.95 vs. 4.83), assurance (4.95 vs. 4.82), and empathy (4.87 vs. 4.85), while responsiveness scores were nearly identical across genders. After treatment, perception scores also remained uniformly high for both groups, with grand means ranging from 4.83 to 4.93. In this case, male patients reported marginally higher perception scores across all five dimensions (e.g., responsiveness 4.90 vs. 4.80; empathy 4.94 vs. 4.91). However, in both expectations and perceptions, the observed numerical differences were minimal and did not reach statistical significance ($p > 0.05$), indicating that gender did not meaningfully influence either anticipated or experienced quality of neurosurgical care.

Discussion

The findings of this study provide meaningful insights into how patients perceive the quality of neurosurgical services and how their expectations align with actual experiences. Patients entered the treatment process with high expectations, and these expectations were generally met or even slightly exceeded, supporting a strong match between perceived and expected service quality [15]. All five SERVQUAL dimensions (tangibility, reliability, responsiveness, assurance, and empathy) recorded average scores above 4.5, indicating high levels of perceived service quality across all domains. These results are consistent with findings from Albalas et al. [10], who reported similarly high patient satisfaction levels in Jordanian public hospitals, particularly emphasizing the role of empathy and assurance in shaping perceptions of quality. While perception scores in our study were consistently higher than expectation scores, only the empathy dimension showed a statistically significant difference, suggesting that patients felt they received more emotional support, attentiveness, and personalized care than expected. This aligns with the previous finding, which highlights the importance of psychological and emotional support in neurosurgical care, given the high levels of patient anxiety and stress [25]. The dimension of tangibility also showed a notable, though not statistically significant, gap, underscoring the relevance of physical infrastructure, modern equipment, and environmental comfort to patient satisfaction. These findings are supported by Ulrich et al. [26], who demonstrated that evidence-based hospital design and physical surroundings significantly impact recovery time and patient experience. Furthermore, the consistency of results across demographic groups such as gender, age, and income suggests that patient satisfaction was not significantly influenced by sociodemographic factors. This is in line with the study of Xesfingi and Vozikis [27], who found that equal access to care and consistent delivery reduce variability in perceived service quality across populations. An in-depth comparison between male and female patients confirmed that there were no meaningful differences in either expectations or perceptions across any SERVQUAL dimension. This absence of gender-related variation supports previous findings and suggests that neurosurgical service quality is delivered consistently and equitably, reinforcing the robustness of functional service quality in high-complexity hospital environments [28]. Importantly, our findings reaffirm that the SERVQUAL model, originally developed in Western service sectors, can be reliably applied within healthcare systems in developing countries. In the context of this study, the term “developing countries” refers to lower- and middle-income health systems, including those in Southeastern Europe. Serbia falls within this classification and shares structural and resource characteristics with similar healthcare systems in this category. The successful cultural adaptation and strong psychometric performance of SERVQUAL in our sample confirm its applicability in such settings, thereby expanding evidence from previously studied regions such as Turkey, Jordan, and India [29]. Kilbourne et al. [30] demonstrated the cross-national applicability of SERVQUAL in healthcare environments, especially when culturally adapted and validated for local contexts. This study contributes to the growing body of evidence confirming the model’s flexibility and robustness across diverse healthcare systems, including Serbia’s. The distinction between technical quality, represented by clinical outcomes, and functional quality, defined as the way services are delivered, including communication, empathy, explanation, and respect during care interactions, has been emphasized in prior research [30, 31]. For instance, some previous studies suggest that patients often value the manner in which care is delivered more than its purely clinical success, a finding consistent with our results [10, 15]. From a practical standpoint, the SERVQUAL model proves to be an effective tool for systematically gathering patient feedback, identifying service gaps, and guiding improvements in healthcare delivery. Similar implementations have been documented by Çaha [31], who applied the SERVQUAL model in Turkish hospitals to improve quality management processes. At a broader level, this patient-centered approach can serve as a foundation for evidence-based quality improvement in healthcare. As Flott et al. [32] argue, patient-reported experience measures are not only important for evaluating care but also for driving systemic transformation across healthcare institutions.

Limitations and future research

Despite contributing new findings to a relatively underexplored area in Serbian healthcare, the study has several limitations. The research was conducted in a single clinical center with a sample of 60 patients, which restricts generalizability to wider neurosurgical populations. Additionally, the SERVQUAL instrument relies on subjective self-reporting, which may introduce response bias. A particularly relevant limitation stems from the timing and location of data collection: both expectation and perception questionnaires were completed while patients were still hospitalized. Since patients were in a dependent and vulnerable position, some may have hesitated to report negative experiences despite assurances of anonymity. To minimize this concern, responses were collected anonymously, coded without personal identi-

fiers, and handled independently of clinical staff. However, the possibility of social desirability bias remains and should be acknowledged when interpreting results.

Future investigations should aim to include multiple neurosurgical centers and larger patient cohorts to strengthen external validity and enable cross-institutional comparison. Longitudinal studies could examine whether perceptions change after discharge and whether higher functional quality translates into improved recovery, reduced anxiety, or better clinical outcomes. Since empathy was the only dimension with a statistically significant gap, qualitative research, such as interviews or focus groups, may help identify specific communication practices and staff behaviors that patients value most.

Conclusion

This study evaluated the quality of neurosurgical services in a tertiary hospital setting using the SERVQUAL measurement instrument, which captures both patient expectations and their actual perceptions of care. By applying a structured and validated tool, the research provides a systematic insight into how patients experience key dimensions of healthcare quality, including tangibility, reliability, responsiveness, assurance, and empathy. Across all measured dimensions, patient perceptions of care were high, indicating that patients assessed the delivered services very positively. Although perception scores exceeded expectation scores in every domain, the only statistically significant gap emerged in the dimension of empathy. This finding highlights the prominence of interpersonal and emotional support in shaping patient satisfaction, especially in neurosurgical care, where anxiety, fear, and physical discomfort are common. The practical relevance of these results lies in the emphasis they place on functional quality, the manner in which care is delivered, in addition to technical quality based on clinical outcomes. The SERVQUAL model proved to be a useful method for identifying subtle strengths and shortcomings in patient experience, offering healthcare managers a targeted approach for quality improvement. Interventions aimed at enhancing communication, emotional reassurance, and personalized interactions may yield tangible improvements in patient satisfaction with minimal resource investment. Furthermore, the absence of statistically significant differences across sociodemographic subgroups suggests that the quality of neurosurgical care is consistently delivered, which is an important signal from a health equity perspective.

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Received on August 4, 2025
Revised on October 7, 2025
Revised on December 12, 2025
Accepted on December 24, 2025
Online First February 2026