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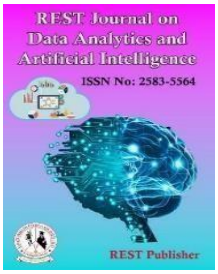

Optimizing Healthcare Delivery: A Systematic Evaluation of Nursing Care Approaches Through TOPSIS Methodology

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Abstract: *This study investigates the effectiveness of different nursing care approaches using a technique for priority ordering by analogy with the Top of Ideal Solution (TOPSIS) approach. The study employed a systematic analytical framework incorporating normalized data matrices and weighted decision criteria to assess the relative performance of each nursing care approach. The TOPSIS analysis revealed that Comprehensive nursing care achieved the highest ranking with a closeness coefficient of 0.8126, followed closely by Provision of nursing care (0.8095). The findings demonstrate that holistic approaches to patient care, which balance multiple aspects of healthcare delivery, yield superior results compared to more narrowly focused methods. The study utilized equal weight distribution (0.25) across all criteria to ensure unbiased evaluation, while the distance metrics from ideal and negative-ideal solutions revealed the relative advantages and limitations of each approach. The research findings indicate that successful nursing care delivery requires consistent performance across all evaluated criteria rather than excellence in isolated areas. The analysis highlights the importance of integrating various nursing care aspects and maintaining high standards across all metrics. These results offer valuable insights for healthcare administrators and nursing professionals in developing and implementing effective nursing care strategies. The study concludes that comprehensive, balanced approaches to nursing care led to optimal healthcare outcomes and patient satisfaction. This research Adds to the expanding collection of research on healthcare quality assessment by demonstrating the utility of multi-criteria decision-making methods in evaluating nursing care effectiveness. The findings provide a framework for healthcare institutions to assess and enhance their nursing care delivery systems while emphasizing the importance of maintaining balanced performance across multiple healthcare delivery metrics.*

Keywords: *Patient care in nursing, Clinical care for patients, Provision of nursing care, Comprehensive nursing care, Nurse-led patient care, Patient Outcomes, Quality of Care, Patient Feedback, Nursing Skills.*

1. INTRODUCTION

Nursing care is now recognized as a competitive field, where patients are viewed as customers and consumers in healthcare. While technically competent care is generally expected as a standard, patients place significant importance on the personal aspects of the care provided by nursing staff. Nursing care is defined as the promotion of health, assistance, support, education and empowerment of patients by unlocking their own resources. It is built on communication and collaboration, aiming to address the global and personal needs related to daily life, which may be affected by illness. Patient satisfaction is a subjective assessment of cognitive and emotional reactions, shaped by how well expectations are met of exceptional nursing care and the care delivered. Nursing care is considered the most critical factor in how patients evaluate their satisfaction with healthcare services. While the importance of

nursing care in patient satisfaction is undeniable, the key question is how nurses can improve it. Therefore, nursing care should prioritize factors that affect patient satisfaction. By focusing on this, nurses can improve the quality of care they provide.[2] None of these studies aimed to investigate the root causes of suicidal behavior or the effects of improving nursing care for suicidal patients. As a result, unlike our current study, they did not elucidate the complex relationships between various factors that influence and interact in the field of medical care for patients at risk of suicide. The idea "providing essential nursing care" emphasizes the importance of nurses being fully present with suicidal patients physically, emotionally, and in their humanity. This presence creates valuable opportunities for therapeutic engagement and attentive listening to verbal and nonverbal expressions from patients.[3] Theoretical variables describing how nursing care organization influences outcomes have not yet been empirically validated with robust statistical methods. However, recent Development in multilevel mediation and moderation methods provide a more precise way to assess these emerging theories. Furthermore, it emphasizes the combined effects Regarding nurse workload and educational qualifications improving essential nursing care and providing important insights for policymakers and decision makers. [4] Patients' evaluations of hospitalization are shaped by a variety of experiences and interactions with healthcare providers, with patients interviewed emphasizing that nurses play a critical role in helping them manage less favorable experiences. Nurses are attuned to patients' perceptions of their environment, whether it is too cold, too hot, noisy, crowded, or otherwise unpleasant. Because patients rely on nurses to guide them through their illness, treatment, and overall hospital stay, their evaluation of the hospital experience is often centered concerning the quality of nursing care they receive. [5] The analysis showed statistics significant variation. in missed care scores between deceased patients and survivors, with mean missed care scores of 51.5% of patients died and 52.6% of survivors ($p = 0.04$). However, the gradual logistical backlog did not reveal a strong link between inadequate nursing care and inpatient mortality. [6] Findings showed that nursing care largely met expected standards, with only two areas identified as unsafe: hygiene and physical comfort, along with nutrition and hydration are classified under the psychological basic human needs (BHN). Nursing care avoidance can often be related to inadequate organization and planning to meet administrative and medical care needs. In this regard, Systematization of Nursing Care (SNC) serves as a valuable tool to guide medical professionals in providing technically competent and scientifically sound information.[7] The scales were developed through interviews and focus groups designed to assess patients' perceptions Nursing care. The activities of nurses and the characteristics of their care, as well as the amount of treatment, their availability and care, the degree of personalized care provided, honesty and transparency, reliability, and communication by nurses. [8] Patient adherence to prescribed care serves as a potential indicator linked to Satisfaction with nursing care. Wiseman and Nathanson (1985) examined The relationship between adolescent customer satisfaction and contraceptive adherence in 77 family planning clinics. Their findings showed that high levels of client satisfaction positively influenced contraceptive adherence.[9] Patient satisfaction with nursing care was evaluated using the Lamonica-Oberst Patient Satisfaction Scale, an instrument consisting of 41 items. that indirectly measures satisfaction by capturing respondents' perceptions of how frequently specific nursing behaviors occur. [10] The PSNCQQ is designed to assess anticipated needs, measure patient satisfaction after a short-term Studying the impact of hospitalization and socio-demographic, individual, and other contributing factors. It serves as a tool for administrators to identify areas for improvement, improve patient-centered outcomes, and point out strengths and weaknesses in nursing care. The scale's items are Nursing is shaped by key factors that impact patient satisfaction with care. Integrated with existing hospital quality monitoring systems, the PSNCQQ provides a reliable, evidence-based indicator of patient satisfaction. It also supports the evaluation of changes in departmental and organizational processes by capturing the outcomes of patient care delivery. [11] Missed nursing care (MNC) refers to patient Neglected or deferred care, partially or completely, often because of errors of omission. These errors can lead to negative outcomes or worsen clinical outcomes, and they are a greater challenge than errors of commission because they are harder to detect. This will help clarify why patient safety movement focuses primarily on preventing errors. [12] The focus groups focused on exploring the question, "What barriers have you faced in participating in your own medical care?" Nurse care was described as interaction with registered nurses. Following Carey's recommendations (25), content related to barriers to participation was refined and expanded during analysis as understanding deepened. Each focus group discussion was verbally summarized, and participants provided feedback on the most important and meaningful points.[13] We argue that technology is not inherently incompatible with humanized care; in fact, it is often intentionally and specifically integrated to support it. Furthermore, we propose that the ongoing division between technology and compassionate care may serve a discourse aimed at preserving a distinct professional identity rather than improving clinical care.[14] Rules for classifying statements were established beforehand. Positive and negative opinions about nursing care quality, as well as statements that did not mention quality or expressed "no opinion," were classified as neutral.

Negative opinions that included justification for care deficiencies were classified as negative. Inter-rater consistency was satisfactory, with a raw percentage agreement of 95% and a Cohen's kappa of 0.91 ($N = 5800$, $p < 0.001$).[15] Research based on empirical patient data has identified key components of quality nursing care, broadly categorized as Cognitive and technical skills, either individually or in combination with emotional skills. Cognitive skills include knowledge in scientific, psychological, and practical domains, along with the cognitive abilities necessary for evaluation, decision-making, and effective psychomotor performance. Although professional nurses have recognized technical competence as a key aspect of quality care, patients generally view these skills differently as providing. [16] Three key themes emerged that underscored the importance of clinical knowledge in providing quality nursing care: (a) fosters patient safety and reassurance by providing essential information, (b) reduces distress and insecurity during chemotherapy, and (c) reduces discomfort, side effects of treatment, and effectively manages symptoms of the disease.

2. MATERIALS AND DISCUSSION

Patient care in nursing: Key Responsibilities. Monitor vital signs and assess changes indicating health improvement or decline. Conduct essential nursing tasks, including wound care and bandage changes. Promote patient comfort by ensuring they are well-nourished and hydrated. In certain settings, may also administer medications.

Clinical care for patients: Medical care involves the direct treatment or evaluation of patients. Providing affordable, high-quality healthcare helps prevent illness and supports the early detection of diseases.

Provision of nursing care: Medical care involves the direct treatment or assessment of patients. Providing affordable, high-quality healthcare helps prevent illness and supports early detection of diseases.

Comprehensive nursing care: Comprehensive care involves providing well-planned, integrated support that addresses a patient's physical, mental, and cognitive health needs. Even at the end of life, patients should receive compassionate and holistic care.

Nurse-led patient care: Nurse-led patient-centered care is a method in which nurses play a leading role in planning, Implementing and supervising various aspects of patient care and treatment. These tasks are based on expertise, knowledge, and skills of nurses of the nursing profession.

Patient Outcomes: Through our conceptual analysis of the literature, we define 'patient outcomes' as the effects of nursing care that patients receive in the hospital. These include preserving the patient's functional status, improving patient safety and ensuring patient satisfaction.

Quality of Care: Improving health quality requires strong national leadership from governments, targeted support at the subnational level, and action within health facilities.

Patient Feedback: Patient feedback refers to the thoughts The perspectives of patients and service users and their opinions about the care they receive. Health organizations collect this feedback using methods such as surveys, audits and feedback or complaints. In addition, staff who interact directly with patients can provide valuable insights.

Nursing Skills: This means that nurses must have a good understanding of core nursing skills, including patient assessment, measuring vital signs, planning care, and providing therapeutic support. They must also have a thorough understanding of medical terminology and legal and ethical guidelines.

TOPSIS Method: We have extended the TOPSIS method in the context of intuitive fuzzy sets. (MCDM) problems or reduce the efficiency of the method. When both functions are IFVs within the A-IFS framework, the undefined power function is such a limitation. This presents a major challenge as it prevents the use of important integration operators such as the weighted geometric mean, where the weights of local criteria are represented as IFVs. [18] A case study in six regions of North China uses a regional water resource security assessment indicator method integrated with the fuzzy BWM-TOPSIS method. Comparison with the equal weight TOPSIS method and sensitivity analysis of indicator weights are performed to evaluate the practicality and effectiveness of the proposed approach. [19] In addition, it improves and modifies the method by integrating intuitive fuzzy sets with GRA techniques. The paper introduces a new approach, the intuitive fuzzy entropy-driven TOPSIS method integrated with GRA techniques to select the most suitable sustainable building materials supplier. To demonstrate its effectiveness, the paper applies this approach to a case study of selecting a sustainable building materials supplier, showing how this method can effectively identify the best alternative. [20] In this approach, decision makers (DMs) define the

objectives they are trying to achieve and set constraints for the model. A zero-one goal programming method is used to select strategic plans, which are then ranked using the TOPSIS method.
Step 1: The first step is to collect data and information from four perspectives to develop the structure of The BSC model, which includes overall objectives, metrics, quantitative targets, and strategic plans.
Step 2: The second step is to calculate the measures for the general objectives using the characteristics of the BSC and group decision-making.

[21] Among physicians in private hospitals in Malaysia. Physicians expressed more positive views of the technology, believing that it would improve their performance, and were more Motivation To implement and utilize the system, the TOPSIS framework is used in a physician adoption model at the micro level. was integrated with the factors and insights discussed in this study, providing valuable guidance for implementing EMR in private hospitals. [22] The TOPSIS method is a widely used technique in (MCDM) that Ranks alternatives based on their proximity to the positive ideal solution and their distance from the negative ideal solution. IF The TOPSIS method is highly preferred because it helps decision makers express their preferences through linguistic expressions. [23] Effective risk assessments are essential for successful investments. To address the Considering the uncertainty and complexity of mining environments, this paper introduces an improved TOPSIS method incorporating LNNs. These are proposed to represent ambiguous and random linguistic values and ensure maximum security of evaluation information. [24] TOPSIS method, is combined with entropy method to improve its reliability and efficiency. The main findings of the study are as follows: The groundwater in the area exhibits slightly acidic to slightly alkaline and high salinity. The concentrations of major cations are ranked in the order $Ca^{2+} > Na^{+} > Mg^{2+} > K^{+}$, while the anions follow the order $Cl^{-} > HCO_3^{-} > SO_4^{2-}$. [25] Research on the development strategy of RDWS is constrained. This article aims to bridge this gap contributing to the development strategy of China's RDWS. It introduces an integrated SWOT-TOPSIS model, incorporating AHP and Shannon's entropy methods are used to assess the strategic environment and recommend an appropriate strategic direction (SD). [26] Furthermore, we have implemented the q-ROF TOPSIS method is used to solve transportation policy problems. Moving forward, we plan to extend our work to tackle real-world MADM problems by combining various aggregation techniques operators and techniques such as TOPSIS, AHP, and VIKOR with methods from the ELECTRE and PROMETHEE families. These approaches will include hybrid fuzzy set structures such as Pythagorean M-polar fuzzy sets, Diophantine fuzzy sets with linear properties, cubic bipolar fuzzy sets, and cubic M-polar fuzzy sets. [27] This study uses the entropy-weighted TOPSIS method to assess groundwater quality by collecting and chemically analyzing groundwater samples. In addition, inverse geochemical modeling is used to quantitatively study the processes involved in groundwater formation. [28] To our knowledge, no research has examined the integration of the modified Delphi method combined with AHP and TOPSIS techniques for neural networks, especially around risk assessment. In addition, fire risk assessment after earthquakes, an important aspect of concern in urban areas, has not been adequately studied in the literature, despite its increasing importance amid recent global challenges. [29] In related research, the Top-down Sorting by Similarity (TOPSIS) technique is commonly used in the decision-making literature to solve multi-attribute problems by identifying the best positive and negative solutions. This study adapts the TOPSIS method to the intuitionistic fuzzy (IF) context and improves it by incorporating an operator based on intuitive fuzzy weighted averaging (IFWA). This approach is applied to a real-world PS case to evaluate criteria and candidates that provide comprehensive solutions to practical PS challenges.[30] The TOPSIS method relies on selecting appropriate linear orders, and selecting the right order is essential for effective decision-making. However, the approach to constructing acceptable linear order distances introduced in this paper is relatively simple and do not fully capture all the properties of the relevant linear order. This limitation may lead to misleading decision-making consequences in some cases. In the future, we aim to further explore the broader construction of linear orders and appropriate distance or similarity measures for IFVs, aiming to improve the robustness and efficiency of IF TOPSIS methods.

3. ANALYSIS AND DISCUSSION

Table1. Nursing care of patient

	Patient Outcomes	Quality of Care	Patient Feedback	Nursing Skills
Patient care in nursing	23.00	89.00	79.00	91.00
Clinical care for patients	25.00	78.00	99.00	31.00
Provision of nursing care	65.00	54.00	36.00	11.00
Comprehensive nursing care	47.00	88.00	23.00	22.00
Nurse-led patient care	32.00	36.00	27.96	33.00

Table 1 presents data on various aspects of nursing care evaluated using the TOPSIS method, focusing on four criteria: Patient Outcomes, Quality of Care, Patient Feedback, and Nursing Skills. The data highlights distinct performance levels across alternatives, such as "Patient care in nursing," which scores high in Quality of Care (89.00) and Nursing Skills (91.00), indicating strong competency. Conversely, "Provision of nursing care" shows lower values in Patient Feedback (36.00) and Nursing Skills (11.00), suggesting room for improvement. By normalizing and analyzing these metrics through TOPSIS, decision-makers can rank nursing care approaches, identifying the most balanced and effective alternative.

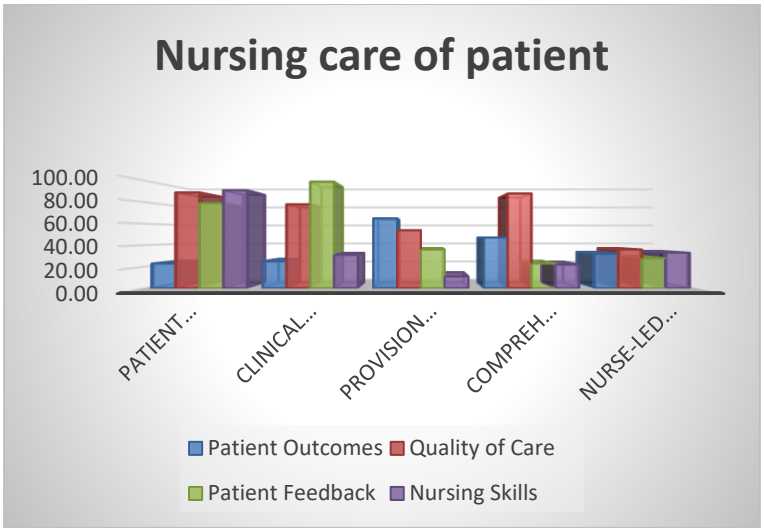

FIGURE 1. Nursing care of patient

Figure 1 illustrates the normalized TOPSIS data for nursing care, comparing alternatives across Patient Outcomes, Quality of Care, Patient Feedback, and Nursing Skills. "Patient care in nursing" excels in Quality of Care and Nursing Skills, while "Provision of nursing care" scores lower in Patient Feedback and Nursing Skills. The analysis aids decision-making.

Table 2. Normalized Data

0.2478	0.5524	0.5785	0.8702
0.2694	0.4841	0.7250	0.2964
0.7004	0.3351	0.2636	0.1052
0.5065	0.5462	0.1684	0.2104
0.3448	0.2234	0.2047	0.3156

Table 2 shows the normalized data using the TOPSIS method, representing the performance of alternatives across four criteria. The values, ranging from 0 to 1, reflect how each alternative performs relative to the ideal solution. For

example, the first row (0.2478, 0.5524, 0.5785, 0.8702) shows that the fourth criterion has the highest value, indicating strong performance in that area. On the other hand, the third row (0.7004, 0.3351, 0.2636, 0.1052) shows relatively weaker performance in the last two criteria. This table serves as a foundation for further analysis in decision-making processes, highlighting strengths and weaknesses across the criteria.

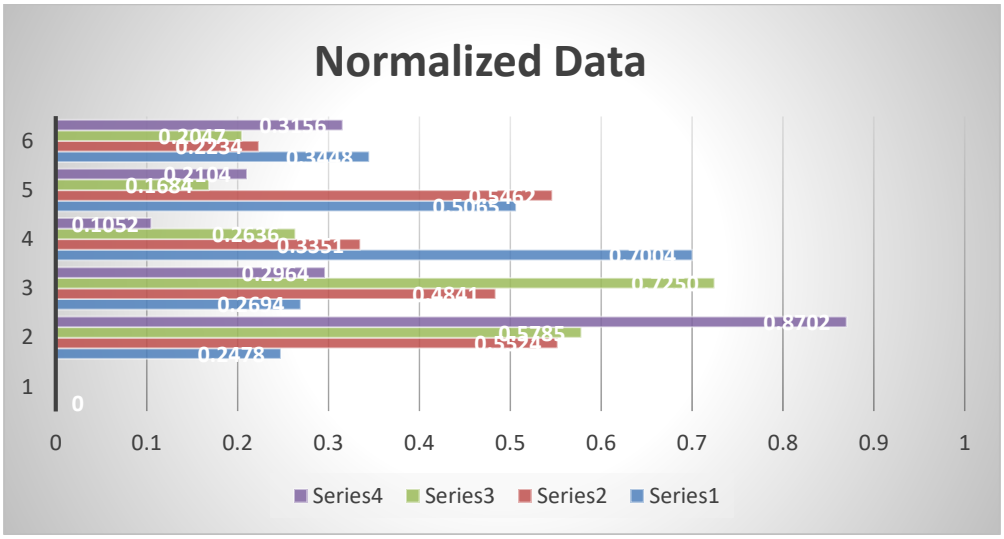

FIGURE 2. Normalized Data

Figure 2 displays normalized data using the TOPSIS method, with values ranging from 0 to 1 across four criteria. The table highlights performance variations among alternatives, with some, like the first row, showing higher scores in the fourth criterion, while others, like the third row, perform weaker in certain areas.

TABLE 3. weight distribution

0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25

Table 3 shows an equal weight distribution across four criteria, with each criterion receiving a weight of 0.25. This uniform distribution suggests that all criteria are considered equally important in the evaluation process, allowing for a balanced comparison of alternatives without prioritizing any factor.

TABLE 4. Weighted normalized decision matrix using topsis method

0.2478	0.5524	0.5785	0.8702
0.2694	0.4841	0.7250	0.2964
0.7004	0.3351	0.2636	0.1052
0.5065	0.5462	0.1684	0.2104
0.3448	0.2234	0.2047	0.3156

Table 4 presents the weighted normalized decision matrix using the TOPSIS method. The values in the table reflect the product of the normalized data and the assigned weights from Table 3. Each value represents the performance of an alternative across different criteria, adjusted by the uniform weight distribution, aiding in the final evaluation.

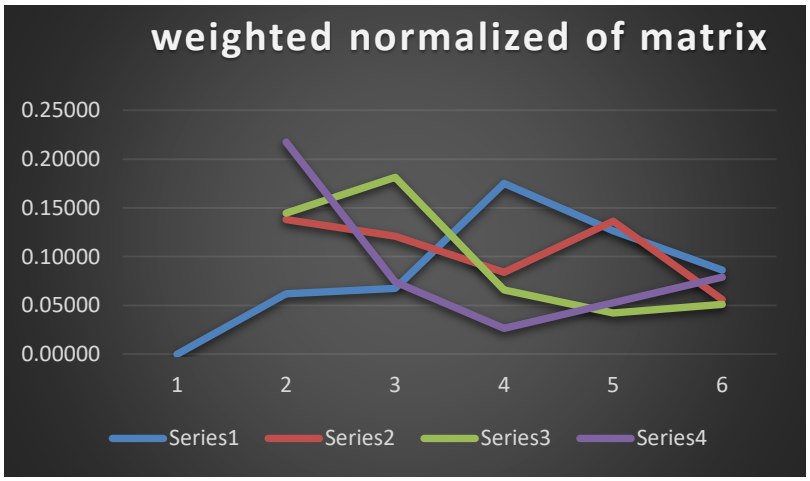

FIGURE 3. Weighted normalized decision matrix using topsis method

Figure 3 displays the weighted normalized decision matrix using the TOPSIS method. The values represent the performance of alternatives across four criteria, with each value adjusted by the uniform weights. This matrix aids in comparing the alternatives by showing their weighted scores, essential for further analysis in the decision-making process.

TABLE 5. the ideal best (A+) and ideal worst values (A-) using topsis method

Nursing care	Patient Outcomes	Quality of Care	Patient Feedback	Nursing Skills
A+	0.175	0.138	0.042	0.026
A-	0.062	0.056	0.181	0.218

Table 5 presents the ideal best (A+) and ideal worst (A-) values for nursing care, calculated using the TOPSIS method. The A+ values represent the best possible performance across the four criteria: Patient Outcomes, Quality of Care, Patient Feedback, and Nursing Skills. For example, A+ has the highest value for Patient Outcomes (0.175) and the lowest for Nursing Skills (0.026). In contrast, the A- values represent the worst possible performance, with the highest value in Nursing Skills (0.218) and the lowest in-Patient Outcomes (0.062). These ideal and worst values serve as benchmarks for evaluating alternatives.

TABLE 6. separation of each alternative from the ideal solution and separation from the negative-ideal solution, Closeness Coefficient's value and rank using topsis method

Nursing care	SI Plus	Si Negative	Ci value	Rank
Patient care in nursing	0.2447	0.0900	0.2689	5
Clinical care for patients	0.1832	0.1576	0.4626	4
Provision of nursing care	0.0593	0.2519	0.8095	2
Comprehensive nursing care	0.0552	0.2393	0.8126	1
Nurse-led patient care	0.1323	0.1916	0.5915	3

Table 6 presents the separation of each alternative from both the ideal solution (SI Plus) and the negative-ideal solution (SI Negative), as well as the closeness coefficient (Ci) and rank, calculated using the TOPSIS method. SI Plus and SI Negative represent the distances from the ideal and worst solutions, respectively. For example, "Patient care in nursing" has a higher separation from the negative-ideal solution (0.0900) and lower closeness coefficient (0.2689), ranking 5th. "Comprehensive nursing care" has the closest value to the ideal solution (0.0552 for SI Plus) and ranks 1st, indicating it is the best alternative overall.

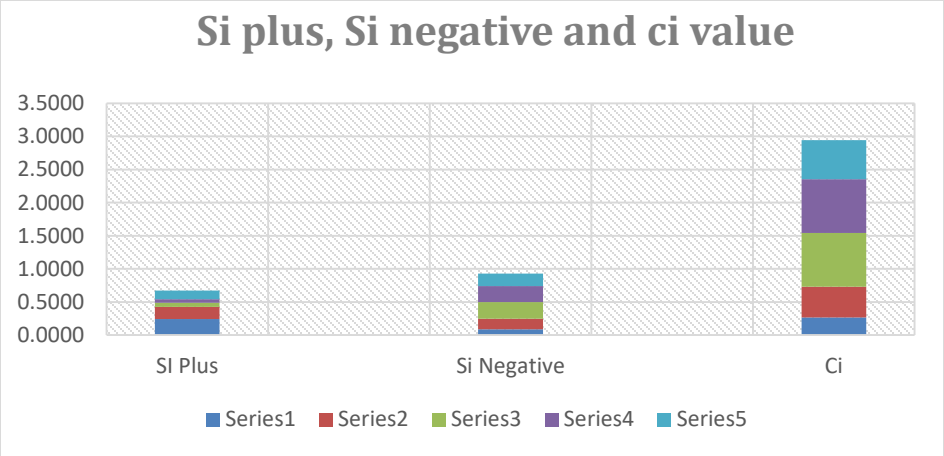

FIGURE 4. separation of each alternative from the ideal solution and separation from the negative-ideal solution, Closeness Coefficient's value using topsis method

Figure 4 displays the separation values for each alternative from both the ideal solution (SI Plus) and the negative-ideal solution (SI Negative), along with the closeness coefficient (Ci) values, using the TOPSIS method. "Comprehensive nursing care" and "Provision of nursing care" show the highest closeness coefficients (0.8126 and 0.8095), indicating their proximity to the ideal solution and ranking them higher. In contrast, "Patient care in nursing" has a lower closeness coefficient (0.2689), reflecting its greater distance from the ideal solution. This analysis helps in determining the best alternative based on the given criteria.

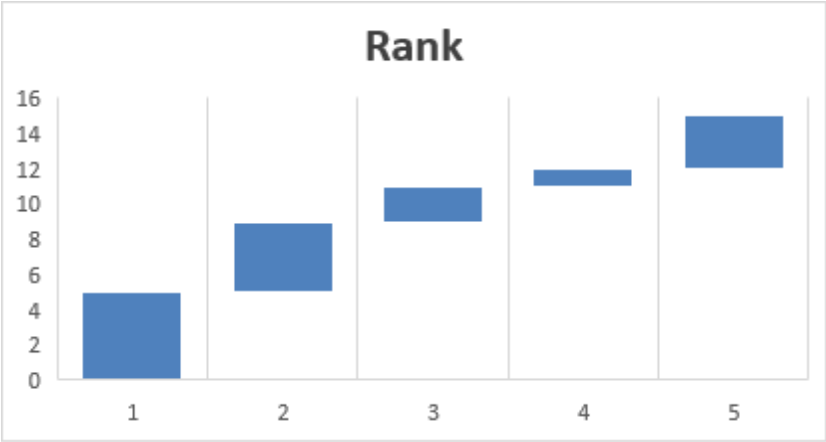

FIGURE 5. Rank

Figure 5 presents the rankings of the nursing care alternatives based on the TOPSIS method. The rankings indicate the relative performance of each alternative, with "Comprehensive nursing care" ranked 1st, followed by "Provision of nursing care" in 2nd, and "Patient care in nursing" in 5th, signifying their respective closeness to the ideal solution.

4. CONCLUSION

The analysis of nursing care quality using the TOPSIS method has revealed significant insights into the effectiveness of different nursing care approaches. The results demonstrate a clear hierarchy in the effectiveness of different nursing care approaches. Notably, Comprehensive nursing care emerged as the highest-ranked alternative with a closeness coefficient of 0.8126, followed closely by Provision of nursing care with 0.8095. This indicates that

these approaches most effectively balance the various aspects of patient care. The high ranking of Comprehensive nursing care suggests that a holistic approach to patient care, which considers multiple aspects of patient needs and care delivery, is most effective in achieving optimal healthcare outcomes. The middle-ranked alternative, Nurse-led patient care (ranked 3rd with a coefficient of 0.5915), demonstrates moderate effectiveness across the evaluated criteria. Clinical care for patients and Patient care in nursing ranked 4th and 5th respectively, suggesting potential areas for improvement in these approaches. The analysis highlights that successful nursing care requires a balanced approach across all evaluated criteria. While some alternatives showed strong performance in specific areas (such as Patient care in nursing scoring high in Quality of Care and Nursing Skills), the most successful approaches were those that maintained consistent performance across all criteria. The equal weight distribution (0.25 for each criterion) used in the analysis ensures an unbiased evaluation of each alternative, suggesting that all aspects of nursing care - from patient outcomes to nursing skills - are equally crucial in delivering high-quality healthcare services.

These findings have important implications for healthcare administrators and nursing professionals. They suggest that:

1. A comprehensive approach to nursing care yields the best overall results
2. Balanced performance across all criteria is more important than excellence in just one or two areas
3. Integration of various nursing care aspects leads to better outcomes than focused approaches

The results provide a clear framework for healthcare institutions to evaluate and improve their nursing care delivery systems. They also highlight the importance of maintaining high standards across all aspects of nursing care rather than focusing on individual metrics in isolation.

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