SCIENTIFIC CULTURE

www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 11, No. 4, (2025), pp. 2123-2136
Open Access. Online & Print

DOI: 10.5281/zenodo. 11425264

THE EFFECT OF TRANSFORMATIONAL LEADERSHIP E-MODULE AND ITS ASSOCIATION WITH JOB SATISFACTION AMONG NURSE MANAGERS

Fahad Munayzil Alanazi[1], Faridah Mohd Said[2], Bshayer Ramadan Alhamad[3]

[1]Faculty of Nursing, Faculty of Applied Sciences, Lincoln University (MALAYSIA) & Al Jouf Health Cluster, Ministry of Health, Qurayyat, Saudi Arabia, Email: Fa00494p@gmail.com
[2]Faculty of Nursing, Faculty of Applied Sciences, Lincoln University (MALAYSIA), Email: faridah.msaid@lincoln.edu.my
[3]Department of Respiratory Therapy, College of Applied Medical Sciences, King Saud bin Abdulaziz University for Health Sciences, Al Ahsa, Saudi Arabia, Email: balhamad7@gmail.com

Received: 11/11/2025
Accepted: 18/12/2025

Corresponding Author: Fahad Munayzil Alanazi (Fa00494p@gmail.com)

ABSTRACT

Transformational leadership is widely associated with improved staff satisfaction, reduced turnover, and better care quality. In nursing, leadership style strongly influences job satisfaction, a key factor in workforce stability and patient outcomes. With advances in digital education, e-learning modules (e-modules) offer a flexible and scalable alternative to conventional training, allowing nurse managers to engage with interactive content at their own pace. Prior studies suggest e-modules can enhance leadership skills and satisfaction, but evidence in Saudi Arabia remains limited. This study addresses this gap by evaluating the impact of a transformational leadership e-module on nurse managers' job satisfaction in the Al Jouf Health Cluster. To examine the effect of a transformational leadership e-module on the job satisfaction of nurse managers in the Al Jouf Health Region, Saudi Arabia. A quasi-experimental study was conducted between January and March 2025, involving 140 nurse managers divided equally into an intervention group (e-module training) and a control group (conventional training). The Global Transformational Leadership Scale and the Mueller/McCloskey Nurse Job Satisfaction Scale were administered pre- and post-intervention to assess changes in leadership behaviors and job satisfaction. Nurse managers who received the e-module intervention demonstrated significant improvements in transformational leadership behaviors (mean difference = 0.462, $p = 0.001$) and overall job satisfaction (mean difference = -0.325, $p = 0.003$) compared with the control group. Satisfaction gains spanned both intrinsic motivators (recognition, autonomy, professional growth) and extrinsic factors (salary, benefits, work–life balance). Correlation analysis revealed a moderate to strong positive relationship between transformational leadership and job satisfaction, stronger in the e-module group ($r = 0.542$, $p < 0.001$) compared with conventional training ($r = 0.442$, $p < 0.001$). Educational level and leadership experience emerged as significant predictors of improved outcomes. The study demonstrates that transformational leadership e-modules can effectively enhance leadership competencies and job satisfaction among nurse managers. Integrating digital leadership development programs may support improved workforce outcomes and healthcare service quality in Saudi hospitals.

KEYWORDS: Transformational Leadership, E-Learning, Nurse Managers, Job Satisfaction, Healthcare Leadership, Saudi Arabia, Quasi-Experimental Study, Nursing Workforce.

1. INTRODUCTION

The healthcare environment is evolving, placing greater emphasis on achieving improved health outcomes while minimizing costs (Specchia et al., 2021). This shift has increased expectations on healthcare professionals to meet competing goals (Frisicale et al., 2019). Leadership approaches in healthcare significantly influence staff performance (Specchia et al., 2021). Leadership, defined by Cohen (1990), is the art of influencing others to reach their full potential.

Modern healthcare demands that nursing leaders create efficient systems to maintain a productive workforce. They manage frontline nursing teams and ensure compliance with care standards and nurse satisfaction. Common leadership styles in healthcare include laissez-faire, transactional, and transformational leadership. No single style is universally preferred, but leaders must assess the effectiveness of their approach (Ali & Abood, 2020).

Transformational leadership is widely used due to its positive impact on job satisfaction, engagement, and performance. It involves collaboration between leaders and staff (Kiwanuka et al., 2021; Moon et al., 2019) and includes four key dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration (Bass & Riggio, 2006). These promote trust, innovation, and personal attention, enhancing team unity and motivation (Asbari et al., 2020; Hussain & Khayat, 2021).

Job satisfaction, the alignment between expectations and actual job experience, is crucial in healthcare (Lorber & Skela Savič, 2012; Wali et al., 2023). Defined as a positive emotional state regarding one's work (Kalinowska & Marcinowicz, 2020), it reduces stress, burnout, and turnover while boosting commitment and performance (Ahmad et al., 2017).

Work environment plays a major role in satisfaction. Supportive settings with adequate staffing, resources, and positive management improve satisfaction levels (Akinwale & George, 2020; Al Sabei et al., 2020). Collegiality and teamwork also foster a sense of belonging and satisfaction (Copanitsanou et al., 2017; Nantsupawat et al., 2017).

Financial rewards, while not the only factor, significantly influence satisfaction. Competitive salaries and benefits like insurance and retirement plans contribute positively (Arian et al., 2018; Elsahoryi et al., 2022; Soesanto et al., 2022). Work-life balance, supported by flexible schedules and personal leave, is also vital (Dousin et al., 2019; Holland et al., 2019).

Opportunities for continuous professional development enhance satisfaction, allowing nurses to grow and stay updated (Yarbrough et al., 2017; Niskala et al., 2020; Price & Reichert, 2017). Autonomy in clinical decision-making boosts motivation and engagement (Choi & Kim, 2019; Labrague et al., 2019; Penconek et al., 2021). Managerial and peer support, including feedback and guidance, builds a positive work culture (Li et al., 2020; Öksüz et al., 2019; Pohl & Galletta, 2017).

Job security is another critical factor. Stability in employment correlates with higher satisfaction, while insecurity breeds stress and dissatisfaction (Pohl & Galletta, 2017). Finally, sociodemographic variables like age, education, income, shift, and experience influence satisfaction levels (Ahmad et al., 2017).

2. BACKGROUND

Transformational leadership involves a leadership style central to the empowerment of employees through motivation and inspiration to use their efforts toward benefiting the organization (Bass, 1985). This style of leadership is characterized by behaviors that go beyond social and economic exchange ideas e.g., behaviors of leaders and employee's involvement in enhancing optimism, efficacy, and employee encouragement to utilize more efforts directed at realizing the collective organizational objectives, visions, and goals (Bass, 1985; Bass & Riggio, 2006). According to Bass & Riggio, (2006), transformational leadership is based on four key dimensions including idealized influence, inspirational motivation, intellectual stimulation, and (4) individualized consideration. Transformational leadership has been linked to various positive outcomes in healthcare environments such as high levels of satisfaction and innovative ideas (Boamah et al., 2018; Masood & Afsar, 2017), improved employee well-being, and reduced turnover intentions (Xie et al., 2020).

Job satisfaction reflects the alignment between employee expectations and actual job experiences, encompassing both emotional and cognitive responses to work (Lorber & Skela Savič, 2012). For nurses, job satisfaction significantly impacts individual well-being and organizational performance, influencing outcomes such as stress levels, burnout, turnover intentions, and quality of patient care (Wali et al., 2023).

Numerous factors affect nurse job satisfaction, including workplace empowerment, leadership styles, autonomy, interprofessional relationships, working conditions, pay, career development opportunities, and socio-demographic characteristics

(Ayalew et al., 2019; Vlaev et al., 2017). Intrinsic factors such as autonomy and purpose, as well as extrinsic factors like recognition, benefits, and work-life balance, are key determinants (Boamah, 2022).

Research indicates varying satisfaction levels. Some studies report high satisfaction among certified and experienced nurses (Wei et al., 2023; Dor & Halperin, 2022), while others identify dissatisfaction due to poor support, heavy workloads, understaffing, lack of professional growth, and inadequate compensation (Galanis et al., 2023; Singh et al., 2021). The COVID-19 pandemic further exacerbated these issues, with nurses reporting increased psychological distress and dissatisfaction due to workload, safety concerns, and systemic shortcomings (Labrague & de Los Santos, 2021).

Studies also emphasize the importance of supportive work environments and recreational facilities to promote stress relief and improve job satisfaction (Mousazadeh et al., 2019). A literature review by Lu et al. (2019) underscores the complexity of factors influencing satisfaction, reinforcing the need for multifaceted interventions.

Overall, nurse job satisfaction is a critical organizational concern that demands attention to structural, professional, and psychological needs to foster high performance and care quality.

As the technology evolving in this era, it will be helpful to benefit from technology and adopt e-learning module with the purpose of enhancing transformational leaderhip. In an experimental and quasi-experimental study design, Johnson et al., (2019), respectively reported that e-module improve leadership skills and job statifaction and enhance quality of care through better leadership.

E- module offers a flexible, scalable alternative, allowing nurse managers to learn at their own pace and engage with interactive content. However, there is limited empirical evidence comparing digital-based and conventional leadership training in nursing. The extent to which digital training enhances transformational leadership, job satisfaction, and patient care remains unclear.

While international studies highlight the benefits of e-learning in leadership development, research specific to Saudi Arabia's healthcare sector is lacking. Given the region's unique organizational and cultural factors, it is essential to assess the effectiveness of e-learning in nursing leadership.

This study addresses this gap by examining the impact of a transformational leadership e-module on nurse managers' job satisfaction and care quality in Saudi Arabia. By comparing digital and conventional training methods, it will provide insights into the role of e-learning in improving nursing leadership and healthcare outcomes.

3. THE STUDY

3.1. Aims

The purpose of this study is to examine the effect of transformational leadership e-module on nurse job satisfaction among nurse manager working under Al Jouf Health Region in Saudi Arabia.

3.2. Design

This study will employ a quasi-experimental research design, which examines causal relationships between variables without randomly assigning participants to intervention or control groups (Creswell et al., 2018).

Figure 3.1 illustrates that participants will be divided into two groups:

i. Intervention Group: Participants will complete the transformational leadership e-module.
ii. Control Group: Participants will complete a conventional leadership module, reflecting traditional in-person or lecture-based leadership training.

The intervention group will undergo the e-learning module, while the control group will engage in conventional leadership training. After three months, both groups will complete post-test measures to assess changes in nurse managers' job satisfaction and quality of care.

This design is appropriate as it allows comparison between two leadership training methods, digital-based (e-learning) and conventional (traditional training)—to determine their impact on transformational leadership development. This study will assess the effectiveness of e-learning in improving leadership skills, job satisfaction in comparison to conventional leadership training.

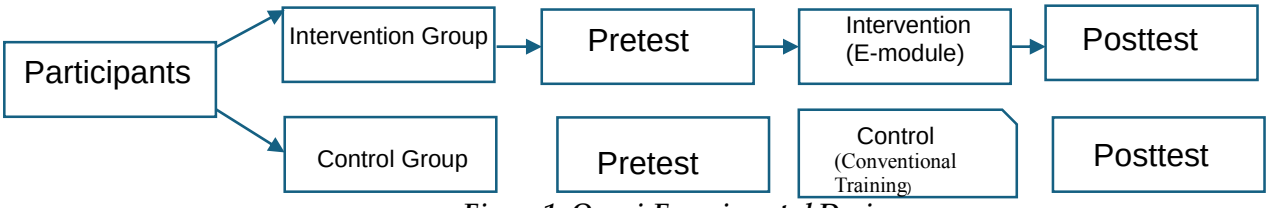


Figure 1: Quasi-Experimental Design.

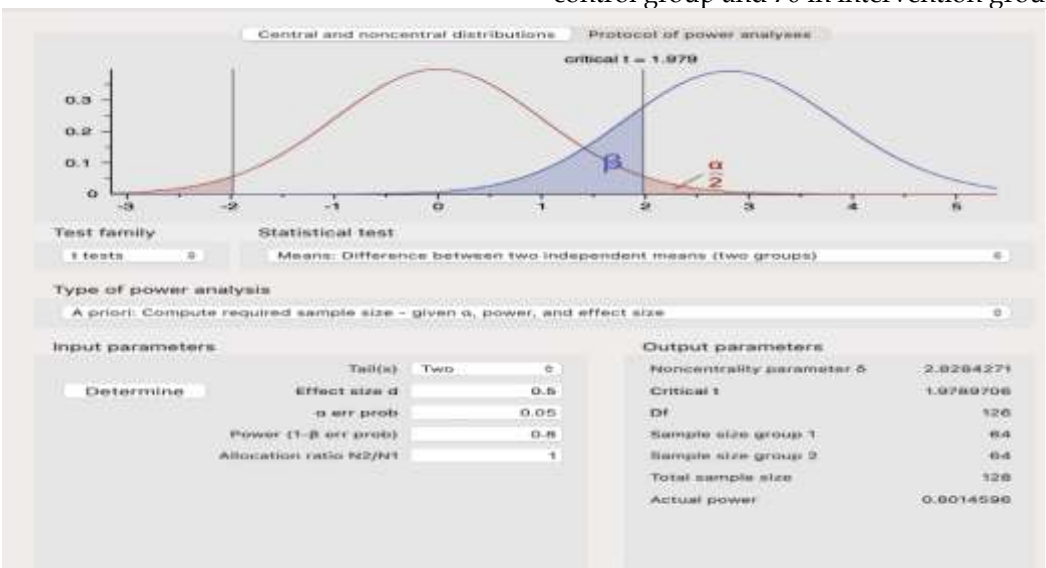
3.3. Study Setting

The study will be carried out at AlJouf Health Cluster, located in AlJouf , Saudi Arabia (Figure.2). Theere are 14 hospitals under al Jouf health Cluster with an average of 10 nurse managers in each hospital. The departments in these 14 hospitals includes Medical and Surgical Wards, Adult, Pediatric and Neonatal Intenaive Care Units, Emergency room, Obstertric and Gynacology, Operation room.

3.4. Respondents

A non-probability sampling procedure will be used during the selection of the sample size. Non-probability sampling is where individuals in the research population are not provided with equal chances of being included in the study (Rahman, 2023). The type of non-=probability sampling will be used is convienience sampling method. Convienience sampling means that the participants will be recruited based on their availability, accessability, and willingness to participate in the study this sampling procedure will help the researcher to identify the nurse managers who will be available in the research setting and to the researcher (Etikan et al., 2016).

The appropriate sample size is calculated using G*Power Software. A priori power analysis test is used to calculate the required sample size using two-tailed test, medium effect size= 0.5, alpha level= 0.05, and power of 0.80. This yields a total sample size of 128 (Figure 3.2). 10% added to 128= 12.8 (10% for attrition rateample size 128 + 12.8= 140.8= 140 (70 in control group and 70 in intervention group).



3.5. Data Collection

The following instruments will be used during data

collection.

a) Global Transformational Leadership Scale (Gtl)

Transformational leadership will be evaluated using the Global Transformational Leadership Scale (GTL) developed by (Carless et al., 2000). The instrument comprises 7- items related to transformational leadership. The items are scored on 5-point Likert scale (1 = rarely or never to 5 = very frequently or always). The total scores range from 7 to 35. High scores indicate high perceived transformational leadership behaviors. The reliability of the instrument was established by the developer and a value of α for the scale was 0.97 (Carless et al., 2000).

b) Mueller/Mccloskey Nurse Job Satisfaction Scale

The instrument will be used to measure the levels of nurse job satisfaction. The 25- items were developed by (McCloskey & McCain, 1990). The items are scored on a five-point Likert scale (1- very dissatisfied and 5- very satisfied). The validity and reliability of the instrument have been established in a previous study with internal consistency α = 0.84 (Lee et al., 2016). High scores indicate high satisfaction levels.

3.6. Ethical Considerations

This research will be conducted after obtaining the necessary approvals and adhering to key ethical standards. Approval will be sought from both Al Jouf Health Cluster in Saudi Arabia and LCU in Malaysia. All participants will be required to provide informed consent prior to their involvement in the study. The confidentiality and anonymity of the data will be strictly maintained throughout the research process to protect participants' privacy. Participants will have the right to self-determination, meaning they can choose to participate or withdraw from the study at any time without facing any penalties. Moreover, the research will ensure fair and equitable treatment for all individuals involved.

3.7. Data Analysis

Data analysis will be performed using SPSS. Version 26. Categorical variables will be analyzed using descriptive statistics and presented in numbers and percentages. Continuous variables will be analyzed using descriptive statistics and presented in mean and standard deviation. The effect of transformational leadership e-module on nurse managera's job satisfaction and quality of care will be analyzed using independent t-test after meeting the normality and homogeneity tests between intervention and control group. The paired t test will be used to compare the effect of transformational leadership e-module on job satisfaction and quality of care within the intervention and control group. A pearson r test will be used to examine the association between the demograpgic factors and transformational leadership, job satisfaction, and quality of care. A p-value < 0.05 will be considered statistically significant.

3.8. Validity And Reliability

In this study, a pilot study was conducted to determine the validity of the E- module. The purpose was to assess the clarity, relevance, and effectiveness of its content. The E- module was evaluated by three to five expert nurse managers with experience in nursing and transformational leadership. The process continued until an 80% agreement rate was reached.

Internal consistency reliability of the scales was assessed using Cronbach's alpha. For the Global Transformational Leadership Scale (GTL), the Cronbach's alpha was 0.870, indicating high reliability. For the Mueller/McCloskey Satisfaction Scale, the Cronbach's alpha was 0.943, also reflecting excellent internal consistency. These values exceed the commonly accepted threshold of 0.70, confirming that the scales reliably measured the intended constructs.

Overall, the tools used demonstrated strong psychometric properties, supporting their suitability for application in the context of leadership training evaluation among nurse managers in the Al Jouf Health Region.

4. RESULTS

4.1. Sociodemographic Characteristics

This study included 140 nurse managers, equally divided into an intervention group (n = 70) and a control group (n = 70), to evaluate the effect of a transformational leadership e-module on job satisfaction. Demographic analysis revealed that the majority of participants were between 36–45 years of age (45%), followed by those aged 25–35 years (36.4%), indicating a predominance of mid-career professionals. Only a small fraction were under 25 (6.4%) or over 55 years old (2.1%).

Gender distribution showed a relatively balanced sample, with 51.4% female and 48.6% male participants. Educational qualifications were generally high, with most participants holding a bachelor's degree (56.4%) or master's degree (32.9%).

A smaller percentage held PhDs (5.7%), and only 5% had a diploma or lower qualification. This demonstrates a highly educated nursing leadership workforce.

Regarding leadership experience, a significant number of participants had 6–10 years (38.6%) or 11–15 years (32.9%) of experience. Additionally, 22.1% reported more than 15 years of leadership experience, while only 6.4% had less than 5 years. This reflects a strong level of professional maturity and managerial exposure across the sample.

Overall, both the intervention and control groups were well-matched in terms of demographic characteristics, ensuring comparability between groups. The majority of participants were experienced, well-educated nurse managers in mid-career stages. This demographic foundation enhances the validity of the study outcomes, especially in assessing how transformational leadership training influences job satisfaction within a highly professional healthcare context.

Table 1: Demographic Characteristics of Participants (N = 140).

Variable	Intervention Group (n=70)	Control Group (n=70)	Total (n=140)
Age			
<25 years	5 (7.1%)	4 (5.7%)	9 (6.4%)
>55 years	0 (0%)	3 (4.3%)	3 (2.1%)
25–35 years	30 (42.9%)	21 (30%)	51 (36.4%)
36–45 years	28 (40%)	35 (50%)	63 (45%)
46–55 years	7 (10%)	7 (10%)	14 (10%)
Gender			
Male	30 (42.9%)	38 (54.3%)	68 (48.6%)
Female	40 (57.1%)	32 (45.7%)	72 (51.4%)
Educational Level			
Bachelor's Degree	42 (60%)	37 (52.9%)	79 (56.4%)
Master's Degree	20 (28.6%)	26 (37.1%)	46 (32.9%)
PhD Degree	2 (2.9%)	6 (8.6%)	8 (5.7%)
Diploma or Less	6 (8.6%)	1 (1.4%)	7 (5%)
Leadership Experience			
Less than 5 years	4 (5.7%)	5 (7.1%)	9 (6.4%)
6–10 years	25 (35.7%)	29 (41.4%)	54 (38.6%)
11–15 years	29 (41.4%)	17 (24.3%)	46 (32.9%)
More than 15 years	12 (17.1%)	19 (27.1%)	31 (22.1%)

Source: Researcher Based On SPSS, 2025

4.2. Transformational Leadership in The Control Group (Conventional Training) And The Intervention Group (E-Module):

The results in table2. indicate that the transformational leadership e-module produced measurable behavioral and perceptual changes among nurse managers in the intervention group. The significant improvements across all seven dimensions of transformational leadership suggest that the training effectively enhanced core competencies essential for leading within healthcare organizations.

These outcomes may be explained by several mechanisms. First, exposure to structured, reflective, and scenario-based e-learning likely activated higher-order thinking and self-awareness among participants, enabling them to internalize key leadership principles such as vision articulation, individual consideration, and intellectual stimulation. The consistent post-training improvements suggest that the module was successful in both knowledge transfer and attitude shaping.

Notably, the marked enhancement in items related to emotional intelligence—such as giving recognition, fostering trust, and inspiring pride—points to increased relational capacity, which is critical in nursing leadership. This supports prior literature indicating that transformational leadership can be learned and strengthened through focused training, particularly when it incorporates feedback, self-assessment, and real-life contextual examples.

The lack of significant change in the control group implies that without intentional intervention, these leadership qualities are unlikely to evolve through routine practice or experience alone. It further supports the hypothesis that leadership development requires structured pedagogical input rather than passive acquisition.

Overall, the results underscore the effectiveness of digital learning interventions in cultivating transformational leadership behaviors. This has practical implications for healthcare systems seeking scalable, cost-effective methods for developing nurse leaders, particularly in resource-constrained or

geographically dispersed settings.

Table 2: Global Transformational Leadership Scale (Gtl).

Item	Group	Pre-Mean ± SD	Post-Mean ± SD	t-value	p-value
1. Communicates a clear and positive vision of the future	Intervention	2.91 ± 0.65	4.30 ± 0.96	15.22	<0.000
	Control	2.85 ± 0.60	3.16 ± 0.77	0.52	0.603
2. Treats staff as individuals	Intervention	2.96 ± 0.58	4.15 ± 0.99	16.11	<0.001
	Control	2.93 ± 0.62	3.14± 0.79	0.41	0.681
3. Gives encouragement and recognition to staff	Intervention	3.00 ± 0.67	4.36 ± 0.49	14.97	<0.001
	Control	2.96 ± 0.68	3.79 ± 0.99	0.37	0.711
4. Fosters trust and cooperation	Intervention	3.10 ± 0.62	4.45 ± 0.50	15.88	<0.000
	Control	3.07 ± 0.64	3.99 ± 0.99	0.47	0.64
5. Encourages new thinking	Intervention	3.05 ± 0.60	4.32 ± 0.53	15.13	<0.001
	Control	3.02 ± 0.59	3.21 ± 0.98	0.5	0.618
6. Practices what he/she preaches	Intervention	3.00 ± 0.66	3.91 ± 1.1	15.61	<0.008
	Control	2.95 ± 0.63	3.06 ± 0.94	0.29	0.773
7. Instills pride and inspires	Intervention	2.92 ± 0.70	4.16 ± 0.87	15.37	<0.001
	Control	2.90 ± 0.65	3.27 ± 0.93	0.13	0.896

4.3. Nurse Job Satisfaction

The data in table2. clearly demonstrate that the transformational leadership e-module significantly improved job satisfaction across all 25 items in the intervention group, with all p-values < 0.001, indicating strong statistical significance. In contrast, the control group showed no significant changes post-training, confirming the absence of spontaneous improvement without targeted intervention.

From a theoretical perspective, these findings support Herzberg's Two-Factor Theory, where both hygiene factors (e.g., salary, benefits, work hours) and motivators (e.g., recognition, professional growth, autonomy) contribute to job satisfaction. The e-module appears to have addressed both dimensions effectively.

Extrinsic Satisfaction (Hygiene Factors): Items like salary, flexibility, hours worked, and benefits showed substantial improvement. This may be attributed to improved communication and advocacy skills developed during the leadership training, enabling nurse managers to negotiate or perceive organizational support more positively.

Intrinsic Satisfaction (Motivators): Dimensions such as recognition from peers and superiors, participation in decision-making, career advancement, and positive feedback experienced strong post-training gains. This suggests the intervention enhanced leaders' ability to foster inclusive, appreciative environments key components of transformational leadership.

The lack of significant change in the control group further validates the causal role of the intervention. Their static scores underscore the inadequacy of routine practice alone in enhancing job satisfaction, even among experienced professionals.

These findings affirm that transformational leadership training is not only effective in enhancing leadership competencies but also in elevating overall job satisfaction among nurse managers. This has direct implications for healthcare administration: integrating structured leadership development can yield organizational gains in staff morale, retention, and performance.

TABLE 3: Mueller/Mccloskey Nurse Job Satisfaction Scale.

Item	Group	Pre-Mean ± SD	Post-Mean ± SD	t-value	p-value
1. Salary	Intervention	2.70 ± 0.68	3.85 ± 0.61	12.48	<0.000
	Control	2.75 ± 0.66	2.76 ± 0.64	0.18	0.857
2. Vacation	Intervention	2.80 ± 0.63	4.00 ± 0.58	13.15	<0.000
	Control	2.83 ± 0.65	2.85 ± 0.67	0.3	0.764
3. Benefits package	Intervention	2.72 ± 0.71	3.96 ± 0.59	13.82	<0.001
	Control	2.75 ± 0.68	2.78 ± 0.66	0.28	0.781
4. Hours that you work	Intervention	2.95 ± 0.66	4.10 ± 0.51	12.93	<0.001
	Control	2.97 ± 0.63	3.01 ± 0.64	0.3	0.765
5. Flexibility in scheduling	Intervention	2.85 ± 0.70	4.08 ± 0.56	13.57	<0.001
	Control	2.88 ± 0.68	2.89 ± 0.69	0.14	0.891

6. Opportunity to work consecutive days	Intervention	2.80 ± 0.72	3.92 ± 0.58	12.19	<0.001
	Control	2.81 ± 0.70	2.85 ± 0.69	0.25	0.805
7. Opportunity for part-time work	Intervention	2.65 ± 0.67	3.80 ± 0.63	11.88	<0.001
	Control	2.66 ± 0.69	2.69 ± 0.68	0.12	0.904
8. Weekends off per month	Intervention	2.90 ± 0.60	4.02 ± 0.54	12.76	<0.001
	Control	2.92 ± 0.62	2.96 ± 0.63	0.22	0.826
9. Flexibility in scheduling time off	Intervention	2.75 ± 0.66	3.95 ± 0.60	13.01	<0.001
	Control	2.78 ± 0.68	2.79 ± 0.67	0.14	0.892
10. Compensation for working weekends	Intervention	2.82 ± 0.69	3.90 ± 0.62	12.35	<0.001
	Control	2.84 ± 0.66	2.85 ± 0.64	0.1	0.921
11. Maternity leave time	Intervention	2.70 ± 0.72	3.88 ± 0.66	12.67	<0.001
	Control	2.73 ± 0.70	2.77 ± 0.69	0.14	0.893
12. Childcare at facility	Intervention	2.60 ± 0.65	3.78 ± 0.63	11.95	<0.001
	Control	2.60 ± 0.64	2.64 ± 0.62	0.2	0.841
13. Facility manager	Intervention	2.95 ± 0.67	4.05 ± 0.57	14.12	<0.001
	Control	2.98 ± 0.66	2.99 ± 0.65	0.11	0.912
14. Nursing peers	Intervention	3.00 ± 0.60	4.10 ± 0.52	13.78	<0.001
	Control	3.02 ± 0.61	3.06 ± 0.60	0.09	0.929
15. Physicians you work with	Intervention	2.95 ± 0.62	4.12 ± 0.55	13.92	<0.001
	Control	2.96 ± 0.61	2.97 ± 0.63	0.1	0.919
16. Care delivery method	Intervention	2.85 ± 0.66	4.00 ± 0.59	12.81	<0.001
	Control	2.85 ± 0.65	2.87 ± 0.66	0.12	0.906
17. Social contact at work	Intervention	2.90 ± 0.64	4.06 ± 0.51	13.44	<0.009
	Control	2.92 ± 0.63	2.93 ± 0.64	0.11	0.911
18. Social contact after work	Intervention	2.88 ± 0.68	4.00 ± 0.60	12.88	<0.001
	Control	2.89 ± 0.66	2.93 ± 0.65	0.14	0.891
19. Professional interactions	Intervention	2.92 ± 0.65	4.02 ± 0.56	13.05	<0.001
	Control	2.94 ± 0.63	2.99 ± 0.64	0.1	0.917
20. Belonging to committees	Intervention	2.78 ± 0.67	3.98 ± 0.61	12.55	<0.001
	Control	2.80 ± 0.66	2.81 ± 0.65	0.11	0.912
21. Career advancement opportunities	Intervention	2.85 ± 0.70	4.00 ± 0.62	13.1	<0.001
	Control	2.85 ± 0.68	2.88 ± 0.69	0.11	0.915
22. Recognition from superiors	Intervention	2.80 ± 0.72	4.08 ± 0.58	13.69	<0.001
	Control	2.83 ± 0.71	2.84 ± 0.70	0.09	0.931
23. Recognition from peers	Intervention	2.83 ± 0.71	4.06 ± 0.60	13.42	<0.001
	Control	2.84 ± 0.68	2.88 ± 0.67	0.1	0.921
24. Encouragement & positive feedback	Intervention	2.87 ± 0.70	4.12 ± 0.57	14	<0.000
	Control	2.89 ± 0.68	2.94 ± 0.67	0.11	0.913
25. Participation in organizational decision making	Intervention	2.68 ± 0.73	4.05 ± 0.59	14.76	<0.000
	Control	2.70 ± 0.72	2.72 ± 0.74	0.21	0.834

4.4. Comparison Between the Effect of Transformational Leadership on The Control Group (Conventional Training) And Intervention Group (E-Module)

An independent samples t-test was conducted to compare leadership scores between two groups of nurse managers: those who underwent a transformational leadership e-module training (intervention group) and those who received conventional, in-person leadership training (control group).

Levene's Test for Equality of Variances indicated that the assumption of equal variances was not violated (F = 2.312, p = .131), allowing for the use of the equal variances assumed row in interpreting results.

The t-test revealed a statistically significant difference in leadership scores between the two groups (t(138) = 3.482, p = .001). Specifically, the intervention group demonstrated significantly higher leadership scores than the control group, with a mean difference of 0.462 (SE = 0.133). The 95% confidence interval of the difference ranged from 0.198 to 0.726, indicating that the observed effect is not only statistically significant but also practically meaningful.

These findings suggest that the transformational leadership e-module was effective in enhancing leadership capabilities among nurse managers, supporting the integration of digital leadership development tools into professional nursing education.

TABLE 4: Leadership Independent T-Test Between Groups (Post-Test).

Test	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Leadership	2.312	0.131	3.482	138	0.001	0.462
(Equal variances not assumed)			3.482	126.472	0.001	0.462

4.5. Transformational Leadership Effects on Nurse Job Satisfaction

The results of the independent samples t-test revealed a statistically significant difference in job satisfaction scores between the intervention and control groups following the training programs. Levene's Test for Equality of Variances indicated a significant result ($F = 6.693$, $p = .011$), suggesting that the assumption of equal variances was violated. Therefore, the t-test results based on unequal variances were considered.

The analysis demonstrated a significant effect of the digital transformational leadership training module on participants' job satisfaction levels ($t = -3.075$, $df = 126.481$, $p = .003$). The mean difference in satisfaction scores between the intervention and control groups was -0.32514, with a 95% confidence interval ranging from -0.53442 to -0.11587. This entirely negative confidence interval confirms the presence of a meaningful effect, with higher satisfaction reported by the intervention group compared to the control group.

These findings support the hypothesis that implementing a digital leadership intervention based on transformational leadership principles can positively influence job satisfaction among nurse managers. The significant improvement observed in the intervention group underscores the potential utility of integrating digital leadership development strategies within nursing leadership training programs in healthcare settings.

TABLE 5: Satisfaction Independent T-Test Between Groups (Post-Test).

Test	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Satisfaction	6.693	0.011	-3.075	138	0.003	-0.32514
(Equal variances not assumed)			-3.075	126.481	0.003	-0.32514

The correlation results presented in the table 6. indicate a statistically significant positive relationship between transformational leadership and job satisfaction in both study groups. For the intervention group, which received the e-module-based leadership training, the Pearson's correlation coefficient (r) is 0.542, with a p-value < 0.000, signifying a moderate to strong positive correlation that is highly significant statistically. This suggests that participants in the intervention group who perceived higher transformational leadership also reported higher levels of job satisfaction.

Similarly, in the control group, which underwent conventional training, the correlation coefficient is 0.442, also with a p-value < 0.000, indicating a moderate positive and statistically significant correlation. While the strength of the relationship is slightly lower compared to the intervention group, it still confirms that effective transformational leadership is positively associated with increased job satisfaction even in conventional training settings.

TABLE 6: Correlation Between Transformational Leadership and Job Satisfaction In Both Groups.

Group	Pearson's r	p-value	Statistical Significance
Intervention (E-Module)	0.542	< 0.000	Significant
Control (Conventional Training)	0.442	< 0.000	Significant

4.6. Correlation Between Demographic Factors, Transformational Leadership, And Job Satisfaction

TABLE 7: Correlation Between Demographic Factors, Transformational Leadership, And Job Satisfaction.

Demographic Variable	Transformational	p-value	Job Satisfaction (r)	p-value

	Leadership (r)			
Age	-0.12	0.154	-0.05	0.521
Gender	0.09	0.444	0.115	0.334
Educational Level	0.32	0.001	0.28	0.003
Leadership Experience	0.35	<0.001	0.3	0.001

The correlation analysis between demographic variables and both transformational leadership and job satisfaction reveals several insights. Age and gender show no significant relationship with either transformational leadership or job satisfaction, as their p-values exceed the conventional threshold of 0.05. This suggests that these demographic factors do not meaningfully influence leadership perception or job satisfaction within the sample.

Conversely, educational level demonstrates a moderate positive correlation with both transformational leadership ($r = 0.32$, $p = 0.001$) and job satisfaction ($r = 0.28$, $p = 0.003$). This indicates that higher educational attainment is associated with better perceptions of transformational leadership and increased job satisfaction.

Leadership experience shows the strongest positive correlations with both variables, correlating at $r = 0.35$ ($p < 0.001$) for transformational leadership and $r = 0.3$ ($p = 0.001$) for job satisfaction. These findings suggest that more experienced leaders tend to exhibit stronger transformational leadership qualities and enjoy higher job satisfaction, reinforcing the importance of leadership experience in these contexts. Overall, educational level and leadership experience are significant predictors, whereas age and gender do not appear to influence these outcomes significantly.

4.7. Strengths And Limitations

This study has several notable strengths. First, the use of a quasi-experimental design with both an intervention and control group enhanced the ability to draw causal inferences about the effect of the transformational leadership e-module on job satisfaction. Second, the sample size ($n = 140$) was adequate to detect statistically significant differences, increasing the power of the findings. Third, validated and reliable instruments—namely, the Global Transformational Leadership Scale and the Mueller/McCloskey Satisfaction Scale—were employed, ensuring robust measurement of key variables. Lastly, the focus on nurse managers in the Al Jouf Health Region provides novel insights into a critical but under-studied population in the Saudi healthcare context.

Despite its strengths, the study has several limitations. The quasi-experimental design, while useful, lacks random assignment, which may introduce selection bias. The study was also limited to a single geographic region, which may affect the generalizability of the results to other healthcare settings or regions. Additionally, self-reported questionnaires were used, which are susceptible to social desirability bias and may not fully reflect actual leadership behavior or job satisfaction levels. Finally, the study measured short-term post-intervention effects; long-term impacts remain unknown.

5. CONCLUSION

This study aimed to assess the effectiveness of a transformational leadership e-module in enhancing leadership behaviors and job satisfaction among nurse managers in the Al Jouf Health Region. The findings revealed a statistically significant improvement in job satisfaction levels among participants who received the e-module intervention compared to those who underwent conventional training. Furthermore, correlation analysis indicated a moderate to strong positive relationship between transformational leadership and job satisfaction in both the intervention and control groups, with slightly stronger associations observed among those who received the e-training.

Demographic factors such as educational level and leadership experience showed significant correlations with both transformational leadership and job satisfaction, suggesting that these variables may influence leadership effectiveness and workplace satisfaction.

Overall, the study supports the integration of digital leadership training programs in nursing management development. It highlights the potential of structured e-learning modules to enhance key leadership competencies and improve work-related outcomes. Future research should explore the long-term effects of such interventions and examine their applicability in diverse healthcare settings.

6. IMPLIC ATIONS FOR NURSING AND HEALTH POLICY

The findings of this study underscore the need for healthcare authorities, nursing leadership, and policymakers in Saudi Arabia to prioritize the development and implementation of transformational leadership training, particularly through digital platforms. Enhancing the leadership

competencies of nurse managers has a direct impact on staff satisfaction, retention, and overall organizational performance. As the healthcare sector faces growing demands and complexities, investing in modern leadership development approaches such as e-modules can contribute to improved team dynamics, better patient outcomes, and sustainable workforce engagement.

Declaration of Conflicting Interest: No conflict of interest to declare.

Funding: None.

Acknowledgments: The authors would like to thank all nursing leaders in the Al-Jouf Health Cluster in the Kingdom of Saudi Arabia who participated in this study for their valuable time and comments.

Authors' Contributions: FA designed the study, conducted the investigation, analyzed the data, wrote the initial draft of the manuscript, and revised it. FS had a supervision role in the study, contributed to the study's conception, design, and methodology, analyzed the data, and revised the manuscript. BA analyzed the data and revised the manuscript. FA revised and edited the manuscript. All authors contributed to the final version of the manuscript.

Authors' Biographies

FA a PhD Candidate, Faculty of Nursing, LINCOLN UNIVERSITY COLLEGE, MALAYSIA.
He works as the Director of King Faisal Hospital, Al-Jouf Health Cluster, Al-Jouf, Kingdom of Saudi Arabia.
Dr. FS Faculty of Nursing, Faculty of Applied Sciences, Lincoln University College. Petaling Jaya, Selangor Darul Ehsan, Malaysia.
BA Department of Respiratory Therapy, College of Applied Medical Sciences, King Saud bin Abdulaziz University for Health Sciences, Al Ahsa, Saudi Arabia, King Abdullah International Medical Research Center, Al Ahsa, Saudi Arabia.

Data Availability: Datasets analyzed for the current study results are available from the first and corresponding authors upon reasonable request.

REFERENCES

Ahmad, N., Oranye, N. O., & Danilov, A. (2017). Rasch analysis of Stamps's Index of Work Satisfaction in nursing population. *Nursing open*, *4*(1), 32-40.

Akinwale, O. E., & George, O. J. (2020). Work environment and job satisfaction among nurses in government tertiary hospitals in Nigeria. *Rajagiri Management Journal*, *14*(1), 71-92.

Ali, H. M., & Abood, S. A. (2020). Relation between leadership styles and behaviors of nurse managers' and organizational commitment of staff nurses. *Minia Scientific Nursing Journal*, *7*(1), 54-62.

AlSabei, S. D., Labrague, L. J., Miner Ross, A., Karkada, S., Albashayreh, A., Al Masroori, F., & Al Hashmi, N. (2020). Nursing work environment, turnover intention, job burnout, and quality of care: The moderating role of job satisfaction. *Journal of Nursing Scholarship*, *52*(1), 95-104.

Arian, M., Soleimani, M., & Oghazian, M. B. (2018). Job satisfaction and the factors affecting satisfaction in nurse educators: A systematic review. *Journal of Professional Nursing*, *34*(5), 389-399.

Asbari, M., Santoso, P. B., & Prasetya, A. B. (2020). Elitical and antidemocratic transformational leadership critics: is it still relevant?(A literature study). *International Journal of Social, Policy and Law*, *1*(1), 12-16.

Ayalew, F., Kibwana, S., Shawula, S., Misganaw, E., Abosse, Z., van Roosmalen, J., Stekelenburg, J., Kim, Y. M., Teshome, M., & Mariam, D. W. (2019). Understanding job satisfaction and motivation among nurses in public health facilities of Ethiopia: a cross-sectional study. *BMC Nursing*, *18*(1), 46. https://doi.org/10.1186/s12912-019-0373-8

Bass, B. M. (1985). Leadership and performing beyond expectations. In: New York Press.

Bass, B. M., & Riggio, R. E. (2006). Transformational leadership.

Bayraktar, A. K., & Sivrikaya, S. K. (2018). Nursing Ethics in the Emergency Department/Acil Servis Hemsirelik Hizmetlerinde Etik. *Journal of Education and Research in Nursing*, *15*(1), 57-63.

Boamah, S. A. (2022). The impact of transformational leadership on nurse faculty satisfaction and burnout during the COVID-19 pandemic: A moderated mediated analysis [https://doi.org/10.1111/jan.15198]. *Journal of Advanced Nursing*, *78*(9), 2815-2826. https://doi.org/https://doi.org/10.1111/jan.15198

Boamah, S. A., Laschinger, H. K. S., Wong, C., & Clarke, S. (2018). Effect of transformational leadership on job satisfaction and patient safety outcomes. *Nursing outlook*, *66*(2), 180-189.

Carless, S. A., Wearing, A. J., & Mann, L. (2000). A short measure of transformational leadership. *Journal of Business and Psychology*, *14*, 389-405.

Choi, S., & Kim, M. (2019). Effects of structural empowerment and professional governance on autonomy and job satisfaction of the Korean nurses. *Journal of Nursing Management*, *27*(8), 1664-1672.

Copanitsanou, P., Fotos, N., & Brokalaki, H. (2017). Effects of work environment on patient and nurse outcomes. *British journal of nursing*, *26*(3), 172-176.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Dor, A., & Halperin, O. (2022). Nurses' Job Satisfaction and Motivation: Patients' and Nurses' Perceptions. *Journal of Biosciences and Medicines*, *10*(6), 121-131.

Dousin, O., Collins, N., & Kler, B. K. (2019). Work-life balance, employee job performance and satisfaction among doctors and nurses in Malaysia. *International Journal of Human Resource Studies*, *9*(4), 306-319.

Elsahoryi, N. A., Alathamneh, A., Mahmoud, I., & Hammad, F. (2022). Association of salary and intention to stay with the job satisfaction of the dietitians in Jordan: A cross-sectional study. *Health Policy OPEN*, *3*, 100058.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, *5*(1), 1-4.

Frisicale, E. M., Grossi, A., Cacciatore, P., Carini, E., Villani, L., Pezzullo, A. M., Gentili, A., Cabral, M., Silenzi, A., & Favaretti, C. (2019). The need of leadership in managing healthcare and policy-making. *G. Ital. Health Technol. Assess*, *12*, 1-13.

Galanis, P., Moisoglou, I., Katsiroumpa, A., Vraka, I., Siskou, O., Konstantakopoulou, O., Meimeti, E., & Kaitelidou, D. (2023). Increased Job Burnout and Reduced Job Satisfaction for Nurses Compared to Other Healthcare Workers after the COVID-19 Pandemic. *Nurs Rep*, *13*(3), 1090-1100. https://doi.org/10.3390/nursrep13030095

Holland, P., Tham, T. L., Sheehan, C., & Cooper, B. (2019). The impact of perceived workload on nurse satisfaction with work-life balance and intention to leave the occupation. *Applied Nursing Research*, *49*, 70-76.

Hussain, M. K., & Khayat, R. A. M. (2021). The impact of transformational leadership on job satisfaction and organisational commitment among hospital staff: a systematic review. *Journal of Health Management*, *23*(4), 614-630.

Kalinowska, P., & Marcinowicz, L. (2020). Job satisfaction among family nurses in Poland: A questionnaire□based study. *Nursing open*, *7*(6), 1680-1690.

Kiwanuka, F., Nanyonga, R. C., Sak□Dankosky, N., Muwanguzi, P. A., & Kvist, T. (2021). Nursing leadership styles and their impact on intensive care unit quality measures: An integrative review. *Journal of Nursing Management*, *29*(2), 133-142.

Komorowski, M., Marshall, D., Salciccioli, J., & Crutain, Y. (2016). Exploratory Data Analysis. In (pp. 185-203). https://doi.org/10.1007/978-3-319-43742-2_15

Labrague, L. J., & de Los Santos, J. A. A. (2021). Fear of Covid□19, psychological distress, work satisfaction and turnover intention among frontline nurses. *Journal of Nursing Management*, *29*(3), 395-403. https://doi.org/10.1111/jonm.13168

Labrague, L. J., McEnroe□Petitte, D. M., & Tsaras, K. (2019). Predictors and outcomes of nurse professional autonomy: A cross□sectional study. *International Journal of Nursing Practice*, *25*(1), e12711.

Lee, S. E., Dahinten, S. V., & MacPhee, M. (2016). Psychometric evaluation of the McCloskey/Mueller Satisfaction Scale. *Jpn J Nurs Sci*, *13*(4), 487-495. https://doi.org/10.1111/jjns.12128

Li, X., Zhang, Y., Yan, D., Wen, F., & Zhang, Y. (2020). Nurses' intention to stay: The impact of perceived organizational support, job control and job satisfaction. *Journal of Advanced Nursing*, *76*(5), 1141-1150.

Lorber, M., & Skela Savič, B. (2012). Job satisfaction of nurses and identifying factors of job satisfaction in Slovenian Hospitals. *Croat Med J*, *53*(3), 263-270. https://doi.org/10.3325/cmj.2012.53.263

Lorber, M., & Skela Savič, B. (2012). Job satisfaction of nurses and identifying factors of job satisfaction in

Slovenian Hospitals. *Croat Med J*, *53*(3), 263-270. https://doi.org/10.3325/cmj.2012.53.263

Lu, H., Zhao, Y., & While, A. (2019). Job satisfaction among hospital nurses: A literature review. *International Journal of Nursing Studies*, *94*, 21-31. https://doi.org/https://doi.org/10.1016/j.ijnurstu.2019.01.011

Masood, M., & Afsar, B. (2017). Transformational leadership and innovative work behavior among nursing staff. *Nursing inquiry*, *24*(4), e12188.

McCloskey, J. C., & McCain, B. E. (1990). Satisfaction, commitment and professionalism of newly employed nurses. *Image: The Journal of Nursing Scholarship*, *19*(1), 20-24.

Moon, S. E., Van Dam, P. J., & Kitos, A. (2019). Measuring transformational leadership in establishing nursing care excellence. Healthcare (4), 1-11. In.

Mousazadeh, S., Yektatalab, S., Momennasab, M., & Parvizy, S. (2019). Job satisfaction challenges of nurses in the intensive care unit: A qualitative study. *Risk management and healthcare policy*, 233-242.

Nantsupawat, A., Kunaviktikul, W., Nantsupawat, R., Wichaikhum, O. A., Thienthong, H., & Poghosyan, L. (2017). Effects of nurse work environment on job dissatisfaction, burnout, intention to leave. *International nursing review*, *64*(1), 91-98.

Niskala, J., Kanste, O., Tomietto, M., Miettunen, J., Tuomikoski, A. M., Kyngäs, H., & Mikkonen, K. (2020). Interventions to improve nurses' job satisfaction: A systematic review and meta□analysis. *Journal of Advanced Nursing*, *76*(7), 1498-1508.

Öksüz, E., Demiralp, M., Mersin, S., Tüzer, H., Aksu, M., & Sarıkoc, G. (2019). Resilience in nurses in terms of perceived social support, job satisfaction and certain variables. *Journal of Nursing Management*, *27*(2), 423-432.

Penconek, T., Tate, K., Bernardes, A., Lee, S., Micaroni, S. P. M., Balsanelli, A. P., de Moura, A. A., & Cummings, G. G. (2021). Determinants of nurse manager job satisfaction: A systematic review. *International Journal of Nursing Studies*, *118*, 103906.

Pohl, S., & Galletta, M. (2017). The role of supervisor emotional support on individual job satisfaction: A multilevel analysis. *Applied Nursing Research*, *33*, 61-66.

Price, S., & Reichert, C. (2017). The importance of continuing professional development to career satisfaction and patient care: meeting the needs of novice to mid-to late-career nurses throughout their career span. *Administrative Sciences*, *7*(2), 17.

Rahman, M. M. (2023). Sample size determination for survey research and non-probability sampling techniques: A review and set of recommendations. *Journal of Entrepreneurship, Business and Economics*, *11*(1), 42-62.

Ryan, C., Powlesland, J., Phillips, C., Raszewski, R., Johnson, A., Banks-Enorense, K., Agoo, V. C., Nacorda-Beltran, R., Halloway, S., & Martin, K. (2019). Nurses' perceptions of quality care. *Journal of Nursing Care Quality*, *32*(2), 180-185.

Singh, A., Chakradhar, R., & Joshi, N. (2021). Job Satisfaction among Nurses Working in a Tertiary Level Government Hospital. *Medical Journal of Shree Birendra Hospital*, *20*, 30-35. https://doi.org/10.3126/mjsbh.v20i1.28777

Soesanto, E., Yanto, A., Irani, N., Pranata, S., Rejeki, S., & Sasmito, P. (2022). Job satisfaction among primary health care nurses. *Int J Public Heal Sci*, *11*(4), 1416-1423.

Specchia, M. L., Cozzolino, M. R., Carini, E., Di Pilla, A., Galletti, C., Ricciardi, W., & Damiani, G. (2021). Leadership Styles and Nurses' Job Satisfaction. Results of a Systematic Review. *Int J Environ Res Public Health*, *18*(4). https://doi.org/10.3390/ijerph18041552

Vlaev, I., Schmidtke, K. A., Balen, J., & Dormon, F. (2017). Healthworkers' motivation in low-and middle-income countries: A systematic review of the literature. *Medical Research Archives*, *5*(8).

Wali, R., Aljohani, H., Shakir, M., Jaha, A., & Alhindi, H. (2023). Job Satisfaction Among Nurses Working in King Abdul Aziz Medical City Primary Health Care Centers: A Cross-Sectional Study. *Cureus*, *15*(1), e33672. https://doi.org/10.7759/cureus.33672

Wei, H., Horsley, L., Cao, Y., Haddad, L. M., Hall, K. C., Robinson, R., Powers, M., & Anderson, D. G. (2023). The associations among nurse work engagement, job satisfaction, quality of care, and intent to leave: A national survey in the United States. *International journal of nursing sciences*, *10*(4), 476-484. https://doi.org/https://doi.org/10.1016/j.ijnss.2023.09.010

Xie, Y., Gu, D., Liang, C., Zhao, S., & Ma, Y. (2020). How transformational leadership and clan culture influence nursing staff's willingness to stay. *Journal of nursing management*, *28*(7), 1515-1524.

Yarbrough, S., Martin, P., Alfred, D., & McNeill, C. (2017). Professional values, job satisfaction, career

development, and intent to stay. *Nursing Ethics*, *24*(6), 675-685.