Effect of a Training Program about Sustainability Development Management on Nurses' Green Management: A Quasi Experimental Study

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Abstract:

Background: *Nurses are uniquely positioned to promote environmental sustainability in healthcare, yet their knowledge and green behaviours remain limited despite positive attitudes.* ***Aim:*** *To evaluate the effect of a training program on sustainability development management on nurses' green management behaviour at Medina General Hospital, Saudi Arabia.* ***Design:*** *Quasi-experimental (pre-post) design.* ***Setting:*** *All inpatient departments at Medina General Hospital, King Salman Medical City.* ***Sampling:*** *Convenience sample of 120 nurses with ≥1 year of experience.* ***Tools:*** *Four questionnaires assessed nurses' knowledge, sustainability consciousness, attitudes, and green management behaviours at pre-test, immediate post-test, and three-month follow-up.* ***Results:*** *The training program significantly improved nurses' knowledge (from 78.3% low pre-test to 98.3% high immediate post-test), sustainability consciousness (from 40.8% low to 81.7% high), and green management behaviors (from 68.3% low to 83.3% high). Strong positive correlations were found between green behaviors and knowledge, consciousness, and attitudes ($r = 0.940–0.973$, $p < 0.001$).* ***Conclusion:*** *The training program effectively enhanced nurses' sustainability-related knowledge, consciousness, attitudes, and green behaviors.* ***Recommendations:*** *Integrate sustainability into mandatory nursing training, establish Green Nurse Teams, incorporate sustainability into nursing curricula, and develop Arabic-language educational materials.* ***Keywords:*** *Green Management Behavior, Nurses, Sustainability Consciousness, Sustainable Development Management, Training Program.*

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1. Introduction

Patient safety entails the prevention of avoidable harm and the provision of treatment below an acceptable risk threshold (Janghorban et al., 2025). The culture of patient safety encompasses the shared values, beliefs, conventions, and behaviours that mitigate the risk of patient harm in healthcare settings. The culture of patient safety is evaluated through the perspectives, values, and practices about safety held by healthcare workers, spanning from top management to frontline staff. An effective patient safety culture encourages nurses to voice concerns and participate in safety initiatives without fear of retaliation. Psychological safety and transparent leadership mitigate tiredness and enhance job happiness. Healthcare providers must feel confident addressing safety concerns. Transparent communication, continuous education, and non-punitive error reporting enhance patient care (Alrasheeday, et al., 2025).

Safety culture is established by the endorsement of safety initiatives, the allocation of resources for safety enhancement, and the execution of safety protocols (Tadia, Kotwal & Jalaunia, 2025). When leaders exemplify safety, workers are motivated to adhere to these standards, leading to constructive behaviour and decision-making. Leadership must cultivate trust with direct care nurses (Tadia, Kotwal & Jalaunia, 2025).

Patient safety is contingent upon effective communication. Adverse incidences diminish when personnel feel secure in voicing concerns, reporting near misses, and collaborating across departments. Safety huddles, debriefings, and SBARs facilitate expedited problem-solving and knowledge acquisition. Feedback from front-line workers and attentive listening can uncover safety issues and improve safety (Agustini, Wahyuni, Mahaputra, & Putri, 2025).

An effective patient safety culture facilitates organisational learning. Systematic and procedural enhancements arise from errors, rather than human shortcomings. Training healthcare workers in root cause analysis, teamwork, and education helps minimise errors. Healthcare need a robust and flexible culture owing to its intricacy and significance (Vikan, et al., 2025). An affirmative safety culture enhances nurse job satisfaction. Nurse job satisfaction increases when they are motivated and appreciated in a secure and nurturing environment. Al-Surimi et al. (2022). Nurse satisfaction is contingent upon the work environment, workload, compensation, collegiality, career advancement, and acknowledgement. Positive reinforcement and the perception that their work contributes to

organisational objectives enhance nurses' performance, commitment, and well-being (Bai & Bai, 2024).

The quality of the workplace significantly influences nurse satisfaction. Favourable outcomes arise from effective leadership, adequate workforce, manageable workload, and sufficient equipment and supplies. Content and collaborative work environments enable nurses to operate safely and efficiently, free from stress and fatigue. Training in quality care enhances nurse satisfaction (Wong, 2024). Nurse satisfaction is influenced by interactions with supervisors, colleagues, and patients. Collaboration, respect, and effective communication among healthcare professionals enhance confidence and a sense of belonging. Nurses manage mental and physical stress via teamwork. Professional discord and ineffective communication may result in dissatisfaction and emotional fatigue (Cubelo, Al Jabri, Jokiniemi, & Turunen, 2024). Professional advancement encompasses nurse satisfaction. Ongoing education, training, and promotion can enhance nurses' competencies and signify the organization's dedication to their professional development.

Aim of the present study

The present study aimed to study the effect of training program about sustainability development management on nurses' green management behavior in Medina General Hospital

1.2. Research Hypothesis

H1. Nurses' knowledge regarding sustainability development management improves after implementing the training program.

H2. Nurses' green management behavior improves after implementing the training program.

Method

1.1. Design:

Quasi experimental (pre – post) research design will be used to achieve the aim of this study. **Setting:**

This study was conducted at all inpatient departments in Medina General Hospital, King Salman Medical City, Saudi Arabia

Participants:

The subject of the present study includes a convenience sample of nurses (n=120) who were available during data collection and responsible for

patient care in various units. These nurses were selected based on their availability

1.2. Tool of data collection

Tool I: Nurses' Knowledge Sustainability Development Management Questionnaire:

This questionnaire was composed of two parts:

The first part was used to identify personal characteristics of nurses such as age, gender, educational qualification, years of experience, and unit of work.

The second part was designed by a researcher after reviewing related literature (Moustafa, & Elsabahy, 2022; Leppänen, et al., 2022) to assess study nurses' pre-post knowledge about sustainability development management during different phases of the training program. It consisted of questions in the form of true and false and multiple-choice that were related to sustainability development management.

The scoring system of the Nurses' Knowledge Sustainability Development Management Questionnaire was classified into three categories based on a predetermined cut-off point, as follows:

- Low level: < 50% of total correct answers.
- Moderate level: 50% – 70% of total correct answers.
- High level: > 70% of total correct answers.

Tool II: Sustainability Consciousness Questionnaire (SCQ)

It was developed by Gericke et al. (2019) to assess sustainability consciousness among nurses. It consisted of 27 items that were categorized under 3 dimensions namely, environmental sustainability consciousness, social sustainability consciousness, and economic sustainability consciousness. Each dimension had 9 items. Nurses' responses were measured by a 4-point Likert Scale.

The scoring system of the Sustainability Consciousness Questionnaire was classified into three categories based on a predetermined cut-off point, as follows:

- Low level: < 60% of total score (< 65 points)
- Moderate level: 60% – 75% of total score (65 – 81 points)
- High level: > 75% of total score (> 81 points)

Tool III: Sustainability Attitudes Questionnaire (SAQ):

The Sustainability Attitudes in Nursing Survey was developed by SANS-2; Richardson et al., (2015), and Richardson et al., (2016) to assess the attitudes towards sustainability development. The SAQ consisted of fourteen items that were divided into three categories. The study participants graded the SAQ items on a five-point Likert scale.

The scoring system of the Sustainability Consciousness Questionnaire was classified into:

- Low level: < 60% of total score (< 42 points)
- Moderate level: 60% – 75% of total score (42 – 52 points)
- High level: > 75% of total score (> 52 points)

Tool IV: Nurses' Green management Behaviors Questionnaire

It was developed by Ones and Dilchert (2012) to evaluate the green behavior levels of nurses. The questionnaire was composed of 40 descriptive items that were categorized under five dimensions. Nurses' responses were measured by a five-point scale.

The scoring system of the Sustainability Consciousness Questionnaire was classified into:

- Low level: < 60% of total score (< 120 points)
- Moderate level: 60% – 75% of total score (120 – 150 points)
- High level: > 75% of total score (> 150 points)

1.1.1.Validity and Reliability

The research instruments were evaluation for face and content validity by five subject matter experts, leading to the requisite adjustments. Reliability testing was conducted and assessed based on the consistency of findings produced by items measuring the same concept. The instruments were evaluated for reliability utilising the Cronbach alpha test. The researcher adapted and translated the knowledge test into Arabic. The reliability coefficients for the Nurses' Knowledge Sustainability Development Management Questionnaire, Sustainability Consciousness Questionnaire (SCQ), Sustainability Attitudes in Nursing Survey, and Nurses' Green Management Behaviours Questionnaire were 0.832, 0.812, 0.872, and 0.788, respectively.

2.6. Ethical Considerations

Ethical permission was secured from the Research Ethics Committee of the Faculty of Nursing, Mansoura University, under code number (661). An accord was secured from the chosen hospital for data acquisition. The agreement of staff nurses who satisfy the inclusion criteria to complete the questionnaires and participate in the study was regarded as written informed consent from the participants. The researcher elucidated the objective of the study to nursing managers to enhance collaboration throughout the data gathering process. Additionally, verbal permission was acquired from each subject. They were apprised of their rights to decline participation or withdraw at any moment, without the necessity of providing

justification. They were guaranteed that all acquired information would be handled secretly and utilised solely for research purposes. They also guarantee that the study procedures do not produce any detrimental impact on participants.

1.2. Pilot study

A pilot study was carried out for 10% (30) of the study participants to check and ensure the clarity and applicability of the tools in addition to calculate the duration required for filling all questionnaires. All nurses who participated in pilot study were excluded from the study participants. Necessary modifications were made accordingly.

2.7. Data Collection Process

- An official permission was obtained from the Faculty of Nursing, Mansoura University to carry out the study. An official letter was issued with approval from the director of Medina General Hospital, King Salman Medical City, Saudi Arabia after the aim of the study and the schedule of data collection were explained. The researcher met the participants individually to clarify the aim of the study and got their approval to participate.
- The questionnaire sheet was distributed to nurses. Data was collected during the 5-6 months period from March to September 2025 through a self-administered questionnaire that was distributed to nurses.
- The Nurses' Knowledge Sustainability Development Management Questionnaire was distributed to nurses according to a predetermined unit schedule. The Sustainability Attitudes Questionnaire was distributed to nurses according to a predetermined unit schedule.
- The researcher was present for the entire duration of data collection for clarification. The data collected during this phase constituted the pretest for the study.
- Based on the data collected and with the help of a literature review, the researcher designed a sustainability training program for nurses. The sustainability training program was implemented, and the nurses were divided into small groups. Each group consisted of a number of nurses according to their availability and workload. Different teaching methods were used, such as brainstorming, lectures, videos, and discussion. Handouts that were prepared by the researcher were distributed to the participants. Immediately after the completion of the training program, the four tools of data

collection were distributed to the participants. The researcher began to follow up on the proposed progress after the training program through a comparison of the post-test results with the baseline findings obtained in the pretest assessment by using the same four tools.

2.8. Statistical Analysis

The collected data were coded, entered, tabulated and analyzed using SPSS (Statistical Package for Social Science) version 25 (IBM Corporation, Armonk, NY, USA). For quantitative data, the range, mean and standard deviation were calculated.

3. Results

Table (1) shows personal characteristics of the studied staff nurses at Medina General Hospital, Saudi Arabia. indicates that 40.8% of the surveyed nurses were aged between 30 and 40, with the majority being female at 84.2%, and 61.7% identified as single. Additionally, 89.2% possessed a bachelor's degree in education, 40.8% had between 5 and less than 10 years of experience, and 62.5% were employed in inpatient units.

Table (2) displays levels of the studied nurse's knowledge about sustainability development management through training program phases at Medina General Hospital, Saudi Arabia. It showed that there was statistically significant improvement in sustainability development management knowledge level through training program phases. In pretest phase nurses' knowledge was at low level (78.3%), while in immediately posttest and after 3 months follow up test phases was at high level (98.3%), (79.2%) respectively.

Table (3) displays levels of the studied nurse's sustainability consciousness through training program phases at Medina General Hospital, Saudi Arabia. It showed that there was statistically significant improvement in sustainability consciousness level through training program phases. In pretest phase nurses' sustainability consciousness was at low level (40.8%), while in immediately posttest and after 3 months follow up test phases was at high level (81.7%), (55.8%) respectively.

Table (4) displays levels of the studied nurse's sustainability attitudes through training program phases at Medina General Hospital, Saudi

Arabia. It showed that there was statistically significant improvement in sustainability attitudes level through training program phases. In pretest phase nurses' sustainability attitudes was at low level (55.0%), while in immediately posttest and after 3 months follow up test phases was at high level (56.7%). Regarding total sustainability attitudes scores, the total mean score of nurses' sustainability attitudes at pretest phase is (40.77±6.79), and improved at immediately posttest and after 3 months follow up test phase to (54.69±10.54) and (52.38±11.82) respectively.

Figure (1) displays levels of the studied nurse's green management behaviors through training program phases at Medina General Hospital, Saudi Arabia. It showed that there was statistically significant improvement in green management behaviors level through training program phases. In pretest phase nurses' green management behaviors was at low level (68.3%), while in immediately posttest and after 3 months follow up test phases was at high level (83.3%) and (79.2%) respectively.

Table (5) illustrates correlation between total scores of green management behaviors and sustainability knowledge, consciousness and attitudes scores among the studied nurses through program phases. According to the table, there were a statistically significant positive correlation between green management behaviors of the studied nurses and their sustainability development management knowledge scores at pretest phase ($r = 0.955$, $p < 0.001$), immediately posttest ($r = 0.940$, $p < 0.001$) and after 3 months follow up test phase ($r = 0.940$, $p < 0.001$). Also, there were a statistically significant positive correlation between green management behaviors of the studied nurses and their sustainability consciousness scores at pretest phase ($r = 0.940$, $p < 0.001$), immediately posttest ($r = 0.950$, $p < 0.001$) and after 3 months follow up test phase ($r = 0.969$, $p < 0.001$). Additionally, there were a statistically significant positive correlation between green management behaviors of the studied nurses and their sustainability attitudes scores at pretest phase ($r = 0.964$, $p < 0.001$), immediately posttest ($r = 0.923$, $p < 0.001$) and after 3 months follow up test phase ($r = 0.973$, $p < 0.001$).

Table (1): Personal characteristics of the studied nurses at Medina General Hospital, Saudi Arabia (n=120).

Variables	No	%
Age (Years)		
▪ 23-30	33	27.5
▪ >30-40	49	**40.8**
▪ >40-49	38	31.7
Mean ±SD	***37.17±8.27***	
Gender		
▪ Male	19	15.8
▪ Female	101	84.2
Educational qualification		
▪ Diploma nursing	24	20.0
▪ Technical institute of nursing	25	20.8
▪ Bachelor degree	71	89.2
Experience (Years)		
▪ < 5	23	19.2
▪ 5-<10	49	40.8
▪ ≥10	48	40.0
Mean ±SD	***12.10±3.14***	
Marital status		
▪ Single	74	61.7
▪ Married	36	30.0
▪ Widow	8	6.7
▪ Divorced	2	1.7
Unit		
▪ Inpatients	75	62.5
▪ Outpatients	25	20.8
▪ ICU	20	16.7

Table (2): Knowledge levels of the studied nurses about sustainability development management through program phases (n=120).

Knowledge total score level about sustainability development management	Total knowledge level of the studied staff nurses through training program phases					
	Pretest		Posttest		Follow up	
	No.	%	No.	%	No.	%
Low level	94	78.3	94	78.3	94	78.3
Moderate level	5	4.2	2	1.7	7	5.8
High level	21	17.5	118	98.3	95	79.2
x2 test P value	201.943 0.0001*					

N.B. Knowledge level was classified into; Low level (<60% of total scores), Moderate level (60-75% of total scores) and high level (>75% of total scores).

Table (3): Level of sustainability consciousness of the studied nurses through program phases (n=120).

sustainability consciousness total score level about sustainability development management	Total sustainability consciousness level of the studied nurses through training program phases					
	Pretest		Posttest		Follow up	
	No.	%	No.	%	No.	%
Low level (27-80)	49	40.8	0	0	3	2.5
Moderate level (81-102)	71	59.2	22	18.3	50	41.7
High level(103-135)	0	0	98	81.7	67	55.8
x2 test P value	203.631 0.0001*					

N.B. Sustainability Consciousness level was classified into; Low level (<50% of total scores), Moderate level (50-70% of total scores) and high level (>70% of total scores).

***Statistically significant (P<0.05)**

Table (4): Total sustainability attitudes scores and level of the studied nurses through program phases (n=120).

Total Sustainability Attitudes (Each item was scored 1-5)	Total Sustainability Attitudes of the studied staff nurses pre and post training program (n=120)						x ² test P value
	Pretest		Immediate posttest		Follow up		
	No.	%	No.	%	No.	%	
Low level (14-41)	66	55.0	12	10.0	24	20.0	109.284
Moderate level (42-53)	49	40.8	40	33.3	28	23.3	0.0001*
High level (54-70)	5	4.2	68	56.7	68	56.7	
•Total Sustainability Attitudes scores (14-70)							
Range	24-56		31-70		24-70		
Mean±SD	40.77±6.79		54.69±10.54		52.38±11.82		
x ² value	107.724						
P value	0.0001*						

N.B. Sustainability Attitudes level was classified into; Low level (<50% of total scores), Moderate level (50-70% of total scores) and high level (>70% of total scores).

***Statistically significant (P<0.05)**

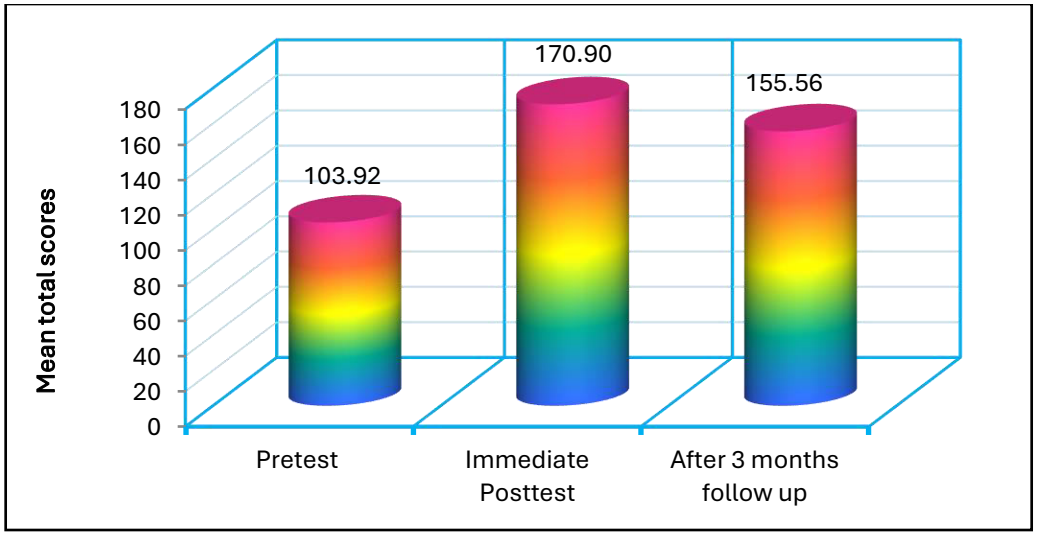

Figure (1): Mean scores of total Green management Behaviors of the studied nurses through program phases (n=120).

Table (5): Correlation between total scores of green management behaviors and sustainability knowledge, consciousness and attitudes scores among the studied nurses through program phases (n=120).

Variables	Total green management behaviors scores of the studied nurses through program phases					
	Pretest		Immediate posttest		After 3 months follow up	
	r	p value	r	p value	r	p value
Total sustainability development management knowledge scores	0.955	0.0001*	0.929	0.0001*	0.966	0.0001*
Total sustainability consciousness scores	0.940	0.0001*	0.950	0.0001*	0.969	0.0001*
Total sustainability attitudes scores	0.964	0.0001*	0.923	0.0001*	0.973	0.0001*

*Statistically significant (P<0.05) r=Correlation Coefficient

4.Discussion:

Sustainable Development Management integrates social, economic, and environmental considerations into organisational decision-making. It entails developing, executing, and assessing programmes that promote social fairness, economic success, and ecological sustainability while meeting existing demands without compromising future requirements. This management emphasises resource efficiency, waste reduction, ethical procurement, community participation, and resilience in health services while maintaining good patient care and operational efficiency (Yassin, Akel & Rabou, 2025).

Sustainable Development Management helps nurses integrate environmental, social, and economic factors into healthcare procedures. This plan creates a sustainable culture in the organisation, teaching nurses how to reduce waste, save energy, and utilise resources responsibly. This aligns professional nursing activities with sustainability goals, improving patient care and ecological responsibility (Othman, Abdelall & Ali, 2025). Green management behaviour of nurses is ecologically responsible clinical

behaviour. These behaviours include waste minimisation, water and energy saving, toxic avoidance, and disposal. Embracing ecological responsibility in nursing practice promotes healthier surroundings and aligns with organisational and global goals (Sürme, Maraş & Aydin Akbuğa, 2025). Healthcare sustainability challenges have grown in relevance because to patient power, specialisation, technology improvements, and the need to provide better treatment (Elabed, Belal, Shamayleh.2019). Given the expanding need for health services and the large budgetary imbalance, healthcare sustainability is the capacity to offer services to future generations (Nyholm, Salmela, Nystrom, Koskinen, 2018). Nurses create Green Teams to promote sustainable practices and reduce healthcare institutions' environmental effect. Improving sustainable health care practices requires examining nurses' environmental awareness, behaviour, and impediments (Luque-Alcaraz et al., 2024) despite current information.

This study found that most nurses had little awareness of sustainability development management before training.The majority of nurses in the study did not attend earlier sustainable development management training owing to time constraints and job responsibilities. Leppanen, et al. (2022) found that nurse managers had low SD knowledge as ecologically sustainable health care leaders. Nurse managers felt their low economic understanding and ecological perspectives hindered their decision-making power.

These findings contradict Algabar, Ghadery, Mohamed, & Shaheen.(2024) found a high overall percent mean score for nurse managers' sustainable management behaviour in building sustainability consciousness among nurses.About two-thirds of nurse managers maintained their managerial styles.

Consumables and resources for sustainable behaviour are lacking.The training programme also improved nurses' sustainability awareness. Initially, few members shared sustainability-focused views. However, after the implementation training programme, most nurses had high sustainability consciousness intervention and agreement levels climbed significantly. This may indicate a major shift in environmental, social, and economic sustainability consciousness. At the three-month follow-up, awareness dropped somewhat, but it remained significantly above baseline, indicating that the training had a lasting impact on nursing staff sustainability practices.This tendency may be due to the program's effectiveness in raising awareness and establishing accountability for environmental, social, and economic sustainability, while the little fall may

indicate that conscious attitudes require continued participation to remain prominent.

El Sayed, Ghallab, Ahmed, & Amin endorse this study.(2024) discovered that more than half of nursing students at three Egyptian colleges were unaware of the SDGs.While social media was scored high for sustainability awareness, it raises worries about the lack of sustainability education in academic contexts (Egyptians and digital: 2022). Anåker and Elf (2022) discovered that a "Green Leadership" course for Swedish nurse managers led to significant changes in sustainability consciousness, notably on personal agency. Participants initially had low agreement that their behaviours may affect their unit's environmental effect. After the training, featuring concrete tools and case studies, agreements about nurse-led sustainability projects' success improved, showing a shift in consciousness and self-efficacy. However, Jackson et al. (2022) examined a 4-week sustainability module in nursing curriculum to raise environmental and healthcare awareness. The majority of nurses were neutral before the intervention and opposed to sustainable resource usage. Few nurses converted from opposing to agreeing after training, demonstrating that formal education did not overshadow clinical objectives and worries about sustainability in acute care situations. This study found that the training programme improved nursing staff sustainability attitudes significantly. Prior to the intervention, few nurses shared sustainability-oriented views. Positive attitudes and agreement levels increased soon after the instruction .Amazingly, the three-month follow-up evaluation sustained and even improved this beneficial trend. This suggests that the training changed participants' views and increased their support for sustainable healthcare practices. The programme may have been able to link sustainability ideas to fundamental nursing duties, making them more relevant and meaningful and helping to maintain good attitude improvements.

Green measures including non-toxic cleaning (Luque-Alcaraz et al., 2024). Nurses should practise green behaviour to promote patient care, community health, and sustainability (Maiz et al., 2023). Nurses using these methods can improve public and individual health (Maiz et al., 2023). The training dramatically improved nurses' green management behaviours. Few individuals indicated strong green behaviour involvement at baseline. Over 50% of the sample reported extremely high involvement following the intervention, increasing rapidly.

Study results match Chen et al.(2023) found that nurses prioritised energy and material saving because they are clearly visible and executed in everyday practice. Some studies suggest that particular training treatments increase nurses' green management behaviours. After teaching nursing managers green management, El-Sayed et al. (2025) reported a considerable improvement from poor green practices to high competency. The managers went from poor waste segregation and energy conservation awareness to high behaviours sustained at follow-up and full adoption of sustainable procedure by leading green activities throughout the plant. This study found a robust, constant, and statistically significant positive link between nurses' green management behaviours and their sustainable development management knowledge, consciousness, and attitudes. Sustainability-related knowledge, awareness, and positive attitudes were linked to ecologically responsible professional behaviours in all programme stages before, after, and three months after training. Professional development's interdependence of learning, perception, and action may explain these outcomes. Nurses' awareness and ethics begin with adequate sustainability understanding.

This study confirmed El Sawah and Elkholy (2024)'s findings on prosocial leadership and organisational sustainability: nurses' green behaviour moderating role.Nursing green behaviour and organisational sustainability were found to be positively correlated. According to Algabar, El-Sayed, & AbdElhameed (2023), nurse managers' sustainable management behaviours build sustainability consciousness among nurses and have a significant positive correlation with nurses' green behaviours. According to Alshammari et al. (2022), Saudi Arabian hospitals that investigated the "knowledge-attitude-practice" (KAP) model had nurses with higher sustainability knowledge exam results.They also reported more positive attitudes and, critically, more green measures like energy reduction and biomedical waste segregation.Path analysis proved knowledge drives behaviour directly and indirectly through attitudes.Mousa & Othman (2020) found that nurses' personal environmental consciousness (a measure of general eco-awareness and concern) was the strongest predictor of their engagement in workplace green initiatives, surpassing organisational policy.High-environmental consciousness nurses aggressively explored methods to limit resource consumption and influence colleagues, demonstrating how internalised beliefs powerfully impact professional activity.

Despite positive attitudes, Bliss & Stenvall (2018) found that nurses' green behaviours were limited by immediate situational factors like poorly

labelled bins, perceived hygiene conflicts ("single-use feels safer"), and overwhelming acute clinical priorities. This implies that contextual obstacles can override strong consciousness. Like a pandemic surge, Chen et al. (2021) found a transient but substantial dissociation between nurses' sustainability attitudes and behaviours. The present study found a robust and statistically significant positive link between nurses' knowledge of sustainable development management and their sustainability consciousness and attitudes throughout the training programme. This persistent relationship suggests that knowledge increases sustainability awareness and attitudes. The constancy of these correlations over time shows that fundamental understanding shapes awareness and attitudinal commitment needed to improve sustainable nursing practices. The findings are explained by how information acquisition shapes awareness and belief. This cognitive pre-work helps nurses comprehend the significance and importance of sustainability concepts including environmental impact, social equality, and economic health care efficiency. This knowledge increases consciousness and responsibility and strengthens positive attitudes by linking sustainability with professional principles like patient safety, quality of care, and ethical stewardship.

Conclusion

The present study found that Medina General Hospital nurses' knowledge, sustainability consciousness, sustainability attitudes, and green management behaviours were significantly improved by the sustainability development management training programme. In all phases of the programme (pre-test, immediately post-test, and three-month follow-up), nurses' green management behaviours correlated positively with their sustainability knowledge, consciousness, and attitudes.

In light of the study findings, the following recommendations are suggested:

• Cover sustainable development management in Saudi hospital nurses' yearly in-service training.

• Establish "Green Nurse Teams" or sustainability teams in each inpatient department to model and sustain green management practices.

• Incorporate sustainability and environmental health courses into undergraduate and continuing education nursing programmes to provide nurses foundational knowledge early on.

• Create and distribute Arabic handbooks, posters, and digital information on waste reduction, energy conservation, and medical waste disposal.

• Create visible recognition and award systems (e.g., “Green Champion of the Month”) to encourage nurses to conduct ecologically friendly clinical practise.
• Maintain positive knowledge, attitudes, and behaviours after intervention via frequent follow-up and refresher training every 3-6 months.
• Encourage hospital managers to implement supporting institutional policies like recycling bins, energy-efficient equipment, and clearly displayed sustainability procedures to help nurses practice green behaviour.

Further studies:

• Effect of longitudinal sustainability training programs with booster sessions on long-term retention of nurses’ green management behaviors over one to two years.
• Comparative study between public and private hospitals in Saudi Arabia regarding nurses’ sustainability consciousness, attitudes, and green management behaviors.
• Evaluation of organizational and institutional barriers (e.g., time constraints, resource availability, administrative support) that inhibit nurses from practicing green management behaviors despite possessing adequate knowledge and positive attitudes.

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