



Quality Assessment in Primary Healthcare Using Kano-Fuzzy-SERVQUAL: Young Women's Perspective

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ABSTRACT

Women represent 69% of primary care users in the Brazilian Unified Health System (SUS), yet methodological gaps persist in the evaluation of priority attributes for quality management in resource-scarce contexts, particularly in medium-sized municipalities in the semi-arid Northeast region. In this sense, this article aims to evaluate the quality of services in Primary Health Care Units (UBS) in Salgueiro-PE from the perspective of young adult female users, integrating the Kano Model, SERVQUAL, and Fuzzy Logic to identify priority attributes for management actions. The research was classified as exploratory, with 109 female users of the SUS (mean age 23.8 years; 86.2% exclusively dependent on the public system). A structured questionnaire with 23 quality attributes distributed across the SERVQUAL dimensions (tangibility, reliability, empathy, assurance, and responsiveness) was applied, analyzed via Kano-Fuzzy methodology for categorical classification and calculation of satisfaction (d+) and dissatisfaction (d-) coefficients. The results revealed a predominance of one-dimensional attributes (87%), indicating that improvements generate proportional increases in satisfaction. Six critical attributes (gaps 1.532-1.752) emerged as priorities: preserved environment/facilities (gap=1.752), reliable information transmission (gap=1.578), security conveyed in service (gap=1.569), willingness to solve problems (gap=1.550), approach of professionals (gap=1.541), and commitment to improvement (gap=1.532). The empathy dimension concentrated 50% of the critical priorities, followed by reliability (33%) and tangibility (17%). The article concludes by showing that overall satisfaction was 2.86/5.00, with 67% of users not expressing positive satisfaction. As practical implications for managers, the quartile prioritization matrix offers an objective tool for the rational allocation of scarce resources. It is recommended: in the short term, training of teams in relational skills, a low-cost action with immediate impact; in the medium term, infrastructural reforms prioritizing cleanliness, conservation, air conditioning, and privacy; and in the long term, implementation of an information management system with standardized protocols and monitoring of informational quality. The scientific contribution of the study refers to its pioneering integration of Kano-Fuzzy-SERVQUAL in the Brazilian context of women's health, in a medium-sized municipality in the semi-arid region of Pernambuco, in addition to providing an objective prioritization tool applicable in underfunded scenarios characteristic of public health management.

Keywords:

Healthcare Quality; Primary Healthcare Unit; Kano Model; Fuzzy Logic; SERVQUAL; Women's Health.

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1. Introduction

The service sector remains a pillar of the Brazilian economy, with growth of 3.1% in 2024, the fourth consecutive increase, consolidating its share of over 70% of the national Gross Domestic Product (GDP) [1]. Even in contexts of economic and health instability, such as the COVID-19 pandemic, the sector demonstrated structural resilience, reinforcing its strategic importance for employment and income generation [2]. In 2023, GDP grew 2.9% reaching R\$ 10.9 trillion, with the service sector contributing substantially to this expansion [3].

Given the growing relevance of service provision, it becomes imperative to expand specialization and ensure continuous improvement for customer satisfaction, job creation, and economic sustainability. To achieve this, according to Albuquerque et al. [4], organizations must adopt quality management for dynamic response to market demands. In this scenario of economic significance, healthcare service quality becomes a strategic element for both efficient allocation of public resources and user satisfaction. In Brazil, federal health expenditures reached R\$ 182.9 billion in 2023, with projections of R\$ 219.5 billion by 2030 [5]. The planned budget for 2024 grew 46% compared to 2023, reaching R\$ 218.5 billion [6], evidencing political prioritization of the area. The Unified Health System (SUS) remains the main provider of public health services, serving approximately 150 million dependents in actions ranging from primary care to high complexity [7-8].

The problem emerges when observing patients' perceptions regarding the quality of services provided in the public health sphere, evidencing the pressing need for adherence to quality tactics to ensure user satisfaction, credibility, and effectiveness. According to Lima, Monteiro, and Vasconcelos [9], considering the country's structural characteristics, service provision becomes incipient, requiring policies that prioritize humanization of care. Even with varied strategies from SUS managers, there is a great challenge in aligning resource scarcity with the guarantee of comprehensive public health. Thus, strategies must be sought to overcome this problem, maintaining sustainability and system quality. Analyzing user perception is the starting point for quality improvement in any organization [10].

Within the scope of Primary Health Care (UBS), are configured as the main gateway to the Healthcare Network, operating with multidisciplinary teams that address numerous demands through the Family Health Strategy (ESF), implemented in 1994 as a care system to reorganize the public health model [11]. Besides the ESF, other programs seek to expand access and population quality of life, notably the National Policy for Comprehensive Women's Health Care (PNAISM), which aims to ensure gestational health, prenatal monitoring, childbirth and postpartum care, and violence prevention [12]. Understanding women's satisfaction with public care is essential, since, according to Sajid and Baig [13], patient satisfaction constitutes the best indicator of organizational competence in healthcare, even surpassing mortality and morbidity.

Considering that women represent 69% of UBS [14] and that SUS is responsible for providing equitable, full, and comprehensive assistance to population health conditions, it is urgent to understand how these services are qualified for women's health. In Salgueiro-PE, a municipality with more than 29 thousand women, 63% of reproductive age [15], there is a need for greater qualification in women's healthcare. It becomes essential to understand how primary care, with its preventive character, contributes to reducing severe cases in this population.

Despite the vast literature on quality assessment in UBSs using SERVQUAL [16-18], three scientific gaps are identified: (1) absence of studies integrating Kano-Fuzzy-SERVQUAL in the Brazilian primary care context; (2) under-representation of medium-sized municipalities in the northeastern semi-arid region, with literature concentrated in capitals; and (3) lack of objective attribute prioritization instruments for managers with scarce resources. Recent studies demonstrate the potential of

integrating hybrid methodologies for healthcare quality assessment [19-20], reinforcing the relevance of innovative approaches that overcome limitations of traditional models.

Thus, the following research problem is reached: Which quality attributes impact the satisfaction of young adult women users of Primary Healthcare Units in Salgueiro-PE, a semi-arid region of northeastern Brazil, allowing prioritization of managerial actions for service improvement? Therefore, this paper aims to evaluate the quality of services provided by UBSs in Salgueiro-PE from the perspective of young adult women users, through the integration of Kano Model, SERVQUAL, and Fuzzy Logic, aiming to identify priority attributes for managerial improvement actions.

Medium-sized municipalities in the semi-arid Northeast of Brazil face specific structural challenges that amplify deficiencies in primary women's health care: chronic underfunding with unequal regional distribution of resources favoring states in the South and Southeast, precarious infrastructure aggravated by extreme temperatures (39-42°C) that compromise the conservation of facilities and comfort during care, instability of human resources with high professional turnover due to the low attractiveness for retaining specialized labor in remote areas, and geographic isolation of more than five hundred kilometers from state capitals limiting access to continuing education and specialized technical support. In this context, where Salgueiro-PE presents health indicators below the national averages, it becomes imperative to develop objective instruments for prioritizing quality attributes that allow for the rational allocation of scarce resources according to the combined potential for generating satisfaction and preventing dissatisfaction among users.

This paper contributes in three interrelated dimensions: (1) Methodological: Pioneer integration of Kano-Fuzzy-SERVQUAL in Brazilian UBSs, overcoming limitations of traditional Kano binarity through quantification of nuances via Fuzzy logic; (2) Contextual: First quality analysis in women's health in a medium-sized municipality in the Pernambuco semi-arid region, an under-represented region in national literature; (3) Managerial: Prioritization matrix based on d+/d- coefficients and quartile analysis, providing an objective instrument for allocation of scarce resources in public management context.

The paper is structured in five sections. After this introduction, Section 2 presents the theoretical foundation on quality management, public health services, SERVQUAL model, Kano model, and Fuzzy logic. Section 3 details the methodological procedures, including sample characterization, questionnaire structuring, and data collection. Section 4 reports and discusses the results obtained. Section 5 presents conclusions, limitations, scientific contributions, and future research agenda.

2. Theoretical Foundation

This section describes the main topics that guide this research: Public Health Services, Service Quality, the Kano Model, and Fuzzy Logic.

2.1 Public Health Services

The evaluation of quality in health services demands structural understanding of the Brazilian system and the technical-care standards that govern it. Donabedian [21] proposed a three-dimensional model based on structure, process, and outcome, emphasizing that quality in healthcare is not limited to clinical outcomes but encompasses the entire patient experience in the continuum of care. This paradigm remains current, being reinforced by recent studies that highlight the centrality of user experience as a quality indicator in healthcare [22-23].

In Brazil, primary healthcare is operationalized mainly through the Unified Health System (SUS), regulated by Organic Health Law No. 8,080/1990, which ensures the fundamental right to health

through an articulated network of care from primary care to high-complexity processes. According to Oliveira and Pereira [24], primary care constitutes a key component of this system, being responsible for first contact, care coordination, and determining work at all SUS levels. When prioritized and qualified, primary care generates better health indicators, reduces chronic cases, optimizes care flows, and increases user satisfaction [25].

Primary Healthcare Units (UBSs) constitute the main gateway to the Care Network, with the function of promoting multidisciplinary assistance for low-complexity services, aiming at health promotion, disease prevention, diagnosis, and treatment [11]. These units operate through the Family Health Strategy (ESF), implemented in 1994, which organizes multidisciplinary teams (physician, nurse, dentist, and community health agents) responsible for up to 4,000 people in a delimited territory. This model seeks to establish longitudinal bonds, recognize contextual needs, and promote cost-effectiveness in primary care [26].

The preventive practices performed by UBSs must respect the essential attributes of primary care defended by Starfield [27]: (i) first contact, ensuring accessibility; (ii) longitudinality, favoring continuity and bonding; (iii) comprehensiveness, articulating preventive and curative actions centered on the user; and (iv) coordination, synchronizing care levels. Recent studies demonstrate that UBSs with high performance in these attributes achieve a 23% reduction in avoidable hospitalizations and 31% in care costs [28].

The contemporary challenge of SUS consists of qualifying the primary care network to effectively coordinate care, providing adequate responses to user needs. Pimentel et al. [8] highlight that, despite structural advances, challenges persist related to chronic underfunding, unequal resource distribution, and infrastructure limitations, particularly in medium-sized municipalities and remote regions. The Federal Court of Audit [5] classified SUS as a "high-risk" area in terms of sustainability, projecting a need for R\$ 219.5 billion annually until 2030 to maintain access and quality.

Women's healthcare in Brazil evolved from a restrictive maternal-child focus to a comprehensive approach throughout the life cycle. Historically, policies concentrated on the pregnancy-puerperal period and birth control [29]. Only after 1970, driven by social movements and health reform, did the focus expand to needs beyond reproduction [30]. The National Policy for Comprehensive Women's Healthcare (PNAISM), established in 2004 and updated in 2015, sets guidelines for humanized and qualified care, including: sexual and reproductive health, prenatal and humanized childbirth, climacteric, prevention of gynecological cancers, family planning, and addressing gender violence [12]. The Primary Care Protocol for Women's Health [31] operationalizes these guidelines in six priority care axes in UBSs. Quality assessment in this context transcends technical dimensions, incorporating aspects of gender, autonomy, and safety. Sajid and Baig [13] demonstrate that female satisfaction in health services correlates strongly with professional empathy, active listening time, and respect for privacy. Young women, particularly, value attributes of responsiveness (service agility), confidentiality, and clear communication about reproductive rights [32-33], elements frequently deficient in contexts of care overload.

Recent studies evidence that quality perceived by women SUS users is significantly associated with outcomes such as treatment adherence, attendance at preventive consultations, and general satisfaction with the system [34]. This specificity justifies the gender segmentation and analysis of attributes sensitive to women's needs adopted in this study.

2.2 Service Quality

Quality was established in organizations as an inspection and statistical control mechanism, evolving into a strategic approach for competitive differentiation [35]. In the service sector, characterized by intangibility, heterogeneity, inseparability, and perishability [36], quality assessment becomes complex as it depends essentially on the client's subjective perception of the experienced service. Fitzsimmons and Fitzsimmons [37] position the client as the definitive judge of service value, basing evaluation on five dimensions: reliability (execution in promised time/manner), assurance (competence and courtesy), responsiveness (readiness to serve), empathy (individualized attention), and tangibility (appearance of facilities and personnel). This multidimensionality is captured by the concept of perceived quality, defined by Parasuraman et al. [38] as the discrepancy between prior expectations and post-experience perceptions.

Client expectations are influenced by personal needs, word-of-mouth communication, and past experiences [37]. Perceived quality manifests in three levels: (i) exceptional, when perception exceeds expectations; (ii) satisfactory, when it meets expectations; and (iii) deficient, when it does not reach expectations. Recent systematic reviews indicate that 68% of service organizations use quality gap models for diagnosis and continuous improvement [39].

In the context of public health services, assessment assumes additional complexity. SUS users face choice limitations, scarce resources, and technical information asymmetry [8], generating a phenomenon of 'adaptive expectations' where chronic deficiencies are normalized [40]. Donabedian [41] proposed seven specific attributes for healthcare quality - efficacy, effectiveness, efficiency, optimization, acceptability, legitimacy, and equity - emphasizing that evaluation must transcend technical indicators, incorporating individual and social values and expectations. To operationalize the measurement of these aspects, the SERVQUAL model, developed by Parasuraman et al. [38], became an international reference. The instrument measures five dimensions through a structured questionnaire with 22 duplicated items: one set captures expectations and another, perceptions. The difference (gap) between scores indicates quality level: negative gaps signal dissatisfaction; positive ones, exceeded expectations. The model uses a seven-point Likert scale, ranging from "strongly disagree" to "strongly agree," allowing numerical quantification of perceived quality.

Beyond SERVQUAL, other models were developed for specific contexts: SERVPERF [42], focused only on perceptions; E-S-QUAL [43], for electronic services; HEDPERF [44] and HEDQUAL [45], adapted for higher education; and HOSPQUAL [46], for hospitals. Recent meta-analysis covering 247 studies (2010-2023) demonstrates that SERVQUAL remains the most globally used model (43% of studies), followed by SERVPERF (28%) [39].

However, these traditional models present a common limitation: they capture expectation and/or perception without considering intrinsic peculiarities in the evaluation of each attribute. As Donabedian [41] observes, subjective characteristics are difficult to define and measure unidimensionally. For this reason, this study integrates SERVQUAL with the Kano model, which considers the differentiated impact of each attribute on satisfaction, and with Fuzzy logic, which captures nuances between discrete categories, as detailed in subsequent sections.

2.3 Kano Model

The quality of products and services is not associated only with functional performance but with intrinsic and subjective aspects of individual evaluation, as highlighted by Shewhart in defining quality as an objective-subjective phenomenon [35]. To capture these subjectivities, Kano et al. [47]

developed the Model of Attractive and Must-be Quality, which revolutionized the understanding of non-linear relationships between product/service attributes and customer satisfaction.

The model is based on the premise that quality attributes affect satisfaction in distinct ways, not constituting a uniform linear relationship. Kano et al. [47] classified attributes into five categories based on how their presence or absence impacts customer satisfaction and dissatisfaction, as detailed in Table 1.

Table 1

Classification of attributes according to Kano model

Attribute	Satisfaction	Dissatisfaction
Must-be (O)	Regardless of performance, does not generate satisfaction.	Absence generates strong dissatisfaction.
Attractive (A)	Presence generates significant satisfaction.	Absence does not generate dissatisfaction.
One-dimensional (U)	Higher performance, higher satisfaction (linear relationship).	Lower performance, higher dissatisfaction.
Indifferent (N)	Does not generate satisfaction.	Does not generate dissatisfaction.
Reverse (R)	Low degree or absence results in satisfaction.	Presence or high-performance results in dissatisfaction.

Source: Adapted from Kano et al. [47].

The model operationalization occurs through a structured questionnaire with pairs of questions for each attribute: one functional (presence) and another dysfunctional (absence), using a five-point Likert scale, as exemplified in Table 2.

Table 2

Example of functional and dysfunctional questions

Question Type	Question	Response Options
Functional	How would you feel if SUS UBSs had clean and organized environments?	1. I would feel very good 2. I would feel good 3. I would feel Indifferent 4. I would feel bad 5. I would feel very bad
Dysfunctional	How would you feel if SUS UBSs did NOT have clean and organized environments?	1. I would feel very good 2. I would feel good 3. I would feel Indifferent 4. I would feel bad 5. I would feel very bad

Source: Elaborated by the authors based on Kano et al. [47].

The combination of functional-dysfunctional responses allows classifying each attribute according to the evaluation table proposed by Kano et al. [47]. Beyond the five main categories, Roos et al. [48] suggested an additional category "Questionable (Q)," indicating inconsistent or misunderstood responses. Sauerwein et al. [49] established a hierarchy of importance: Must-be > One-dimensional > Attractive > Indifferent, guiding organizational resource prioritization.

The Kano model's differential lies in its capacity to identify competitive differentiation opportunities. While must-be attributes are minimum conditions (their presence is expected but does not generate delight), attractive attributes constitute differentials that positively surprise users. One-dimensional attributes, in turn, present a direct relationship: the better the performance, the higher the satisfaction; the worse, the higher the dissatisfaction. This categorization allows managers

to prioritize investments: correct deficiencies in must-be (avoid dissatisfaction), improve one-dimensional (increase satisfaction proportionally), and implement attractive (exceed expectations).

Recent applications of the Kano model in healthcare contexts demonstrate its effectiveness in identifying critical attributes. A study in Egyptian nursing education identified that 58.3% of training system attributes were classified as one-dimensional, while only 12.5% were must-be, suggesting high sensitivity of student satisfaction to incremental improvements in relational and developmental aspects of clinical training [50]. This distribution parallels the present findings, where 87% of women's healthcare attributes demonstrated one-dimensional characteristics, indicating that user satisfaction responds proportionally to performance improvements across most quality dimensions. A systematic literature review of 38 healthcare Kano studies identified that 47.6% of quality attributes were classified as one-dimensional, while only 17.9% were must-be, indicating that patient satisfaction responds proportionally to service improvements across most quality dimensions [51]. This pattern validates the present study's finding of 87% one-dimensional classification, suggesting particularly strong linear performance-satisfaction relationships in women's primary healthcare contexts.

2.4 Fuzzy Logic

Fuzzy logic constitutes a mathematical modeling that adopts realistic evaluation of complex and imprecise situations. Developed by Zadeh [52], it aims to handle vague and uncertain information, translating verbal expressions and imprecise aspects of human perception into computable numerical values [53]. Unlike classical Boolean logic (true/false), Fuzzy logic allows intermediate degrees of membership, varying continuously between 0 (non-membership) and 1 (total membership) [54].

Considered an intelligent quantification system, Fuzzy modeling comprehends intermediate spaces, examining degrees of truth between "being" and "not being," overcoming binarity and capturing multivalent aspects. This aspect proves particularly useful in human satisfaction evaluations, where judgments are not linear, change according to contexts, and are based on subjective and complex parameters. As Simões and Shaw [53] state, imprecise verbal expressions inherent to human perception are perfectly manageable with Fuzzy logic. The Kano-Fuzzy integration aims to reduce imprecision and vagueness of respondent answers, obtaining more reliable quality assessment [55]. According to Aquino et al. [56], evaluation with Fuzzy modeling makes results more consistent, processes more robust, and strengthens individual characteristics in aggregate analyses. Wang and Wang [57] demonstrate that Fuzzy Kano reduces complexity and ambiguity, measuring the degree of possibility of customer satisfaction with attribute presence and dissatisfaction with its absence.

Kano-Fuzzy operationalization involves three main stages: (1) collection of responses on Likert scale for functional and dysfunctional questions; (2) conversion of percentage frequencies into Fuzzy sets; (3) matrix calculation of possibility degrees for each Kano category. For example, if 40% of respondents mark "I would feel very good" (functional) and 60% mark "I would feel very bad" (dysfunctional) for an attribute's absence, matrix multiplication calculates the probability of it being classified as Must-be, mathematically quantifying what would be treated categorically in traditional Kano. Table 3 illustrates the percentage representation of functional and dysfunctional questions that underpin subsequent calculations.

Table 3

Percentage representation of functional and dysfunctional questions

Attribute	Type	Very Good	Good	Indifferent	Bad	Very Bad
Attribute 1	Functional	Af ₁ %	Bf ₁ %	Cf ₁ %	Df ₁ %	Ef ₁ %
	Dysfunctional	Ad ₁ %	Bd ₁ %	Cd ₁ %	Dd ₁ %	Ed ₁ %
...	Functional	...	...	...	...	...
	Dysfunctional	...	...	...	...	...
Attribute N	Functional	Af _N %	Bf _N %	Cf _N %	Df _N %	Ef _N %
	Dysfunctional	Ad _N %	Bd _N %	Cd _N %	Dd _N %	Ed _N %

Source: Adapted from Melo et al. [55].

For each attribute, functional (I) and dysfunctional (II) linguistic sets are established:

- I. Functional linguistic set: (CF) = {Afn, Bfn, Cfn, Dfn, Efn}
- II. Dysfunctional linguistic set: (CD) = {Adn, Bdn, Cdn, Ddn, Edn}

Where:

- Afn = Percentage "I would feel very good" (functional)
- Bfn = Percentage "I would feel good" (functional)
- Cfn = Percentage "I would feel indifferent" (functional)
- Dfn = Percentage "I would feel bad" (functional)
- Efn = Percentage "I would feel very bad" (functional)
- Analogous for dysfunctional (Adn, Bdn, Cdn, Ddn, Edn)

With the sets identified, the Fuzzy Matrix (F) (III) is calculated by multiplying the dysfunctional set by the transpose of the functional set, resulting in the 5x5 matrix (IV).

$$\text{III. } F = (CD) \times (CF) = [Adn, Bdn, Cdn, Ddn, Edn] \times \begin{bmatrix} Afn\% \\ Bfn\% \\ Cfn\% \\ Dfn\% \\ Efn\% \end{bmatrix}$$

$$\text{IV. } F = \begin{bmatrix} f_{11} & f_{12} & f_{13} & f_{14} & f_{15} \\ f_{21} & f_{22} & f_{23} & f_{24} & f_{25} \\ f_{31} & f_{32} & f_{33} & f_{34} & f_{35} \\ f_{41} & f_{42} & f_{43} & f_{44} & f_{45} \\ f_{51} & f_{52} & f_{53} & f_{54} & f_{55} \end{bmatrix}$$

This matrix is overlaid on the Kano classification table to calculate possibility degrees. The Kano classification table relates functional responses (columns) and dysfunctional (rows):

$$\text{V. } \text{Kano} = \begin{bmatrix} QAAAQ \\ RIIIM \\ RIIIM \\ RIIIM \\ RRRRQ \end{bmatrix}$$

The possibility degree (VI) for each category is obtained by summing the elements of matrix F corresponding to that category in the Kano table.

$$\text{VI. Possibility} = \left\{ \frac{\sum Q}{Q} \quad \frac{\sum R}{R} \quad \frac{\sum A}{A} \quad \frac{\sum I}{I} \quad \frac{\sum O}{O} \quad \frac{\sum M}{M} \right\}$$

Wang and Wang [57] adapted the satisfaction coefficients proposed by Berger et al. [58] to quantify positive (VII) and negative (VIII) perceptions:

$$\text{VII. } D_i^+ = \frac{A_i + O_i - R_i}{A_i + M_i + O_i + R_i + I_i}$$

$$\text{VIII. } D_i^- = -\frac{M_i + O_i - R_i}{A_i + M_i + O_i + R_i + I_i}$$

A = Possibility degree of Attractive attribute; O = Possibility degree of One-dimensional attribute; M = Possibility degree of Must-be attribute; I = Possibility degree of Indifferent attribute; R = Possibility degree of Reverse attribute

The d^+ coefficient indicates the potential for increased satisfaction if the attribute is improved (ranges from 0 to 1). The d^- coefficient indicates the negative impact if the attribute is absent or deficient (ranges from -1 to 0). The gap between perceptions is calculated by: $\text{Gap} = d^+ - |d^-|$, providing a unique metric that combines both effects. Gap values close to 2 indicate highly critical attributes (high positive potential and high negative impact), while values close to 0 suggest indifferent attributes.

Recent applications demonstrate that Kano-Fuzzy reduces the rate of inconsistent classifications by 34% compared to traditional Kano, increasing diagnostic reliability [59]. Methodological integration in public health quality management has advanced considerably. Vasconcelos et al. [60] successfully combined Kano model for attribute classification with Balanced Scorecard for strategic deployment in Brazilian public health service, demonstrating that user perception analysis can be systematically translated into measurable organizational performance targets. This integration evidences maturation and consolidation of approaches tailored for public sector constraints, where limited resources demand evidence-based prioritization aligned with strategic management frameworks.

2.5 Application of Quality Assessment in Healthcare

Based on the theoretical foundation presented, the importance of quality assessment in SUS primary care services, particularly in UBSs, becomes evident. Several studies aimed to evaluate quality in these units using predominantly the SERVQUAL model, as synthesized below.

Lima, Monteiro, and Vasconcelos [61] applied the Kano model to evaluate prenatal services in a northeastern capital, identifying that dissatisfaction concentrated on aspects of administrative organization and professional care. Main critical points were exam scheduling and first contact with community health agents, indicating the need for qualification of these groups for effective care network for pregnant women.

Santos [16] used SERVQUAL in a UBS in Rio Grande do Norte to understand perceived versus desired quality, identifying dissatisfaction in all proposed dimensions, with expectations systematically higher than perceptions, indicating need for comprehensive improvements.

Martins [62] applied SERVQUAL with 408 users in a Minas Gerais municipality, identifying Empathy and Reliability as the most critical dimensions (lowest means), evidencing need for practices to improve interpersonal relationships and trust in services. Junior et al. [63] evaluated a UBS in

Paraná via SERVQUAL, finding critical levels in Reliability, Understanding, and Empathy, with Reliability presenting the greatest deficiency, demonstrating lack of credibility perceived by users.

Protasio et al. [64] analyzed 65,391 primary healthcare users across Brazilian regions through national quality assessment, identifying generalized dissatisfaction with negative gaps in multiple quality dimensions including physical facilities, service responsiveness, and staff empathy. The authors emphasized the need for comprehensive improvements in infrastructure, transparency, reliability, and informational security, warning that persistent quality deficiencies generate user migration toward better-performing units, creating overload risks and amplifying inequities in access to quality care. Andrade et al. [65] investigated elderly satisfaction in UBSs in Paraíba with SERVQUAL, identifying greater dissatisfaction in Reliability and Assurance. All dimensions presented expectations higher than perceptions, indicating generalized dissatisfaction. Ribeiro and Scatena [66] argue that medium-sized municipalities face specific quality management challenges in Family Health Strategy, combining complex demands typical of large urban centers with limited institutional and financial capacity characteristic of smaller municipalities. In these contexts, intervention prioritization becomes even more critical, reinforcing the relevance of the quartile prioritization matrix developed in this research as a managerial decision support tool in scarce resource scenarios.

Regarding women's health quality in Brazilian primary care, national evaluation involving 16,566 women identified inadequate prenatal quality in 75% of services, with concentration of research efforts on obstetric care and substantial gaps in evaluating other PNAISM axes such as family planning, STI prevention, and cervical cancer screening [67]. No studies focused specifically on young adult women (18-30 years), a segment that represents significant proportion of reproductive health service users but remains underrepresented in quality evaluation literature, limiting understanding of specific expectations and perceptions of this demographic group.

Computational approaches integrating soft computing with quality assessment models offer advantages for healthcare management. Batista et al. [68] demonstrated that fuzzy logic techniques enable more sophisticated priority ranking by quantifying uncertainty in patient perceptions, overcoming limitations of deterministic classification methods. This approach underpins the present study's Kano-Fuzzy methodology, where improvement gap metric ($d+ - |d-|$) synthesizes satisfaction generation potential and dissatisfaction prevention impact into single prioritization criterion, enabling identification of six critical attributes (gaps 1.532-1.752) demanding immediate managerial attention among twenty-three evaluated dimensions.

More recent studies expand this panorama. Monteiro et al. [69] analyzed 5,347 users in Paraíba using PMAQ-AB data, confirming persistence of gaps in Reliability and Assurance. Silva et al. [70] conducted qualitative research in the Federal District (2018-2019) identifying communication, service shifts, and professional qualification as critical points. Pena et al. [71], in Contagem-MG, found an atypical result: 81.8% satisfaction in a UBS pharmaceutical office, attributed to qualified local management and investments in training. Possmoser et al. [72] identified satisfaction of elderly people in Rio Grande do Sul with reception and continuity in primary care, related to the historical consolidation of ESF in the southern region. Table 4 presents a comparison of these studies.

Table 4
 Studies on quality in Brazilian UBSs (2016-2026)

Author(s)	Year	Location	Method	Critical Dimensions	Ref.
Lima et al.	2017	NE Capital	Kano	Organization, Care	[61]
Santos	2016	RN	SERVQUAL	All dimensions	[16]
Martins	2017	MG	SERVQUAL	Empathy, Reliability	[62]
Junior et al.	2018	PR	SERVQUAL	Reliability	[63]
Andrade et al.	2019	PB (elderly)	SERVQUAL	Reliability, Assurance	[65]
Monteiro et al.	2021	PB	PMAQ-AB	Reliability, Assurance	[69]
Silva et al.	2023	DF	Qualitative	Professionals, Shifts, Communication	[70]
Pena et al.	2023	MG (Contagem)	SERVQUAL	Access, Cordiality, Care	[71]
Possmoser et al.	2025	RS (elderly)	Quali-Quanti	Reception, Continuity	[72]

The analysis of studies (2016-2026) reveals consolidated patterns and emerging trends. Negative gaps persist in 75% of studies, with Reliability and Empathy emerging as critical dimensions in 85% of research, consolidating as national priorities for intervention. However, recent studies present methodological diversification (qualitative approaches [70], PMAQ-AB data [69]) and, for the first time in the historical series, occasional positive gaps: Pena et al. [71] identified 81.8% satisfaction in Contagem-MG, attributed to qualified local management; Possmoser et al. [72] found satisfaction of elderly people in Rio Grande do Sul with reception, related to ESF consolidation in the southern region. Despite these advances, gaps persist: (1) none of the 13 studies integrates Kano-Fuzzy-SERVQUAL; (2) medium-sized municipalities in the semi-arid region remain underrepresented (1/13 studies); (3) young adults (18-30 years) continue absent as a specific target audience; (4) post-COVID impact is not yet adequately characterized. This expanded review reinforces the three scientific gaps that this study aims to fill, now validated by a decade-long time series (2016-2026).

Recent international studies reinforce the need for hybrid methodological approaches for healthcare quality assessment. Liu et al. [19] developed a model integrating SERVQUAL, Analytic Hierarchy Process, and Six Sigma in Chinese community hospitals, demonstrating 34% gains in diagnostic accuracy of critical attributes and 28% reduction in patient complaints. Al-Assaf [20], in a systematic review covering 156 studies (2005-2023), identified that Healthcare 4.0 technologies (telemedicine, electronic health records, artificial intelligence) transform traditional quality dimensions, incorporating aspects of digital accessibility, algorithmic personalization, and informational continuity.

3. Methodology

According to Gil [73], the scientific method is a set of intellectual and technical procedures adopted to achieve knowledge. This research can be classified regarding approach, investigation methodology, objectives, and technical procedures, as described below.

Regarding nature, the research is of applied nature, as it managed to develop a diagnosis identifying problems and proposing solutions, with the research itself serving as a source of knowledge for immediate practical application [74].

Regarding approach, this is combined quantitative-qualitative research. Combined research considers that the researcher can integrate both approaches in all or some stages of the research process [75]. Thus, it is possible to understand aspects quantitatively, concerning public health service provision through statistical indicators, as well as qualitative aspects permeating participants' subjectivity through responses, enabling comprehensive understanding of the study object. Regarding method, this is survey research which, according to Nakano [75], seeks to obtain quantifiable information about a specific group through questions expressing opinions. Thus, the survey methodology enables understanding how service provision for women's health in city UBSs is qualified through quantification of studied variables.

In methodological terms, regarding objectives, the study can be classified as Exploratory Research, considering that no studies related to UBS service quality in Salgueiro municipality were identified in the literature, thus providing more information on the topic; and Descriptive Research, since observation, recording, and analysis will occur correlating facts [76]. This study was conducted in Salgueiro municipality, located in the semi-arid region of Pernambuco state, Brazil, 518 km from the capital Recife. According to IBGE data [15], the city had 29,769 women in 2010, of which 63% (18,755) were of reproductive age (15-49 years). The municipality's primary care network comprises 18 Primary Healthcare Units, with 82% population coverage by the Family Health Strategy in 2020.

Regarding health service utilization, National Health Survey data indicate that women represent 69% of primary care users in the Northeast region [14], with main demands concentrated on prenatal care, family planning, cervical cancer screening, and general consultations. Salgueiro presents health indicators typical of the semi-arid region: infant mortality rate of 12.4 per 1,000 live births (2019) and prenatal coverage of 89.3% (DATASUS, 2020). The target population of this study comprised adult women (≥ 18 years) residing in Salgueiro who had used SUS UBS services at least once. Given the absence of a registry listing all women SUS users in the municipality, it was not possible to determine the exact size of the accessible population, which prevented calculation of a probabilistic sample.

Regarding sampling technique, this study adopted a non-probabilistic convenience sample, characterized by selection of participants according to accessibility and availability to respond to the online questionnaire [77]. The choice of this technique is justified by the context of restrictions imposed by the COVID-19 pandemic during the collection period (November 2020 to April 2021), which made in-person questionnaire application at UBSs and systematic respondent approach unfeasible. The instrument dissemination through social media (WhatsApp and Instagram) used the "snowball sampling" method, in which initial participants shared the questionnaire link within their contact networks [78-79]. Although this strategy enabled data collection in an adverse scenario, it is recognized that it presents limitations regarding statistical representativeness of the target population.

The non-probabilistic convenience sampling method adopted in this study has inherent limitations that must be explicitly acknowledged to ensure proper interpretation of the findings. Unlike probabilistic sampling, where each element of the population has a known and calculable probability of selection, allowing statistical inference for the broader population [80], convenience

sampling does not guarantee representativeness of the diversity of the target population in terms of age, education, income, maternity status, and service utilization patterns [77, 81].

Three primary limitations affect the generalizability of the results: First, digital selection bias systematically excluded women without internet access or digital literacy, precisely the most socioeconomically vulnerable segment whose perceptions of quality may differ substantially from the predominantly young and educated sample obtained (54% with initiated or completed higher education vs. 29.4% municipal average). This digital exclusion likely resulted in underestimation of infrastructure and accessibility problems that disproportionately affect low-income populations. According to the age concentration (76.1% aged 18-24 years), it does not reflect the actual age distribution of women using primary health care units in the Northeast, where data from the National Health Survey indicate a more balanced distribution between age groups [14]. Perceptions of quality vary significantly between life stages, with young women prioritizing reproductive health attributes (contraception, STI prevention), while older women value chronic disease management and menopausal care [33-34]. Third, the predominance of nulliparous women (83.5%) restricts the validity of the findings regarding maternal and child health services (prenatal, childbirth, postpartum), which constitute central axes of the PNAISM [12] and represent the main demand that triggers contact with primary health care units for women of reproductive age.

Methodological implications include: (1) External validity limitations - the findings cannot be statistically generalized to the entire population of women using the SUS in Salgueiro-PE (n≈18,755 women of reproductive age), nor to women using UBS in other medium-sized municipalities in the semi-arid region, as the sample characteristics (young, educated, nulliparous, digitally connected) represent a specific subset that is not proportionally representative of the population heterogeneity [80-81]; (2) Specificity of attribute ranking - the prioritization of critical attributes (empathy, reliable information, preserved facilities) reflects perceptions of predominantly young, single, and educated women using preventive reproductive health services, and may differ from the priorities of mothers (who may emphasize quality of pediatric care, vaccination, nutritional monitoring) or older women (who may prioritize management of chronic diseases, access to medications, referrals to specialists); (3) Socioeconomic perspective bias - although 84.4% reported economic vulnerability (≤ 3 minimum wages), the high educational level (54% with higher education) may have raised expectations and critical capacity compared to women with lower education, potentially inflating the perceived gaps between expectations and performance.

These limitations are partially mitigated by the exploratory nature of this research. As an exploratory study [73-74], the primary objective is not statistical generalization to populations, but rather in-depth investigation of a phenomenon (perception of quality in primary health care services for women) in a previously unstudied context (medium-sized municipality in the semi-arid region), generation of empirically grounded hypotheses about critical attributes, and pilot testing of an innovative methodological approach (Kano-Fuzzy-SERVQUAL integration) [75-76]. The exploratory design justifies the use of convenience sampling as an efficient and viable strategy under pandemic restrictions, prioritizing methodological depth (fuzzy quantification of Kano categories, calculation of d+/d- coefficients, prioritization matrix by quartiles) over statistical representativeness [77]. The findings should therefore be interpreted as:

- Indicators of quality perceptions among a specific segment (young, educated, nulliparous women dependent on the SUS) rather than definitive conclusions about all women using primary health care units in Salgueiro.

- Hypothesis generators for future confirmatory studies with stratified probabilistic sampling ($n \geq 377$ for 95% confidence, 5% margin of error [80]) allowing statistical generalization and testing of variation in the pattern of critical attributes among demographic subgroups (age, motherhood, education, income).
- Methodologically pioneering in demonstrating the feasibility of Kano-Fuzzy-SERVQUAL integration in the Brazilian context of primary health care for women, providing a validated protocol replicable in other settings.
- Contextually relevant for primary health care unit managers in Salgueiro and similar municipalities that predominantly serve young women dependent on the SUS, for whom the identified priorities (empathy, reliable information, infrastructure) constitute empirically grounded intervention targets.

Despite the sample limitations, the sample obtained ($n=109$) meets the minimum limits for stability of the Kano-Fuzzy methodology (100-200 respondents for 23 attributes [55, 57]), provides an adequate ratio of cases per variable (4.7 respondents/attribute, exceeding the minimum of 3-5 for multivariate analyses [81]), and captures perceptions of a numerically significant segment of users, given that women aged 20-29 represent 38% of primary care consultations in the Northeast [14]. The exploratory contribution lies in identifying patterns of critical attributes in a novel context, generating a prioritization framework (d+/d- coefficients, improvement gap matrix) applicable by managers operating under resource scarcity, and establishing methodological foundations for future research with representative samples allowing definitive generalizations.

The questionnaire aimed to capture how women users of the Unified Health System perceived services provided by UBSs in Salgueiro-PE. The instrument was based on attributes proposed by the SERVQUAL model and five quality dimensions proposed by Parasuraman et al. [38] associated with the Kano Model, being structured in four sections totaling 77 items:

- Section 1: Sociodemographic profile and SUS usage (10 questions) - capturing age, marital status, education, income, number of children, health insurance coverage, frequency of UBS visits, and reasons for seeking services.
- Section 2: Functional questions (23 items) - evaluating user reaction when quality attributes ARE PRESENT, using Kano methodology with 5-point scale: 1=I would feel very good; 2=I would feel good; 3=I would feel indifferent; 4=I would feel bad; 5=I would feel very bad.
- Section 3: Dysfunctional questions (23 items) - evaluating user reaction when quality attributes ARE ABSENT, using the same 5-point scale.
- Section 4: Global service evaluation (8 closed questions + 1 open question) - assessing overall satisfaction using 5-point Likert scale (1=strongly disagree; 5=strongly agree) and collecting qualitative comments about experienced services.

The 23 attributes analyzed (Sections 2 and 3) were based on SERVQUAL dimensions [38] and adapted for women's healthcare context in Brazilian primary care, grounded in PNAISM guidelines [12] and validated by recent studies in similar contexts [61-72], as detailed in Table 5.

Table 5
SERVQUAL dimensions and attributes adapted for women's healthcare in UBSs

Dimension	Code	Attribute	References
Tangibility	Attribute 1	Modern and well-maintained equipment	[38, 61]
	Attribute 2	Preserved environment and physical facilities	[38, 61]
	Attribute 3	Professional appearance and attire of staff	[38, 61]
	Attribute 4	Easy access and location	[38, 18]
Reliability	Attribute 5	Predictability of service	[63, 69]
	Attribute 6	Reliable information transmission	[63, 70]
	Attribute 7	Estimated service time	[18, 69]
	Attribute 8	Service effectiveness	[62, 18]
	Attribute 9	Commitment to service improvement	[17, 66]
	Attribute 10	Monitoring of care process updates	[70, 66]
Empathy	Attribute 11	Staff willingness to solve problems	[62, 65]
	Attribute 12	Service resourcefulness	[63, 17]
	Attribute 13	Safety conveyed before and after service	[61, 63]
	Attribute 14	Staff approach	[63, 70]
Assurance	Attribute 15	Detailed knowledge about procedures	[63, 18]
	Attribute 16	Personalized care	[71, 72]
	Attribute 17	Competence to clarify doubts	[62, 18]
	Attribute 18	Standardized procedures	[66, 18]
Responsiveness	Attribute 19	Care and attention in problem resolution	[61, 16]
	Attribute 20	Personalized service hours	[17, 70]
	Attribute 21	Easily accessible communication means	[70, 71]
	Attribute 22	Prioritization of patient interest	[61, 17]
	Attribute 23	Attention to specific needs	[61, 72]

Note: Attributes were adapted from the original SERVQUAL scale [38] specifically for women's healthcare context in Brazilian primary care, based on PNAISM guidelines.

Data collection occurred between November 2020 and April 2021, during the COVID-19 pandemic, which necessitated online administration via Google Forms. The questionnaire link was disseminated through WhatsApp and Instagram.

All potential respondents received information about research objectives, data confidentiality, voluntary participation, and right to withdraw. Data analysis was conducted in five stages: (I) Data preparation and cleaning; (II) Descriptive analysis; (III) Kano-Fuzzy classification; (IV) Global evaluation analysis; (V) Prioritization matrix.

4. Results

This section presents research results in five subsections: sociodemographic profile of respondents, Kano-Fuzzy classification of quality attributes, satisfaction and dissatisfaction coefficients, attribute prioritization matrix, and global service quality evaluation.

4.1 Sociodemographic Profile of Respondents

The valid sample consisted of 109 women users of the Unified Health System in the municipality of Salgueiro-PE. Sociodemographic characterization is presented in Table 6. According to the Pan American Health Organization [82], socioeconomic indicators directly contribute to the analysis of living conditions that affect health, justifying the need for detailed characterization of the sample profile.

Table 6
 Sociodemographic profile of respondents (n=109)

Variable	Category	n	%
Age	18-24 years	83	76.1%
	25-34 years	21	19.3%
	35+ years	5	4.6%
	Mean \pm SD	23.8 \pm 5.4 years	
Marital Status	Single	88	80.7%
	Married	18	16.5%
	Divorced	3	2.8%
Education Level	Complete elementary	1	0.9%
	Incomplete high school	11	10.1%
	Complete high school	38	34.9%
	Incomplete higher education	44	40.4%
	Complete higher education	7	6.4%
Monthly Family Income	Graduate degree	8	7.3%
	Up to 1 minimum wage	42	38.5%
	1 to 3 minimum wages	50	45.9%
	3 to 6 minimum wages	6	5.5%
	6 to 9 minimum wages	9	8.3%
Household Composition	More than 9 minimum wages	2	1.8%
	Lives with up to 4 people	65	59.6%
	Lives with 5+ people	44	40.4%
	Head of household	14	12.8%
Motherhood	Has children	18	16.5%
	Does not have children	91	83.5%
Health Coverage	Has health insurance	15	13.8%
	Uses SUS exclusively	94	86.2%
	At least twice/month	37	33.9%
SUS Usage Frequency	Monthly	28	25.7%
	Bimonthly	22	20.2%
	Semiannually or less	22	20.2%

The sample presents strong concentration in young women, with seventy-six percent in the age range of eighteen to twenty-four years, with mean age of twenty-three point eight years and standard deviation of five point four years. Regarding marital status, eighty point seven percent declared themselves single, sixteen point five percent married, and two point eight percent divorced. Concerning education level, a relatively high educational profile is observed for the regional context, with forty point four percent pursuing incomplete higher education, six point four percent with

complete higher education, and seven point three percent with graduate degrees, totaling fifty-four percent with initiated or completed higher education. This educational profile contrasts with the socioeconomic reality of respondents, since thirty-eight point five percent declared family income of up to one minimum wage and forty-five point nine percent between one and three minimum wages, characterizing economic vulnerability in eighty-four point four percent of the sample.

Regarding household composition, fifty-nine point six percent reside in households with up to four people, while twelve point eight percent declared themselves heads of household. A particularly relevant aspect for interpreting results refers to motherhood status, with eighty-three point five percent of respondents declaring they do not have children, while only sixteen point five percent are mothers. This datum introduces an important limitation to the scope of conclusions, since quality perceptions in women's health services may differ substantially between nulliparous women and those with experience in maternal-infant services, particularly concerning attributes related to personalized care and attention to specific needs.

Regarding health coverage, eighty-six point two percent of respondents depend exclusively on the Unified Health System, while only thirteen point eight percent have supplementary health insurance. This almost absolute dependence on the public system reinforces the relevance of investigated quality perceptions, since the absence of private care alternatives makes these users particularly vulnerable to deficiencies in public service quality. Service utilization frequency reveals a pattern of recurrent use, with thirty-three point nine percent attending primary healthcare units at least twice per month, twenty-five point seven percent monthly, twenty point two percent bimonthly, and twenty point two percent semiannually or annually. This distribution indicates that approximately sixty percent of the sample has frequent contact with services, conferring accumulated experience that grounds the evaluations presented in subsequent sections.

The identified profile, characterized by young, single women with incomplete higher education, nulliparous, socioeconomically vulnerable, and SUS-dependent, reflects a specific segment of primary care users in medium-sized municipalities of the northeastern semiarid region. Although this profile introduces sampling bias that limits statistical generalizations to the entire population of women SUS users in Salgueiro, National Health Survey data indicate that women aged twenty to twenty-nine represent thirty-eight percent of consultations in primary healthcare units in the Northeast region [14], suggesting that the sample profile, albeit non-probabilistic, is representative of a numerically significant user segment. The predominance of young women without children implies that captured perceptions refer predominantly to experiences with preventive women's care services, such as cytopathological examinations for cervical cancer screening, family planning guidance, access to contraceptive methods, and sexually transmitted infection screening, not substantially encompassing perceptions about maternal health services such as prenatal care, childbirth assistance, and puerperal follow-up, which constitute central axes of the National Policy for Comprehensive Women's Healthcare [12]. This sample characteristic should be considered when interpreting results, particularly in evaluating attributes related to personalized care and attention to specific needs, whose perceptions may differ between young women and those in active reproductive phase, as evidenced by recent studies on attributes valued by different age groups in women's health services [33-34].

4.2 Kano-Fuzzy Classification of Quality Attributes

The Kano-Fuzzy methodology was applied to twenty-three quality attributes derived from the SERVQUAL model adapted for the context of women's health in Brazilian primary care. Unlike the traditional Kano model, which classifies attributes into discrete categories based on the modal response of the respondent set, the Fuzzy approach proposed by Wang and Wang [57] calculates possibility degrees for each Kano category, quantifying consensus intensity and perception distribution among different classifications. This approach proves particularly relevant in public health service contexts, where user expectation heterogeneity stems from socioeconomic, educational, and experiential variations [40].

For each of the twenty-three attributes, respondents indicated how they would feel with the attribute's presence through a functional question and with the attribute's absence through a dysfunctional question, using a five-point scale where one represents "I would feel very good," two represents "I would feel good," three represents "I would feel indifferent," four represents "I would feel bad," and five represents "I would feel very bad." Percentage distributions of functional responses are presented in Table 7, grouped according to the five SERVQUAL model dimensions, namely tangibility, reliability, empathy, assurance, and responsiveness.

Analysis of Table 7 reveals that in all twenty-three investigated attributes, more than sixty-five percent of respondents indicated they would feel very good with the attributes' presence, with this percentage exceeding eighty percent in nineteen attributes, evidencing widespread recognition of the importance of all proposed quality aspects. There were no responses recorded in the "bad" or "very bad" categories for functional questions, indicating absence of negative perception regarding the presence of any investigated attributes. This pattern demonstrates that users universally value the investigated quality aspects, considering them beneficial when present in health services. Table 8 presents the percentage distribution of dysfunctional responses, corresponding to respondents' reactions to the absence of investigated attributes.

Analysis of Table 8 reveals a pattern inverse to that observed in functional responses, evidencing that attribute absence generates strongly negative reactions among respondents. In all twenty-three attributes, more than fifty percent of respondents indicated they would feel very bad with the absence of investigated aspects, with this percentage exceeding sixty percent in eighteen attributes. There were no responses recorded in the "very good" or "good" categories for any dysfunctional attributes, demonstrating that no respondent considers acceptable or desirable the absence of any investigated quality aspects. The notable exception refers to attribute three, concerning staff appearance and attire, where fifteen point six percent of respondents declared indifference regarding this aspect's absence, a percentage significantly higher than other attributes that presented maximum indifference of seven point three percent. This pattern suggests that, although professional appearance is valued when present, its absence does not constitute a critical dissatisfaction aspect for a significant portion of users.

Table 7
 Percentage distribution of functional responses by SERVQUAL dimension

Dimension	Attribute	Very Good	Good	Indifferent	Bad	Very Bad
Tangibility	Attribute 1	84.4%	15.6%	0.0%	0.0%	0.0%
	Attribute 2	92.7%	7.3%	0.0%	0.0%	0.0%
	Attribute 3	65.1%	33.9%	0.9%	0.0%	0.0%
	Attribute 4	88.1%	11.9%	0.0%	0.0%	0.0%
Reliability	Attribute 5	81.7%	18.3%	0.0%	0.0%	0.0%
	Attribute 6	89.9%	10.1%	0.0%	0.0%	0.0%
	Attribute 7	89.9%	10.1%	0.0%	0.0%	0.0%
	Attribute 8	71.6%	27.5%	0.9%	0.0%	0.0%
	Attribute 9	87.2%	12.8%	0.0%	0.0%	0.0%
	Attribute 10	80.7%	19.3%	0.0%	0.0%	0.0%
Empathy	Attribute 11	85.3%	14.7%	0.0%	0.0%	0.0%
	Attribute 12	79.8%	20.2%	0.0%	0.0%	0.0%
	Attribute 13	86.2%	13.8%	0.0%	0.0%	0.0%
	Attribute 14	85.3%	14.7%	0.0%	0.0%	0.0%
Assurance	Attribute 15	83.5%	16.5%	0.0%	0.0%	0.0%
	Attribute 16	69.7%	28.4%	1.8%	0.0%	0.0%
	Attribute 17	76.1%	22.9%	0.9%	0.0%	0.0%
	Attribute 18	67.0%	31.2%	1.8%	0.0%	0.0%
Responsiveness	Attribute 19	80.7%	19.3%	0.0%	0.0%	0.0%
	Attribute 20	77.1%	22.9%	0.0%	0.0%	0.0%
	Attribute 21	82.6%	17.4%	0.0%	0.0%	0.0%
	Attribute 22	74.3%	24.8%	0.9%	0.0%	0.0%
	Attribute 23	80.7%	19.3%	0.0%	0.0%	0.0%

Based on the percentage distributions of functional and dysfunctional responses presented in Tables 7 and 8, possibility degrees for each Kano category were calculated through the Fuzzy methodology proposed by Wang and Wang [57]. Initially, functional and dysfunctional linguistic sets were constructed for each attribute, according to equations one and two presented in the theoretical foundation section. Subsequently, the Fuzzy matrix was calculated through multiplication of the dysfunctional set by the transpose of the functional set, according to equation three.

Table 8
 Percentage distribution of dysfunctional responses by SERVQUAL dimension

Dimension	Attribute	Very Good	Good	Indifferent	Bad	Very Bad
Tangibility	Attribute 1	0.0%	0.0%	0.9%	38.5%	60.6%
	Attribute 2	0.0%	0.0%	0.0%	17.4%	82.6%
	Attribute 3	0.0%	0.0%	15.6%	45.0%	39.4%
	Attribute 4	0.0%	0.0%	6.4%	40.4%	53.2%
Reliability	Attribute 5	0.0%	0.0%	1.8%	35.8%	62.4%
	Attribute 6	0.0%	0.0%	1.8%	30.3%	67.9%
	Attribute 7	0.0%	0.0%	3.7%	34.9%	61.5%
	Attribute 8	0.0%	0.0%	2.8%	32.1%	65.1%
	Attribute 9	0.0%	0.0%	0.0%	33.9%	66.1%
	Attribute 10	0.0%	0.0%	1.8%	33.0%	65.1%
Empathy	Attribute 11	0.0%	0.0%	1.8%	28.4%	69.7%
	Attribute 12	0.0%	0.0%	0.9%	28.4%	70.6%
	Attribute 13	0.0%	0.0%	6.4%	22.9%	70.6%
	Attribute 14	0.0%	0.0%	4.6%	26.6%	68.8%
Assurance	Attribute 15	0.0%	0.0%	0.0%	31.2%	68.8%
	Attribute 16	0.0%	0.0%	7.3%	38.5%	54.1%
	Attribute 17	0.0%	0.0%	0.9%	31.2%	67.9%
	Attribute 18	0.0%	0.0%	0.9%	36.7%	62.4%
Responsiveness	Attribute 19	0.0%	0.0%	0.0%	31.2%	68.8%
	Attribute 20	0.0%	0.0%	0.9%	37.6%	61.5%
	Attribute 21	0.0%	0.0%	4.6%	35.8%	59.6%
	Attribute 22	0.0%	0.0%	0.9%	32.1%	67.0%
	Attribute 23	0.0%	0.0%	0.9%	33.9%	65.1%

This matrix was then overlaid on the Kano classification table, allowing calculation of possibility degrees for each category through equation six. Finally, positive and negative satisfaction coefficients were calculated through equations seven and eight, respectively, allowing determination of the improvement gap through the difference between the positive coefficient and the absolute value of the negative coefficient. Results of these calculations are presented in Table 9.

Table 9
 Kano-Fuzzy classification and satisfaction coefficients

Attribute	PD(M)	PD(O)	PD(A)	PD(I)	Classification	d+	d-	Gap	Ranking
Attribute 2	6.1%	76.5%	16.2%	1.3%	One-dimensional	0.927	-0.826	1.752	1
Attribute 6	6.9%	61.0%	28.9%	3.2%	One-dimensional	0.899	-0.679	1.578	2
Attribute 13	9.7%	60.9%	25.3%	4.0%	One-dimensional	0.862	-0.706	1.569	3
Attribute 11	10.2%	59.5%	25.8%	4.4%	One-dimensional	0.853	-0.697	1.550	4
Attribute 14	10.1%	58.7%	26.6%	4.6%	One-dimensional	0.853	-0.688	1.541	5
Attribute 9	8.5%	57.6%	29.6%	4.4%	One-dimensional	0.872	-0.661	1.532	6
Attribute 15	11.4%	57.4%	26.0%	5.2%	One-dimensional	0.835	-0.688	1.523	7
Attribute 7	6.2%	55.3%	34.6%	3.9%	One-dimensional	0.899	-0.615	1.514	8
Attribute 12	14.3%	56.4%	23.4%	5.9%	One-dimensional	0.798	-0.706	1.505	9
Attribute 19	13.3%	55.6%	25.2%	6.0%	One-dimensional	0.807	-0.688	1.495	10
Attribute 10	12.6%	52.6%	28.2%	6.7%	One-dimensional	0.807	-0.651	1.459	11
Attribute 23	12.6%	52.6%	28.2%	6.7%	One-dimensional	0.807	-0.651	1.459	12
Attribute 1	9.4%	51.1%	33.3%	6.2%	One-dimensional	0.844	-0.606	1.450	13
Attribute 5	11.5%	50.9%	30.7%	6.9%	One-dimensional	0.817	-0.624	1.440	14
Attribute 17	16.2%	51.7%	24.5%	7.7%	One-dimensional	0.761	-0.679	1.440	15
Attribute 21	10.4%	49.2%	33.3%	7.0%	One-dimensional	0.826	-0.596	1.422	16
Attribute 4	6.4%	46.9%	41.2%	5.6%	One-dim./Attractive	0.881	-0.532	1.413	17
Attribute 22	17.2%	49.8%	24.5%	8.5%	One-dimensional	0.743	-0.670	1.413	18
Attribute 20	14.1%	47.4%	29.7%	8.8%	One-dim./Attractive	0.771	-0.615	1.385	19
Attribute 8	18.5%	46.6%	25.0%	9.9%	One-dimensional	0.716	-0.651	1.367	20
Attribute 18	20.6%	41.8%	25.2%	12.4%	One-dim./Must-be/Attr.	0.670	-0.624	1.294	21
Attribute 16	16.4%	37.7%	32.0%	13.9%	One-dim./Attractive	0.697	-0.541	1.239	22
Attribute 3	13.8%	25.7%	39.4%	21.1%	Attractive	0.651	-0.394	1.046	23

Legend: PD(M) = Possibility degree of Must-be attribute; PD(O) = Possibility degree of One-dimensional attribute; PD(A) = Possibility degree of Attractive attribute; PD(I) = Possibility degree of Indifferent attribute; d+ = Positive satisfaction coefficient; d- = Negative dissatisfaction coefficient; Gap = Improvement potential. Note: Attributes with multiple classifications indicate difference less than ten percent between category possibility degrees.

Analysis of Table 9 reveals significant predominance of attributes classified as one-dimensional, with twenty of the twenty-three investigated attributes falling into this category, representing eighty-

seven percent of the total. One-dimensional attributes are characterized by presenting a linear relationship between perceived performance and user satisfaction, such that performance improvements generate proportional satisfaction increases, while performance deterioration results in proportional dissatisfaction increases. This predominance suggests that users have clear expectations regarding minimum acceptable performance in virtually all investigated quality aspects, considering them as basic needs whose presence is expected in services of adequate quality. The only attribute classified predominantly as attractive was attribute three, concerning staff appearance and attire, with a possibility degree of thirty-nine point four percent for the attractive category versus twenty-five point seven percent for the one-dimensional category. Attractive attributes are characterized by generating satisfaction when present but not provoking significant dissatisfaction when absent, suggesting that although professional appearance is valued, it does not constitute a prerequisite for perception of minimum acceptable quality, unlike aspects such as preserved physical facilities or reliable information transmission.

Four attributes presented dual classification, with differences less than ten percent between possibility degrees of one-dimensional and attractive categories, revealing heterogeneity in user perceptions. Attribute four, concerning easy access and location, presented forty-six point nine percent possibility degree for the one-dimensional category and forty-one point two percent for the attractive category. Attribute seven, referring to estimated service time, presented fifty-five point three percent one-dimensional and thirty-four point six percent attractive. Attribute twenty, concerning personalized service schedules, presented forty-seven point four percent one-dimensional and twenty-nine point seven percent attractive. Attribute twenty-one, relating to easily accessible communication means, presented forty-nine point two percent one-dimensional and thirty-three point three percent attractive. This dual classification reveals the existence of two distinct user segments with divergent perceptions about these attributes, with approximately half considering them basic needs whose performance relates linearly with satisfaction, while the other half perceives them as pleasant differentials but not essential. This heterogeneity may be related to different service utilization patterns, with users having higher contact frequency with primary healthcare units tending to value more facilitated access aspects, efficient communication, and flexible schedules, while occasional users prioritize primarily technical-care aspects.

Attribute eighteen, concerning standardized procedures, presented classificatory fragmentation with forty-one point eight percent possibility degree for the one-dimensional category, twenty point six percent for the must-be category, and twenty-five point two percent for the attractive category. This dispersion suggests that users have heterogeneous understandings about what constitutes procedure standardization and its importance for service quality. Some users interpret standardization as a minimum safety requirement that must be present regardless of desired quality level, classifying it as must-be. Another portion perceives standardization as a growing quality factor whose increase generates proportional satisfaction, classifying it as one-dimensional. A third portion considers standardization as a positive but not essential differential, classifying it as attractive. This ambiguity may indicate lack of transparency about clinical protocols and standardized operational procedures in primary healthcare units, demanding better institutional communication about care processes.

The Kano-Fuzzy classification of attributes reveals patterns of expectations that have distinct managerial implications for the allocation of scarce resources. Unlike traditional approaches that treat all quality attributes as equally important, the Kano-Fuzzy methodology allows the identification

of three categories with differentiated impacts on user satisfaction, each demanding specific investment strategies.

For the Unidimensional Attributes (87% of the attributes investigated), the predominance in this category indicates that user satisfaction responds linearly and proportionally to perceived performance. For these attributes, incremental improvements generate proportional increases in satisfaction, while deteriorations result in proportional dissatisfaction. This linear relationship has three critical practical implications: (1) the priority of continuous investment since unidimensional attributes do not have a saturation point where further improvements cease to generate perceived value. For example, Attribute 2 (preserved environment and physical facilities) has a probability of 76.5% for the one-dimensional category, meaning that 76.5% of users clearly expect that the better the facilities are preserved, the greater their satisfaction will be, with no upper limit. Managers should therefore establish continuous improvement programs instead of one-off interventions, with progressive targets for raising standards (example: establish a weekly deep cleaning target, then move on to predictive equipment maintenance, then to adequate air conditioning).

(2) The high risk of dissatisfaction, since the one-dimensional category implies that the absence or deficiency of these attributes generates proportional dissatisfaction. Attribute 6 (reliable transmission of information) exemplifies this risk: 67.9% of users indicated that they would feel "very bad" with the absence of reliable information (Table 8), generating a dissatisfaction coefficient $d^- = -0.679$. In practice, this means that informational failures (such as contradictory guidance between professionals, lack of clarification about test results, or lack of clear instructions on the use of contraceptives) generate a severe negative impact on the overall perception of quality, which may compromise adherence to treatments and return for subsequent preventive consultations. (3) The opportunity for competitive differentiation within the SUS, which although UBS are public services without traditional market competition, users with multiple accessible units tend to migrate to those with better perceived performance [64]. Unidimensional attributes with high d^+ coefficients represent opportunities for relative differentiation that can increase territorial linkage and reduce overload in specific units. Attribute 13 (security conveyed in care) with $d^+ = 0.862$ indicates that 86.2% of users would experience increased satisfaction if professionals demonstrated greater technical and empathetic security, potentially reducing the search for private or more complex services for demands that can be resolved in primary care.

For the attractive attribute such as attribute 3 (Appearance and attire of professionals), this classification has a counter-intuitive managerial interpretation. Attractive attributes do not generate dissatisfaction when absent, but generate disproportionate satisfaction when present, functioning as "charms" [47]. Attribute 3 presented a probability degree of 39.4% for the attractive category (against 25.7% for unidimensional), with a coefficient $d^- = -0.394$ (the lowest among all attributes, indicating low potential for dissatisfaction). In this case, investments in standardized professional uniforms, clear visual identification, and careful personal presentation constitute relatively low-cost actions that can generate a differentiated positive impact, especially in contexts where other basic attributes have already been met. However, in scenarios of extremely scarce resources, attractive attributes should only be prioritized after resolving critical deficiencies in unidimensional attributes.

Some attributes had a dual classification (Attributes 4, 7, 20, 21). The identification of four attributes with degrees of possibility divided between unidimensional and attractive categories (difference <10%) reveals heterogeneity of expectations among subgroups of users. For example, Attribute 4 (ease of access and location) showed 46.9% unidimensional possibility and 41.2%

attractiveness, suggesting that approximately half of the users consider geographical accessibility as a basic need whose absence generates strong dissatisfaction, while the other half perceives it as a convenient but not essential differentiator.

This heterogeneity may be related to different usage patterns. Users with high frequency of service (33.9% attend at least 2x/month, Table 6) tend to value convenience attributes (location, flexible hours, accessible means of communication) as unidimensional, as they significantly impact their routine. Users with occasional use (20.2% attend semi-annually or less) may perceive these same attributes as attractive, since the additional effort is punctual. Managers can use this segmentation for territorial prioritization, such as units that serve populations with a high proportion of users of continuous programs (hypertension, diabetes, family planning with the use of quarterly injectable contraceptives) should prioritize improvements in accessibility and communication. Units with predominantly sporadic demand can postpone these investments.

4.3 Satisfaction Coefficients and Prioritization Matrix

Based on calculated possibility degrees for each Kano category, positive and negative satisfaction coefficients were calculated according to the methodology of Wang and Wang [57], as per equations seven and eight presented in the theoretical foundation. The positive satisfaction coefficient, designated $d+$, quantifies the potential for satisfaction increase if the attribute is improved, ranging from zero to one, where values close to one indicate high potential to generate satisfaction. The negative dissatisfaction coefficient, designated $d-$, quantifies the negative impact on satisfaction if the attribute is absent or deficient, ranging from minus one to zero, where values close to minus one indicate high potential to generate dissatisfaction. The difference between the positive coefficient and the absolute value of the negative coefficient constitutes the improvement gap, a unique metric that combines both effects and allows attribute hierarchization according to their criticality for quality management.

The twenty-three attributes were ordered in descending fashion according to improvement gap and divided into quartiles, allowing identification of priority levels for managerial interventions. Table 10 presents the resulting prioritization matrix.

Analysis of the prioritization matrix reveals that six attributes concentrate the largest improvement gaps, situated in the upper quartile with values between one point five three two and one point seven five two, demanding immediate and priority managerial attention. These attributes are distributed across three of the five SERVQUAL dimensions, being one attribute from the tangibility dimension, two from the reliability dimension, and three from the empathy dimension. Attribute two, concerning preserved environment and physical facilities, presents the largest individual gap with a value of one point seven five two, resulting from a positive satisfaction coefficient of zero point nine two seven and a negative dissatisfaction coefficient of minus zero point eight two six. This result indicates that ninety-two point seven percent of users have potential to experience satisfaction increase if physical facilities are improved, while eighty-two point six percent have high probability of manifesting dissatisfaction if facilities are deteriorated or inadequate. The criticality of this attribute converges with findings from Santos [16] who identified deteriorated physical infrastructure as the main complaint among primary healthcare unit users in Northeastern and Southeastern states, respectively.

Table 10
 Attribute prioritization matrix by improvement gap quartiles

Priority Level	Attributes	Gap	Quartiles
Critical (Q4)	Attribute 2	1.752	1.752294
	Attribute 6	1.578	
	Attribute 13	1.569	
	Attribute 11	1.550	
	Attribute 14	1.541	
	Attribute 9	1.532	
High (Q3)	Attribute 15	1.523	1.527523
	Attribute 7	1.514	
	Attribute 12	1.505	
	Attribute 19	1.495	
Moderate (Q2)	Attribute 10	1.459	1.458716
	Attribute 23	1.459	
	Attribute 1	1.450	
	Attribute 5	1.440	
	Attribute 17	1.440	
	Attribute 21	1.422	
Low (Q1)	Attribute 4	1.413	1.399083
	Attribute 22	1.413	
	Attribute 20	1.385	
	Attribute 8	1.367	
	Attribute 18	1.294	
	Attribute 16	1.239	
	Attribute 3	1.046	

In the reliability dimension, two attributes emerge as critical. Attribute six, concerning reliable information transmission, presents a gap of one point five seven eight, positioning itself in second place in the overall ranking. Attribute nine, concerning commitment to continuous service improvement, presents a gap of one point five three two, occupying sixth position. The criticality of reliable information transmission proves particularly relevant in the women's health context, where guidance on self-care, contraceptive methods, sexually transmitted infection prevention, preventive exam result interpretation, and referrals to specialized services constitute fundamental components of comprehensive care advocated by the National Policy for Comprehensive Women's Healthcare [12]. Recent studies on attributes valued by young women in reproductive health services evidence that clear communication, evidence-based information, and guidance respecting decision-making autonomy constitute central determinants of satisfaction and treatment adherence [33].

The empathy dimension concentrates the largest absolute number of critical attributes, being three of the six priority attributes. Attribute thirteen, concerning safety conveyed before and after service, positions itself in third place with a gap of one point five six nine. Attribute eleven, relating to staff willingness to solve problems, occupies fourth position with a gap of one point five five zero. Attribute fourteen, concerning staff approach, positions itself in fifth place with a gap of one point

five four one. This concentration of half the critical attributes in a single dimension evidences that relational aspects and care humanization constitute the most acute deficiency perceived by women's health service users in Salgueiro. This finding aligns with results from Martins [62], who identified empathy as the dimension with lowest means in a study with four hundred eight primary healthcare unit users in a municipality in Minas Gerais, and from Andrade et al. [65], who evidenced reliability and assurance, dimensions conceptually close to empathy, as most deficient among elderly users of primary care in Paraíba.

Analysis of SERVQUAL dimensions represented among the six critical attributes reveals that empathy concentrates fifty percent, reliability thirty-three point three percent, and tangibility sixteen point seven percent of priorities, while responsiveness and assurance, although relevant, do not appear among the most critical attributes, suggesting they present relatively better performance or that users prioritize primarily infrastructure aspects, reliable information, and humanized reception before service promptness and technical knowledge aspects. This priority hierarchy has important practical implications for scarce resource allocation in the context of chronic underfunding of the Unified Health System, as diagnosed by the Federal Court of Accounts [5] and evidenced by Pimentel et al. [8] in analysis of system sustainability challenges.

The high priority quartile, comprising four attributes with gaps between one point four nine five and one point five two three, is distributed across four distinct dimensions, evidencing that after resolution of critical deficiencies concentrated in empathy, reliability, and tangibility, improvement needs in more specific aspects emerge. Attribute fifteen, concerning detailed knowledge about procedures, represents the assurance dimension. Attribute seven, concerning estimated service time, represents reliability. Attribute twelve, referring to service resourcefulness, represents empathy. Attribute nineteen, relating to care and attention in problem resolution, represents responsiveness. These attributes, although not as critical as those in the upper quartile, still present significant improvement potential and should be addressed after resolution of critical priorities or concurrently if resources are available.

The prioritization matrix based on satisfaction (d^+) and dissatisfaction (d^-) coefficients provides an objective tool for managerial decision-making in a context of budgetary scarcity. Below are specific practical recommendations for the six critical attributes identified (upper quartile, gaps 1.532-1.752), organized by implementation time horizon and relative cost.

Attribute 2 (Environment and preserved physical facilities) has a Gap=1.752, $d^+=0.927$ and $d^- = -0.826$. The coefficient $d^+=0.927$ (the highest among all attributes) indicates that 92.7% of users have the potential to experience increased satisfaction with improvements in facilities. Simultaneously, $d^-=-0.826$ reveals that 82.6% would express dissatisfaction with deteriorated facilities. This combination characterizes the attribute as bilaterally critical, as it generates both satisfaction from presence and dissatisfaction from absence. As short-term suggestions, one could implement an intensified cleaning protocol with a visually displayed daily checklist, spot repairs (painting peeling areas, repairing broken seats, replacing burnt-out light bulbs), organization and visual signage (directional signs, clear zoning of environments, numbering of consulting rooms), and provide ceiling/wall fans in waiting rooms to mitigate extreme temperatures (39-42°C in the semi-arid region). As a medium-term suggestion, it is recommended to renovate bathrooms prioritizing privacy, cleanliness, and accessibility, install an air conditioning system in at least gynecological consulting rooms and collection rooms (to ensure thermal comfort during invasive examinations), adapt waiting

rooms (sufficient seating, functioning water fountains, well-ventilated environment), and perform preventive maintenance on medical equipment (autoclave, stethoscopes, sphygmomanometers).

Attribute 6 (Reliable transmission of information) has a Gap=1.578, $d^+=0.899$ and $d^-=-0.679$). The $d^+=0.899$ indicates that 89.9% of users value reliable information as a source of satisfaction. $d^-=-0.679$ reveals that 67.9% consider unreliable information as a significant source of dissatisfaction. In women's health, where decisions about contraception, interpretation of preventive exams, and referrals to specialists crucially depend on informational quality, this attribute directly impacts therapeutic adherence and return for subsequent consultations [33]. These are short- and medium-term recommendations: training teams in clear, evidence-based communication (4 monthly 4-hour workshops using active methodologies), standardization of verbal instructions through scripts for frequent situations (preventive exam results, contraceptive methods, referrals), development and distribution of validated printed educational materials (brochure on IUDs, booklet on STIs, post-preventive exam instructions), implementation of "teach-back" (asking the user to repeat in their own words what they understood from the instructions, confirming understanding), establishing a knowledge management system with clinical protocols accessible on tablets/computers in the offices, training in updated PNAISM guidelines for the entire multidisciplinary team, and implementing a feedback channel for clarifying post-consultation questions (institutional WhatsApp with pre-defined response times).

Attribute 13 (Safety conveyed in the service) obtained a Gap=1.569, $d^+=0.862$ and $d^-=-0.706$. The $d^+=0.862$ indicates that 86.2% of users value the perception of professional safety. $d^-=-0.706$ reveals that 70.6% would feel dissatisfied with service that does not convey safety. "Safety conveyed" is a multidimensional construct that includes perceived technical competence, trust in the professional, absence of hesitation or contradiction, and an emotionally safe environment to share intimate issues [13]. The main recommendations for this attribute are related to training in relational skills, bi-weekly technical supervision for discussing complex cases, reducing professional insecurity, a standardized initial presentation protocol (the professional introduces themselves, explains their training, clarifies procedures before performing them), continuing education on critical women's health issues (sexual violence, domestic abuse, perinatal mental health) to expand technical repertoire and implement a functional referral and counter-referral system to demonstrate continuity of care.

Attribute 11 (Team's willingness to solve problems) has the fourth largest (Gap=1.550, $d^+=0.853$ and $d^-=-0.697$). Willingness to solve problems transcends technical competence, involving proactivity, accountability and defending the user's interests in the system. The $d^+=0.853$ and $d^-=-0.697$ indicate a robust bilateral impact. The suggestions for this attribute are linked to establishing a "case manager" for complex situations (high-risk pregnancy, domestic violence) with a designated person responsible, a complaint and grievance resolution protocol with defined deadlines and guaranteed feedback, training in problem-solving techniques and advocacy in the SUS, and establishing resolution metrics (percentage of demands resolved on first contact).

Attribute 14 (Professional Approach) has a Gap=1.541, $d^+=0.853$ and $d^-=-0.688$). "Approach" refers to the relational mode of care - whether it is respectful, empathetic, non-judgmental, and culturally sensitive. In women's health, judgmental approaches to reproductive choices or sexual behavior constitute a severe barrier to access [33]. In this regard, training in person-centered approach (PCA) and nonviolent communication (NVC) is recommended, as well as raising awareness about implicit judgments (gender, age, and socioeconomic biases), implementing quarterly "conversation circles" between teams and users for qualitative feedback on care experiences, and including a question about respect and empathy in professional performance evaluations.

Attribute 9 (Commitment to service improvement) with a Gap=1.532, $d^+=0.872$ and $d^-=-0.661$ assesses the perception that management values quality and actively seeks to improve. The gap of 1.532 indicates that users perceive stagnation or conformity with chronic deficiencies. Areas for improvement include communicating implemented actions through notice boards ("You asked, we did"), accessible semi-annual reports, establishing formal channels for participation (Local Management Council, active ombudsman with feedback), implementing quarterly PDCA cycles with publicized goals, and conducting periodic satisfaction surveys with public dissemination of results and action plans.

4.4 Global Service Quality Evaluation

In addition to the specific evaluation of twenty-three attributes through the Kano-Fuzzy methodology, the final section of the questionnaire contained eight global evaluation questions about women's health services in primary healthcare units, using a five-point Likert scale where one represents strongly disagree, two represents disagree, three represents neither agree nor disagree, four represents agree, and five represents strongly agree. Results are presented in Table 11.

Table 11

Global service quality evaluation

Item	Evaluated Statement	Mean	SD	Median	Mode
Q1	I consider the women's healthcare service received at the SUS UBS excellent	2.60	1.18	3	3
Q2	The service I/acquaintance received is among the best available	2.49	1.12	2	2
Q3	Women's health exams met expectations	2.65	1.21	3	2
Q4	After exams, women are well-guided on how to proceed	2.91	1.09	3	3
Q5	Women feel comfortable with staff during exams	2.87	1.14	3	3
Q6	Pregnant women are well-monitored in prenatal/postpartum	3.40	1.23	3	4
Q7	Information about preventive vaccinations is well-communicated	2.96	1.11	3	3
Q8	Overall satisfaction with UBS service quality	3.00	1.20	3	3
GLOBAL SATISFACTION INDEX (mean Q1-Q8)		2.86	0.94	3.0	-

Analysis of Table 11 reveals that the global satisfaction index calculated as the arithmetic mean of the eight questions reached two point eight six with standard deviation of zero point nine four, situated below the theoretical midpoint of the scale of three point zero. The median of three point zero in all questions indicates central tendency toward neutrality, corresponding to the option "neither agree nor disagree," suggesting that most users do not position themselves as clearly satisfied nor explicitly dissatisfied, but rather in a state of ambivalence or indifference. This neutral position may reflect both conformism with median quality resulting from expectations adapted to a resource-scarce context, as described by Macinko and Lima Costa [40], as well as genuine perception that services present positive and negative aspects that balance each other.

Categorical distribution of responses to question eight, concerning overall satisfaction with service quality at the most recently attended primary healthcare unit, reveals that thirty-six point seven percent of respondents positioned themselves in dissatisfaction categories, corresponding to

grades one or two, thirty point three percent positioned themselves in the neutral category corresponding to grade three, and thirty-three percent positioned themselves in satisfaction categories, corresponding to grades four or five. This distribution evidences that approximately sixty-seven percent of respondents do not express positive satisfaction with services, a value representing the sum of dissatisfied and neutral categories, reinforcing the need for substantial improvements to elevate quality perception to satisfactory levels. Question six, concerning pregnant women monitoring in prenatal and postpartum, presented mean of three point four zero and mode of four, constituting the only item with mean above the scale midpoint and mode indicating agreement. However, this finding should be interpreted with methodological caution, since only sixteen point five percent of the sample has children as evidenced in Table 6, suggesting that most responses were based on indirect perceptions through acquaintances or relatives, or on stereotypes about maternal-infant service quality, and not on direct experience with prenatal and puerperal follow-up. This sample limitation restricts validity and reliability of this specific finding, which should be considered indicative but not conclusive about perceived quality of maternal health services.

Questions two and one presented the worst evaluations, with means of two point four nine and two point six zero, respectively, and modes of two and three. Question two states that the received service is among the best available, while question one states that the service is considered excellent. Low evaluations on these questions indicate that users do not consider Salgueiro primary healthcare unit services as quality references, even when compared exclusively with other public services, and do not recognize excellence in received care. This finding suggests that perceived deficiencies are not relativized or justified by limitations inherent to the public sector, but rather evaluated according to absolute standards of expected quality.

A paradox is observed between theoretical valuation of quality attributes evidenced in Kano-Fuzzy analysis and median global satisfaction revealed in this section. Although more than sixty-five percent of respondents indicated they would feel very good with the presence of all twenty-three investigated attributes according to Table 7, demonstrating recognition of the theoretical importance of these aspects, global satisfaction remains at a median level below the scale's neutral point. This paradox suggests that, although users recognize the importance of investigated quality attributes, concrete experience in services does not meet these expectations, generating significant gap between desired quality and perceived quality. This phenomenon aligns with the service quality gaps model proposed by Parasuraman et al. [38], particularly gap five which represents discrepancy between customer expectations and perceptions.

4.5 Discussion

Results obtained in this research present relevant convergences and divergences in relation to previous studies on quality in Brazilian primary healthcare units, allowing more comprehensive understanding of national patterns and regional specificities that characterize primary healthcare in the Unified Health System. Comparative analysis will be developed considering five thematic axes: critical quality dimensions, users' global satisfaction, demographic profile and its implications, employed evaluation methodologies, and investigated geographic contexts.

Regarding critical quality dimensions according to the SERVQUAL model, findings from this study substantially converge with the set of research developed in different Brazilian states over the last decade. Identification of the empathy dimension as most deficient, concentrating fifty percent of critical attributes in the upper priority quartile, corroborates findings from Martins [62] in Belo

Horizonte-MG, where the empathy dimension presented the lowest means among four hundred eight users interviewed in two thousand seventeen. This study from Minas Gerais, developed in a large urban context with socioeconomic characteristics distinct from Salgueiro, identified a mean of two point four three for empathy on a scale from one to five, a value close to the global satisfaction index of two point eight six found in the present research. Convergence between contexts as diverse as a developed state capital and a medium-sized municipality in the semi-arid region suggests that deficiencies in relational aspects constitute a structural pattern of the Brazilian Unified Health System, transcending regional and socioeconomic specificities.

The criticality of the reliability dimension, responsible for thirty-three point three percent of priority attributes in this study, aligns with results from Andrade et al. [65] who investigated primary care quality from elderly perspectives in a study published in two thousand nineteen. Although the population investigated by Andrade et al. [65] has demographic characteristics inverse to the present study, being composed predominantly of elderly individuals over sixty years while the Salgueiro sample concentrates seventy-six percent of young women between eighteen and twenty-four years, both studies identified reliability and assurance, a dimension conceptually close to empathy, as the most problematic aspects. This intergenerational convergence suggests that reliable information transmission, established deadline compliance, and institutional commitment to continuous improvement constitute transversal deficiencies affecting different user profiles, regardless of age group or socioeconomic characteristics.

Monteiro et al. [69], in a cross-sectional study developed in Paraíba with five thousand three hundred forty-seven users using data from the National Program for Improving Access and Quality of Primary Care, confirmed persistence of these gaps in two thousand twenty-three, evidencing that even after implementation of primary care qualification policies, reliability and assurance dimensions remain most deficient. This study from Paraíba, with a sample twenty times larger than the present research and distributed across multiple municipalities, identified that fifty-eight point three percent of users negatively evaluated reliability aspects, a percentage close to the sixty-seven percent of users who did not express positive satisfaction in the present study. Geographic proximity between Paraíba and Pernambuco, both northeastern states with similar health financing and infrastructure challenges, may partially explain this convergence, although temporal persistence of the problem over six years, from two thousand seventeen to two thousand twenty-three, suggests deeper structural issues than punctual reforms.

The criticality of the tangibility dimension, specifically the preserved environment and physical facilities attribute which presented the largest individual gap of one point seven five two, strongly converges with findings from Santos [16] and Rio Grande do Norte. Santos [16], using traditional SERVQUAL methodology in two thousand sixteen, identified dissatisfaction across all five investigated dimensions, with particular emphasis on deteriorated physical aspects of primary healthcare units. Convergence among studies developed in states from the Northeast regions, with different levels of economic development and per capita health investment, suggests that physical facility deterioration constitutes a systemic national problem affecting both municipalities with scarce resources and those theoretically better financed.

Silva et al. [70], in qualitative research developed in the Federal District between two thousand eighteen and two thousand nineteen with four hundred fifty-one users, identified deficient communication, limited service shifts, and low professional qualification as critical points. This finding reinforces the criticality of reliable information transmission identified as the second most deficient

attribute in the present study, suggesting that communication problems between professionals and users constitute a transversal deficit in the Unified Health System. However, Silva et al. [70] worked with exclusively qualitative methodology, not allowing direct magnitude comparisons or quantitative attribute hierarchization, evidencing the complementarity between methodological approaches in health service quality evaluation.

Andrade et al. [65] specifically focused on users over sixty year and Monteiro et al. [69] used aggregated data from all age groups. The age specificity of the present sample, with seventy-six percent between eighteen and twenty-four years, introduces bias that limits generalizations but simultaneously offers differentiated contribution to literature by capturing perceptions of a specific segment little investigated isolatedly in quantitative quality studies.

International studies on attributes valued by young women in reproductive health services corroborate the criticality of reliable information transmission identified in this research. Brittain et al. [33], in research on confidentiality in family planning services in the United States published in two thousand twenty-three, demonstrated that young people particularly value consultation privacy and guarantee that sensitive information will not be shared with family members without consent. These findings suggest that perceptions captured in this study, although limited to a specific age segment, reflect international patterns of young women's expectations in reproductive health contexts, conferring external validity to results within this demographic scope. Possmoser et al. [72], in a study recently published in two thousand twenty-five on elderly satisfaction with primary care in Rio Grande do Sul, identified positive evaluation of reception and care continuity aspects, contrasting with the criticality of the empathy dimension found in the present study and other northeastern research. The authors attribute this atypical result to historical consolidation of the Family Health Strategy in the southern region, with stable teams, low professional turnover, and longitudinal bonds established over decades. This explanation reinforces the hypothesis that deficiencies in empathy and relational aspects partially stem from team instability and high professional turnover, problems particularly acute in regions with lower attractiveness for qualified health human resource retention, such as the northeastern semiarid region.

Pena et al. [71], in a study on pharmaceutical consultation service quality at a primary healthcare unit in Contagem-MG published in two thousand twenty-three, identified an atypical result of eighty-one point eight percent satisfaction, a value substantially higher than those found in most Brazilian studies including the present one. The authors attribute this result to specific investments in local management, continuous pharmacist training, and implementation of clinical pharmaceutical care protocols. This case demonstrates that even in systemic constraint contexts, well-planned and executed local interventions can generate significant improvements in specific service aspects, offering evidence that identified gaps are potentially reversible through qualified management and targeted investment.

Regarding global satisfaction measured through aggregated indices, the value of two point eight six found in this study on a scale from one to five is situated slightly lower than satisfaction levels reported by Possmoser et al. [72] in Rio Grande do Sul. This variation reinforces that satisfaction is not determined exclusively by objective service characteristics, being mediated by prior expectations that vary according to socioeconomic context, previous experiences, available alternatives, and cultural patterns of public service evaluation. Macinko and Lima Costa [40] denominate this phenomenon as "adapted expectations," in which users chronically exposed to deficient services adjust their expectations to lower levels, generating a paradox where objectively precarious services

receive neutral or even positive evaluations. The distribution of sixty-seven percent of users not expressing positive satisfaction found in this study approximates the sixty-two percent of negative or neutral evaluations reported by Junior et al. [63] in Paraná in two thousand eighteen, using SERVQUAL in a primary healthcare unit and identifying reliability, understanding, and empathy as most deficient dimensions. This convergence between states from the South and Northeast regions, with substantially distinct socioeconomic characteristics and public management traditions, reinforces the hypothesis of a national pattern of median primary care quality, with regional variations less pronounced than would be expected considering financing and development disparities among Brazilian regions.

Identified divergences, particularly in relation to Possmoser et al. [72] and Pena et al. [71] regarding satisfaction levels, evidence that context matters and that generalizations must consider geographic, organizational, and demographic specificities. Amazonian municipalities with geographic dispersion face access challenges distinct from compact semiarid municipalities. Regions with consolidated Family Health Strategy tradition present relational indicators superior to regions with more recent or unstable implementation. Young populations prioritize different attributes than elderly populations. Therefore, although national patterns are identifiable and useful for macro diagnosis, intervention prioritization should consider local diagnoses capturing contextual specificities, as performed in this research through the quartile prioritization matrix adapted to Salgueiro's reality.

The methodological contribution of this study resides in the pioneering application of the Kano-Fuzzy approach in women's health services in a medium-sized municipality of the Brazilian semiarid region, a methodology that allowed identification not only of which attributes are deficient, but also of how different attributes relate to satisfaction in non-linear ways, crucial information for scarce resource prioritization. Classification of twenty attributes as one-dimensional, one as attractive, and four with dual classification reveals complexity that traditional models like SERVQUAL do not capture, offering a more sophisticated managerial tool for decision-making about where to invest limited resources to maximize impact on user satisfaction.

4.6 Practical Implications for Managers

The prioritization matrix developed in this study, based on the satisfaction (d^+) and dissatisfaction (d^-) coefficients derived from the Kano-Fuzzy methodology, constitutes an objective instrument for managerial decision-making in contexts of resource scarcity. Unlike traditional approaches that treat all quality attributes as equally important, the classification into Kano categories (mandatory, unidimensional, and attractive) allows managers to understand the differentiated impact of each attribute on user satisfaction and, consequently, prioritize investments according to criteria of maximum effectiveness with limited resources.

The six critical attributes identified in the upper quartile of the prioritization matrix (gaps between 1.532 and 1.752) demand immediate intervention and can be addressed through implementation strategies phased by time horizon and relative cost. In the short term (0 to 6 months), it is recommended to prioritize actions with low financial cost but high perceived impact, particularly training of multidisciplinary teams in relational skills. Three of the six critical attributes belong to the empathy dimension (security conveyed in care, willingness to solve problems, and professionals' approach), suggesting that deficiencies are primarily concentrated in communicational and relational aspects of care, not in insurmountable technological or infrastructural limitations. Continuing

education programs focused on empathetic communication, active listening, clear transmission of evidence-based information, and a non-judgmental approach in reproductive health can be implemented with a relatively modest investment (estimated at R\$ 5,000 to R\$ 8,000 per unit for a series of four monthly four-hour workshops), simultaneously impacting three critical attributes and generating a potential increase of 0.4 to 0.6 points in the overall satisfaction index on a five-point scale.

The critical attribute with the largest identified gap (preserved environment and physical facilities, gap = 1.752) requires medium-term interventions (6 to 12 months) with moderate to high costs (R\$ 50,000 to R\$ 80,000 per unit). However, even in this infrastructural domain, managers can implement immediate, low-cost actions that partially mitigate perceived dissatisfaction, such as intensified cleaning protocols with visible checklists, punctual repairs (painting, seat repairs, light bulb replacement), visual organization of the space, and installation of fans in waiting rooms to mitigate the thermal discomfort characteristic of the semi-arid Northeast (temperatures of 39 to 42°C). These measures, with an estimated cost of less than R\$ 10,000 per unit, can generate a perception of managerial commitment to quality, an attribute that emerged as the sixth most critical (gap = 1.532), creating a virtuous circle where small, visible improvements reinforce users' confidence in the institution's responsiveness.

The criticality of the attribute "reliable transmission of information" (second largest gap, 1.578) has particularly relevant implications for women's health, given that decisions about contraceptive methods, interpretation of preventive exam results, understanding of post-consultation guidelines, and adherence to treatments crucially depend on the quality of information received. International studies on attributes valued by young women in reproductive health services corroborate that clear, evidence-based communication that respects decisional autonomy are central determinants of satisfaction and continuity of care. Managers can implement three actions with minimal incremental cost but significant impact: first, standardization of verbal instructions through validated scripts for frequent situations (oncotic cytology results, guidance on long-acting contraceptive methods, referrals to specialists); second, development and distribution of printed educational materials in accessible language validated by test users; third, systematic adoption of the "teach-back" technique, in which professionals ask users to repeat in their own words what they understood from the guidance received, confirming understanding before the end of the consultation. These measures, with an estimated cost of R\$ 3,000 to R\$ 5,000 for material development and initial training, simultaneously address the attributes "reliable transmission of information" and "security conveyed in service," potentially generating a combined increase of 0.6 to 0.8 points in the satisfaction index.

The predominance of attributes classified as unidimensional (87% of the attributes investigated) has critical managerial implications: for these attributes, incremental improvements generate proportional increases in satisfaction, without a clear saturation point. Unlike mandatory attributes (whose presence is expected but does not generate additional satisfaction beyond the absence of dissatisfaction) or attractive attributes (which delight when present but do not generate dissatisfaction when absent), unidimensional attributes respond linearly to perceived performance. This characteristic implies that managers should establish continuous improvement programs instead of one-off interventions, with progressive targets for raising standards. For example, in the attribute "preserved environment and physical facilities" (classified as one-dimensional with a 76.5% probability level), the strategy should not be limited to a one-off renovation, but rather establish a cycle of continuous improvement: phase one, deep cleaning and immediate repairs; phase two,

quarterly preventive maintenance of facilities; phase three, adequate air conditioning of critical environments (gynecological offices, collection rooms); phase four, aesthetic adaptation and comfort of waiting rooms. Each successive phase raises the perceived performance level, generating additional satisfaction without an identifiable maximum ceiling in the studied sample.

5. Conclusions

This study evaluated the perceived quality of women's healthcare services in primary healthcare units (UBSs) in Salgueiro-PE, identifying critical attributes and proposing a prioritization framework for resource allocation through the Kano-Fuzzy methodology integrated with the SERVQUAL model.

Three main findings emerged. Initially, it was verified that 87% of the 23 attributes investigated were classified as one-dimensional, indicating a linear relationship between performance and satisfaction. Only staff appearance was classified as attractive, while four attributes (access, estimated time, personalized schedules, and accessible communication) presented dual classification, revealing heterogeneity in perceptions. Six critical attributes were identified in the upper priority quartile: preserved physical facilities (gap=1.752), reliable information (gap=1.578), conveyed safety (gap=1.569), willingness to solve problems (gap=1.550), staff approach (gap=1.541), and commitment to improvement (gap=1.532). These concentrated in empathy (50%), reliability (33%), and tangibility (17%), evidencing that relational aspects constitute the most acute deficiency. Finally, global satisfaction was median (index 2.86/5.00), with sixty-seven percent not expressing positive satisfaction, validating that specific deficiencies translate into global dissatisfaction according to the gaps model of Parasuraman et al. [38].

Theoretically, findings consolidate a national pattern of deficiencies in empathy, reliability, and tangibility in SUS primary care, convergent with studies in Minas Gerais [62], Rio Grande do Norte [16], and Paraíba [65, 69] throughout 2016-2025. This persistence transcends regional variations, indicating structural system characteristics that demand systemic reforms.

The findings contribute to improving primary women's health care by providing an evidence-based prioritization matrix that guides managers in the rational allocation of scarce resources, identifying six critical attributes focused on empathy, reliability, and tangibility. Specifically for young women, the criticality of relational and informational attributes indicates that training in empathetic communication and reliable transmission of reproductive health guidance constitute high-impact interventions. Future research should include confirmatory studies with probabilistic sampling stratified by age and motherhood, longitudinal intervention studies to establish causal relationships, regional multicenter comparisons, qualitative investigations into mechanisms of dissatisfaction, and implementation studies documenting the feasibility and cost-effectiveness of the Kano-Fuzzy matrix in real-world municipal management contexts.

Methodologically, the pioneering application of Kano-Fuzzy in women's health in the Brazilian semiarid region demonstrates superiority over traditional SERVQUAL by distinguishing attribute categories (must-be, one-dimensional, attractive) with distinct managerial implications. The improvement gap metric synthesizes satisfaction potential and dissatisfaction prevention in a single prioritization criterion, overcoming limitations of the one-dimensional SERVQUAL gap.

Empirically, the study fills a gap regarding quality in women's health, an underrepresented segment despite constituting sixty-nine percent of primary care users in the Northeast [14]. The predominance of one-dimensional attributes (87%) suggests more demanding expectations in women's health compared to general primary care.

The prioritization matrix offers an objective tool for rational resource allocation in a context of chronic underfunding [5]. Three priority strategies are suggested from the findings. In the short term (0-6 months), team training in relational competencies (empathetic communication, active listening, clear information transmission) is necessary; this action simultaneously addresses three critical empathy attributes, at relatively low cost. In the medium term (6-12 months), infrastructural reforms are necessary, prioritizing cleanliness, conservation, climate control, privacy, and adequate waiting room capacity. In the long term, it is necessary to implement an information management system with standardized clinical protocols, training in updated guidelines, and monitoring of informational quality transmitted to users. Continuous monitoring through quarterly surveys segmented by demographic profile, unit-specific diagnostics for targeted resource allocation, and establishment of women's health advisory councils ensuring user participation in quality governance are also recommended.

Some limitations must be considered, such as non-probabilistic sampling prevents statistical generalization to the entire population of women users, with findings to be interpreted as indicative of a specific segment [80]. Digital selection bias excluded women without internet access, precisely the most vulnerable, underestimating problems perceived by this group. Age concentration (76% between 18-24 years) does not reflect the actual distribution of users, limiting validity for adults and elderly whose perceptions differ [65, 72]. The predominance of nulliparous women (83.5%) restricts conclusions about maternal-infant services, a central axis of PNAISM [12].

The cross-sectional design does not allow causal or temporal inferences. The absence of qualitative triangulation limits understanding of mechanisms generating the identified gaps. Potential social desirability bias may have inflated the importance of humanistic attributes. The specificity of Salgueiro, a medium-sized semiarid municipality with 82% FHS coverage, limits transferability to large urban centers, rural areas, or regions with distinct characteristics.

Thus, for future work, it is suggested to use probabilistic sampling stratified by age, motherhood, and socioeconomic level ($n \geq 377$ for 95% confidence) aiming at statistical generalization and testing variation in the pattern of critical attributes among demographic profiles. Comparative studies among medium-sized municipalities, large centers, and different regions would test generalization of findings and identify contextual moderators, investigating whether the North-South regional gradient in empathy constitutes a systematic pattern.

Author Contributions

Conceptualization, E.A.N.S., F.J.C.M. and E.F.M.S.; methodology, E.A.N.S. and F.J.C.M.; software, F.J.C.M.; validation, F.J.C.M. and E.F.M.S.; formal analysis, E.A.N.S., F.J.C.M. and E.F.M.S.; investigation, E.A.N.S., F.J.C.M. and E.F.M.S.; resources, E.A.N.S., and F.J.C.M.; data curation, E.A.N.S., F.J.C.M. and E.F.M.S.; writing—original draft preparation, E.A.N.S., F.J.C.M. and E.F.M.S.; writing—review and editing, E.A.N.S., F.J.C.M. and E.F.M.S.; visualization, E.A.N.S., F.J.C.M. and E.F.M.S.; supervision, F.J.C.M.; project administration, F.J.C.M.; funding acquisition, F.J.C.M. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

All the data used is included in the paper.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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