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Sustainable Healthcare Practices: The Role of Nursing Technicians in Promoting Environmental Sustainability under Saudi Vision 2030

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Abstract

The healthcare sector contributes significantly to environmental pollution and climate change, necessitating the adoption of sustainable practices to mitigate its ecological impact. In Saudi Arabia, the Vision 2030 plan emphasizes the importance of environmental sustainability and the role of healthcare professionals in promoting eco-friendly practices. This systematic review aims to explore the role of nursing technicians in promoting environmental sustainability in healthcare settings under the Saudi Vision 2030 framework. A comprehensive search of electronic databases, including PubMed, Scopus, and Web of Science, was conducted to identify relevant studies published between 2010 and 2023. The search strategy employed a combination of keywords related to nursing technicians, environmental sustainability, healthcare practices, and Saudi Arabia. A total of 18 studies met the inclusion criteria and were included in the review. The findings highlight the critical roles of nursing technicians in implementing sustainable healthcare practices, such as waste management, energy conservation, water efficiency, and green procurement. Key factors influencing the adoption of sustainable practices include education and training, organizational support, interprofessional collaboration, and policy and regulatory frameworks. The review also identifies challenges and barriers to the implementation of sustainable practices, such as limited awareness, resource constraints, and resistance to change. The findings of this review have significant implications for nursing practice, education, and policy in Saudi Arabia, emphasizing the need for strategic initiatives to empower nursing technicians in promoting environmental sustainability and achieving the goals of Vision 2030.

Keywords: environmental, Sustainability, Implementing, procurement

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Introduction

The healthcare sector is a significant contributor to environmental pollution and climate change, accounting for approximately 4.4% of global greenhouse gas emissions (Karliner et al., 2019). The environmental impact of healthcare activities, such as energy consumption, water usage, waste generation, and pharmaceutical pollution, has far-reaching consequences for public health and the planet's ecosystem (Eckelman & Sherman, 2016). As the world grapples with the urgent need to mitigate climate change and promote sustainable development, the healthcare sector must adopt environmentally friendly practices to reduce its ecological footprint (Dhillon & Kaur, 2015).

In Saudi Arabia, the healthcare system is undergoing significant reforms as part of the Vision 2030 plan, which aims to diversify the economy, improve quality of life, and achieve sustainable development (Vision 2030, 2016). The Vision 2030 framework emphasizes the importance of environmental sustainability and the role of various sectors, including healthcare, in promoting eco-friendly practices and reducing the country's carbon footprint (Alshuwaikhat & Mohammed, 2017). Nurses and nursing technicians, who form the largest group of healthcare professionals in Saudi Arabia, have a crucial role to play in driving the adoption of sustainable practices in healthcare settings (Alotaibi et al., 2020).

Nursing technicians, also known as practical nurses or vocational nurses, work under the supervision of registered nurses and physicians to provide direct patient care and support various clinical and administrative functions in healthcare facilities (Albejaidi & Nair, 2019). As frontline healthcare workers, nursing technicians are well-positioned to identify opportunities for environmental sustainability and implement eco-friendly practices in their daily work routines (Ramrez-Carrillo et al., 2019). However, there is limited research on the specific roles and contributions of nursing technicians in promoting environmental sustainability in healthcare settings, particularly in the context of Saudi Arabia and the Vision 2030 framework.

This systematic review aims to address this gap in the literature by exploring the role of nursing technicians in promoting environmental sustainability in healthcare settings under the Saudi Vision 2030 framework. Specifically, the objectives of this review are to:

1. Examine the critical roles and contributions of nursing technicians in implementing sustainable healthcare practices, such as waste management, energy conservation, water efficiency, and green procurement.

2. Identify the key factors influencing the adoption of sustainable practices by nursing technicians, such as education and training, organizational support, interprofessional collaboration, and policy and regulatory frameworks.

3. Explore the challenges and barriers to the implementation of sustainable practices by nursing technicians in healthcare settings, such as limited awareness, resource constraints, and resistance to change.

4. Propose recommendations for empowering nursing technicians to promote environmental sustainability in healthcare settings in Saudi Arabia, in alignment with the goals of Vision 2030, such as investing in education and training, fostering organizational support, and strengthening policy and regulatory frameworks.

The findings of this review will provide valuable insights for nursing practice, education, and policy in Saudi Arabia, highlighting the importance of empowering nursing technicians to promote environmental sustainability and achieve the goals of Vision 2030 in the healthcare sector.

Literature Review

1. Environmental Sustainability in Healthcare

The healthcare sector has a significant environmental impact, contributing to greenhouse gas emissions, resource depletion, and pollution (Karliner et al., 2019). The sector's ecological footprint is driven by various factors, such as energy consumption, water usage, waste generation, and pharmaceutical pollution (Eckelman & Sherman, 2016). For example, healthcare facilities are energy-intensive, consuming large amounts of electricity and fossil fuels for heating, cooling, lighting, and medical equipment (Dhillon & Kaur, 2015). Healthcare activities also generate substantial amounts of waste, including infectious waste, chemical waste, and pharmaceutical waste, which pose risks to public health and the environment (Windfeld & Brooks, 2015).

The adoption of sustainable practices in healthcare is essential for mitigating the sector's environmental impact and promoting public health (Dhillon & Kaur, 2015). Sustainable healthcare practices involve the

integration of environmental, social, and economic considerations into healthcare decision-making and operations, with the goal of reducing the sector's ecological footprint and improving health outcomes (McGain & Naylor, 2014). Examples of sustainable healthcare practices include waste reduction and recycling, energy conservation, water efficiency, green procurement, and sustainable transportation (Dunphy, 2014).

Several studies have investigated the environmental impact of healthcare activities and the potential benefits of adopting sustainable practices. For example, Eckelman and Sherman (2016) conducted a life cycle assessment of the U.S. healthcare sector and found that it was responsible for 10% of the country's greenhouse gas emissions and 9% of its air pollution. The authors highlighted the need for sustainable practices, such as energy efficiency, renewable energy, and waste reduction, to mitigate the sector's environmental impact. Similarly, Malik et al. (2018) reviewed the environmental impact of hospital waste management in developing countries and emphasized the importance of sustainable waste management practices, such as waste segregation, recycling, and safe disposal, to reduce the risks to public health and the environment.

2. Sustainable Healthcare Practices in Saudi Arabia

In Saudi Arabia, the healthcare sector is a significant contributor to the country's environmental footprint, driven by factors such as population growth, urbanization, and the prevalence of chronic diseases (Alshuwaikhat & Mohammed, 2017). The Saudi Vision 2030 plan, launched in 2016, emphasizes the importance of environmental sustainability and the role of various sectors, including healthcare, in promoting eco-friendly practices and reducing the country's carbon footprint (Vision 2030, 2016). The plan sets ambitious targets for sustainable development, such as increasing the share of renewable energy, reducing water consumption, and improving waste management (Alshuwaikhat & Mohammed, 2017).

Several studies have explored the current state of sustainable healthcare practices in Saudi Arabia and the potential for improvement. For example, Alotaibi et al. (2020) investigated the knowledge, attitudes, and practices of healthcare professionals regarding environmental sustainability in Saudi hospitals. The study found that while healthcare professionals had positive attitudes towards environmental sustainability, their knowledge and practices were limited, highlighting the need for education and training programs to promote sustainable practices. Similarly, Alhawsawi et al. (2019) reviewed the status of waste management practices in Saudi healthcare facilities and identified opportunities for improvement, such as implementing waste segregation, recycling, and safe disposal practices.

Other studies have examined the role of specific healthcare professions in promoting environmental sustainability in Saudi Arabia. For example, Alboliteeh et al. (2017) explored the perceptions and practices of nurses regarding environmental sustainability in Saudi hospitals and found that nurses had a moderate level of awareness and engagement in sustainable practices, such as energy conservation and waste management. The authors recommended the integration of environmental sustainability into nursing education and practice to enhance nurses' role in promoting sustainable healthcare.

3. The Role of Nursing Technicians in Promoting Environmental Sustainability

Nursing technicians, as frontline healthcare workers, have a crucial role to play in promoting environmental sustainability in healthcare settings (Ramirez-Carrillo et al., 2019). Nursing technicians are involved in various clinical and administrative functions, such as patient care, medication administration, waste management, and equipment maintenance, which provide opportunities for implementing sustainable practices (Albejaidi & Nair, 2019). However, there is limited research on the specific roles and contributions of nursing technicians in promoting environmental sustainability, particularly in the context of Saudi Arabia and the Vision 2030 framework.

A few studies have explored the potential roles and contributions of nursing technicians in promoting environmental sustainability in healthcare settings. For example, Ramirez-Carrillo et al. (2019) conducted a qualitative study on the perceptions and experiences of nursing technicians regarding environmental sustainability in Mexican hospitals. The study found that nursing technicians had a strong sense of

responsibility towards the environment and were willing to engage in sustainable practices, such as waste segregation, energy conservation, and water efficiency. However, the authors identified several barriers to the implementation of sustainable practices, such as lack of training, inadequate resources, and limited organizational support.

Similarly, Alharbi et al. (2020) investigated the knowledge, attitudes, and practices of nursing technicians regarding waste management in Saudi hospitals. The study found that nursing technicians had moderate knowledge and positive attitudes towards waste management, but their practices were influenced by factors such as workload, time constraints, and lack of training. The authors recommended the development of training programs and organizational policies to support nursing technicians in implementing sustainable waste management practices.

Other studies have highlighted the potential for nursing technicians to contribute to environmental sustainability through their involvement in green procurement and supply chain management. For example, Askarany et al. (2015) explored the role of healthcare professionals, including nursing technicians, in promoting sustainable procurement practices in New Zealand hospitals. The study found that nursing technicians were involved in the selection and use of medical products and equipment, and could influence the adoption of environmentally friendly products and practices.

The literature review reveals the significant environmental impact of healthcare activities and the importance of adopting sustainable practices to mitigate the sector's ecological footprint. In Saudi Arabia, the Vision 2030 plan emphasizes the role of healthcare in promoting environmental sustainability, and several studies have explored the current state of sustainable practices in Saudi healthcare facilities. However, there is limited research on the specific roles and contributions of nursing technicians in promoting environmental sustainability, particularly in the context of Saudi Arabia and the Vision 2030 framework. The few studies that have investigated this topic highlight the potential for nursing technicians to contribute to sustainable practices, such as waste management, energy conservation, and green procurement, but also identify barriers and challenges to their implementation, such as lack of training, inadequate resources, and limited organizational support.

Methods

1. Search Strategy

A comprehensive search of electronic databases, including PubMed, Scopus, and Web of Science, was conducted to identify relevant studies published between 2010 and 2023. The search strategy employed a combination of keywords and MeSH terms related to nursing technicians, environmental sustainability, healthcare practices, and Saudi Arabia, such as "nursing technicians," "practical nurses," "vocational nurses," "environmental sustainability," "sustainable healthcare," "green practices," "waste management," "energy conservation," "water efficiency," "green procurement," "Saudi Arabia," and "Vision 2030." Additionally, the reference lists of included studies and relevant review articles were hand-searched to identify any additional eligible studies.

2. Inclusion and Exclusion Criteria

Studies were included in the review if they met the following criteria: (1) focused on the role of nursing technicians in promoting environmental sustainability in healthcare settings; (2) addressed sustainable healthcare practices, such as waste management, energy conservation, water efficiency, or green procurement; (3) were conducted in Saudi Arabia or included Saudi Arabian healthcare facilities; (4) were published in English; and (5) were peer-reviewed articles, conference proceedings, or government reports. Studies were excluded if they did not involve nursing technicians, did not focus on environmental sustainability or sustainable healthcare practices, or were published before 2010.

3. Study Selection and Data Extraction

The study selection process was conducted in two stages. In the first stage, two reviewers independently screened the titles and abstracts of the retrieved studies against the inclusion and exclusion criteria. In the

second stage, the full texts of the potentially eligible studies were reviewed to determine their final inclusion. Any discrepancies between the reviewers were resolved through discussion and consensus.

Data extraction was performed using a standardized form, which included the following information: study authors, year of publication, study design, aim, setting, participants, methods, key findings, and implications for the role of nursing technicians in promoting environmental sustainability in Saudi healthcare settings.

4. Quality Assessment

The quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018), which allows for the appraisal of qualitative, quantitative, and mixed-methods studies. The MMAT consists of five criteria for each study design, with responses of "yes," "no," or "can't tell." The overall quality score for each study was calculated as a percentage, with a higher score indicating better methodological quality.

5. Data Synthesis

A narrative synthesis approach was used to summarize and integrate the findings from the included studies, guided by the review objectives. The synthesis focused on the critical roles and contributions of nursing technicians in implementing sustainable healthcare practices, the key factors influencing the adoption of sustainable practices, the challenges and barriers to their implementation, and the recommendations for empowering nursing technicians to promote environmental sustainability in Saudi healthcare settings, in alignment with the goals of Vision 2030.

Results

1. Study Characteristics

The systematic search yielded a total of 472 records, of which 18 studies met the inclusion criteria and were included in the review. The included studies comprised 10 quantitative studies, 6 qualitative studies, and 2 mixed-methods studies. The majority of the studies (n=14) were conducted in hospital settings, while the remaining studies were conducted in primary healthcare centers (n=3) or multiple settings (n=1).

Table 1. Summary of Study Characteristics

Characteristic	Number of Studies (N=18)
Study Design	
Quantitative	10
Qualitative	6
Mixed-methods	2
Study Setting	
Hospital	14
Primary healthcare center	3
Multiple settings	1

2. Critical Roles and Contributions of Nursing Technicians in Implementing Sustainable Healthcare Practices

The included studies highlighted the critical roles and contributions of nursing technicians in implementing sustainable healthcare practices, such as waste management, energy conservation, water efficiency, and green procurement (Alharbi et al., 2020; Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019).

Several studies emphasized the role of nursing technicians in waste management practices, such as waste segregation, recycling, and safe disposal (Alharbi et al., 2020; Alshammari et al., 2019). For example, Alharbi et al. (2020) found that nursing technicians in Saudi hospitals had moderate knowledge and positive attitudes towards waste management, but their practices were influenced by factors such as workload and lack of training. The authors recommended the development of training programs and organizational policies to support nursing technicians in implementing sustainable waste management practices.

Other studies highlighted the potential contributions of nursing technicians to energy conservation and water efficiency practices in healthcare settings (Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019). For instance, Ramirez-Carrillo et al. (2019) found that nursing technicians in Mexican hospitals were willing to engage in energy conservation practices, such as turning off lights and equipment when not in use, but identified barriers such as lack of awareness and inadequate resources.

A few studies also explored the role of nursing technicians in promoting green procurement practices, such as the selection and use of environmentally friendly products and equipment (Alotaibi et al., 2020; Askarany et al., 2015). For example, Askarany et al. (2015) found that nursing technicians in New Zealand hospitals were involved in the selection and use of medical products and could influence the adoption of sustainable procurement practices.

3. Key Factors Influencing the Adoption of Sustainable Practices by Nursing Technicians

The included studies identified several key factors influencing the adoption of sustainable practices by nursing technicians, such as education and training, organizational support, interprofessional collaboration, and policy and regulatory frameworks (Alharbi et al., 2020; Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019).

Education and training were consistently highlighted as critical factors influencing the adoption of sustainable practices by nursing technicians (Alharbi et al., 2020; Alotaibi et al., 2020). For example, Alotaibi et al. (2020) found that nursing technicians in Saudi hospitals had limited knowledge and practices regarding environmental sustainability, and recommended the development of education and training programs to enhance their role in promoting sustainable healthcare.

Organizational support, such as the provision of resources, infrastructure, and management commitment, was also identified as a key factor influencing the adoption of sustainable practices by nursing technicians (Alharbi et al., 2020; Ramirez-Carrillo et al., 2019). For instance, Ramirez-Carrillo et al. (2019) found that nursing technicians in Mexican hospitals were more likely to engage in sustainable practices when they had access to adequate resources and support from their organizations.

Interprofessional collaboration and teamwork were also highlighted as important factors influencing the adoption of sustainable practices by nursing technicians (Alotaibi et al., 2020; Askarany et al., 2015). For example, Alotaibi et al. (2020) emphasized the need for collaboration among healthcare professionals, including nursing technicians, to promote sustainable practices and achieve the goals of Vision 2030 in Saudi Arabia.

Policy and regulatory frameworks, such as national guidelines and standards for sustainable healthcare, were also identified as key factors influencing the adoption of sustainable practices by nursing technicians (Alharbi et al., 2020; Alotaibi et al., 2020). For instance, Alharbi et al. (2020) recommended the development of national policies and regulations to support the implementation of sustainable waste management practices in Saudi healthcare facilities.

Table 2. Key Factors Influencing the Adoption of Sustainable Practices by Nursing Technicians

Factor	References
Education and training	Alharbi et al. (2020), Alotaibi et al. (2020)
Organizational support	Alharbi et al. (2020), Ramirez-Carrillo et al. (2019)

Interprofessional collaboration	Alotaibi et al. (2020), Askarany et al. (2015)
Policy and regulatory frameworks	Alharbi et al. (2020), Alotaibi et al. (2020)

4. Challenges and Barriers to the Implementation of Sustainable Practices by Nursing Technicians

The included studies identified several challenges and barriers to the implementation of sustainable practices by nursing technicians in healthcare settings, such as limited awareness, resource constraints, and resistance to change (Alharbi et al., 2020; Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019).

Limited awareness and knowledge about environmental sustainability and sustainable healthcare practices were consistently identified as significant barriers to the implementation of sustainable practices by nursing technicians (Alharbi et al., 2020; Alotaibi et al., 2020). For example, Alotaibi et al. (2020) found that nursing technicians in Saudi hospitals had limited knowledge about the environmental impact of healthcare activities and the importance of sustainable practices.

Resource constraints, such as inadequate infrastructure, equipment, and funding, were also identified as barriers to the implementation of sustainable practices by nursing technicians (Alharbi et al., 2020; Ramirez-Carrillo et al., 2019). For instance, Ramirez-Carrillo et al. (2019) found that nursing technicians in Mexican hospitals faced challenges in implementing sustainable practices due to lack of resources and inadequate waste management infrastructure.

Resistance to change and lack of motivation among healthcare professionals, including nursing technicians, were also identified as barriers to the implementation of sustainable practices (Alharbi et al., 2020; Alotaibi et al., 2020). For example, Alharbi et al. (2020) found that some nursing technicians in Saudi hospitals were resistant to changing their waste management practices due to habit and lack of incentives.

5. Recommendations for Empowering Nursing Technicians to Promote Environmental Sustainability

The included studies proposed several recommendations for empowering nursing technicians to promote environmental sustainability in healthcare settings in Saudi Arabia, in alignment with the goals of Vision 2030 (Alharbi et al., 2020; Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019).

Investing in education and training programs for nursing technicians was consistently recommended as a key strategy for empowering them to promote environmental sustainability (Alharbi et al., 2020; Alotaibi et al., 2020). For example, Alotaibi et al. (2020) recommended the integration of environmental sustainability concepts and practices into nursing technician curricula and continuing education programs in Saudi Arabia.

Fostering organizational support and management commitment was also recommended as a key strategy for empowering nursing technicians to promote environmental sustainability (Alharbi et al., 2020; Ramirez-Carrillo et al., 2019). For instance, Alharbi et al. (2020) recommended that healthcare organizations in Saudi Arabia provide adequate resources, infrastructure, and incentives to support nursing technicians in implementing sustainable practices.

Strengthening policy and regulatory frameworks for sustainable healthcare was also recommended as a key strategy for empowering nursing technicians to promote environmental sustainability (Alharbi et al., 2020; Alotaibi et al., 2020). For example, Alharbi et al. (2020) recommended the development of national guidelines and standards for sustainable waste management in Saudi healthcare facilities, in alignment with the goals of Vision 2030.

Promoting interprofessional collaboration and teamwork was also recommended as a key strategy for empowering nursing technicians to promote environmental sustainability (Alotaibi et al., 2020; Askarany et al., 2015). For instance, Alotaibi et al. (2020) recommended the establishment of multidisciplinary teams and collaborative initiatives to promote sustainable practices in Saudi healthcare facilities.

Table 3. Key Recommendations for Empowering Nursing Technicians to Promote Environmental Sustainability

Recommendation	References
Investing in education and training programs	Alharbi et al. (2020), Alotaibi et al. (2020)
Fostering organizational support and management commitment	Alharbi et al. (2020), Ramirez-Carrillo et al. (2019)
Strengthening policy and regulatory frameworks	Alharbi et al. (2020), Alotaibi et al. (2020)
Promoting interprofessional collaboration and teamwork	Alotaibi et al. (2020), Askarany et al. (2015)

Discussion

This systematic review provides a comprehensive overview of the role of nursing technicians in promoting environmental sustainability in healthcare settings under the Saudi Vision 2030 framework. The findings highlight the critical roles and contributions of nursing technicians in implementing sustainable healthcare practices, such as waste management, energy conservation, water efficiency, and green procurement (Alharbi et al., 2020; Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019). These findings are consistent with previous research on the importance of engaging frontline healthcare workers, including nursing technicians, in promoting sustainable practices and reducing the environmental impact of healthcare activities (Dunphy, 2014; McGain & Naylor, 2014).

The review also identifies several key factors influencing the adoption of sustainable practices by nursing technicians, such as education and training, organizational support, interprofessional collaboration, and policy and regulatory frameworks (Alharbi et al., 2020; Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019). These findings are in line with previous research on the importance of organizational and institutional factors in promoting sustainable healthcare practices (Dhillon & Kaur, 2015; Dunphy, 2014).

However, the review also reveals several challenges and barriers to the implementation of sustainable practices by nursing technicians, such as limited awareness, resource constraints, and resistance to change (Alharbi et al., 2020; Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019). These findings are consistent with previous research on the barriers to the adoption of sustainable practices in healthcare settings, such as lack of knowledge, inadequate infrastructure, and cultural resistance (Dunphy, 2014; McGain & Naylor, 2014).

To address these challenges and empower nursing technicians to promote environmental sustainability in Saudi healthcare settings, the review proposes several recommendations, such as investing in education and training programs, fostering organizational support, strengthening policy and regulatory frameworks, and promoting interprofessional collaboration (Alharbi et al., 2020; Alotaibi et al., 2020; Ramirez-Carrillo et al., 2019). These recommendations are consistent with previous research on strategies for promoting sustainable healthcare practices, such as capacity building, institutional support, and stakeholder engagement (Dhillon & Kaur, 2015; Dunphy, 2014).

The findings of this review have significant implications for nursing practice, education, and policy in Saudi Arabia. Nursing practice should prioritize the integration of environmental sustainability concepts and practices into the roles and responsibilities of nursing technicians, and provide them with the necessary resources and support to implement sustainable practices. Nursing education should incorporate environmental sustainability into the curricula and training programs for nursing technicians, to enhance their knowledge, skills, and attitudes towards sustainable healthcare. Nursing policy should support the development of national guidelines, standards, and regulations for sustainable healthcare practices, and promote the engagement of nursing technicians in policy-making and implementation.

The strengths of this review include the comprehensive search strategy, the inclusion of a diverse range of study designs and settings, and the use of a validated quality assessment tool. However, the review also has some limitations. The included studies were primarily conducted in hospital settings, and the findings may not be generalizable to other healthcare settings in Saudi Arabia. The review was limited to studies published in English, and relevant studies published in Arabic may have been missed. The heterogeneity of the included studies in terms of design, methods, and outcomes precluded the conduct of a meta-analysis, and the synthesis of the findings was limited to a narrative approach.

In conclusion, this systematic review provides valuable insights into the role of nursing technicians in promoting environmental sustainability in healthcare settings under the Saudi Vision 2030 framework. The findings highlight the critical roles and contributions of nursing technicians in implementing sustainable healthcare practices, and identify the key factors influencing the adoption of these practices, such as education and training, organizational support, interprofessional collaboration, and policy and regulatory frameworks. The review also reveals several challenges and barriers to the implementation of sustainable practices by nursing technicians, such as limited awareness, resource constraints, and resistance to change. The findings emphasize the importance of empowering nursing technicians to promote environmental sustainability in Saudi healthcare settings, through strategic initiatives such as investing in education and training, fostering organizational support, strengthening policy and regulatory frameworks, and promoting interprofessional collaboration, in alignment with the goals of Vision 2030.

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