# Advancing Green Work Engagement In Healthcare: A Systematic Review And Future Research Directions

Fajar Satria[1]*; Ahmad Hidayat Sutawijaya[2]; Abdul Haeba Ramli[3]; Triyono Arief Wahyudi[4]

[1-4]Doctor of Management, Business and Economy Faculty, Universitas Esa Unggul, Jakarta, Indonesia 11510

[1]fajar.satria@esaunggul.ac.id; [2]ahmad.hidayat@esaunggul.ac.id; [3]abdul.haeba@esaunggul.ac.id; [4]triyono.arief@esaunggul.ac.id;

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## ABSTRACT

The healthcare sector, while central to public well-being, is paradoxically responsible for 4–5% of global greenhouse gas emissions. This systematic literature review (SLR) critically explores the emerging concept of Green Work Engagement (GWE)—defined as employees' proactive involvement in sustainable practices—and its transformative potential for healthcare institutions. Guided by the PRISMA framework, this review synthesizes high-quality studies from 2014 to 2024, identifying leadership, organizational support, environmental awareness, and green HRM as pivotal antecedents of GWE. Findings highlight that green servant leadership and green talent management foster innovative behaviors, enhance job satisfaction, and improve both environmental performance and clinical outcomes. Technological integration (e.g., cloud computing) and structured frameworks (e.g., GreenEd, 5R) also emerge as key enablers of systemic change. However, the literature reveals methodological gaps, limited application in developing contexts, and insufficient empirical evaluation of behavioral interventions. This study offers a robust conceptual foundation and practical roadmap for embedding sustainability into healthcare operations, emphasizing the role of leadership, employee engagement, and inclusive organizational culture in advancing environmental stewardship. The review concludes with actionable research directions to strengthen the theoretical and practical relevance of GWE and support the healthcare sector's alignment with global sustainability goals.

**Keywords:** Green Work Engagement, Healthcare Sustainability, Green HRM, Employee Engagement, Environmental Leadership, Systematic Review

## INTRODUCTION

The healthcare sector, known for its operational complexity and high environmental footprint, urgently requires sustainable transformation. Green Work Engagement—defined as employees' commitment to ecological initiatives within healthcare institutions—emerges as a vital construct for advancing both environmental performance and workforce well-being (Pestian et al., 2023). Despite its strategic relevance, this domain remains underexplored in current *Scopus*-indexed literature. This *Systematic Literature Review* seeks to critically synthesize existing research, offering a structured foundation for future inquiry and sustainable healthcare development.

### Definition, Importance, and Impact of Green Work Engagement in Healthcare

Green Work Engagement refers to employees' proactive involvement in environmentally sustainable behaviors within their organizations. In the healthcare industry, this includes resource efficiency, waste reduction, and ecological policy implementation that supports both environmental and patient health (Baffoe-Djan & Smith, 2020) Beauregard & Henry, 2009). Green Work Engagement aligns individual

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eco-consciousness with institutional goals, promoting operational excellence and service quality.

Its significance lies in mitigating the environmental burden of healthcare operations—particularly through energy conservation and sustainable material use—while simultaneously enhancing employee satisfaction, performance, and organizational image (Aryee et al., 2002; Pham et al., 2020). Importantly, Green Work Engagement also improves patient outcomes by creating healthier care environments and demonstrating organizational integrity. Key antecedents include environmental awareness, training, and leadership support (Lee & Lee, 2022; Gokhale, 2023), while its consequences span across increased employee well-being, reduced operational costs, and enhanced care quality (Scott et al., 2022; Sypniewska et al., 2023). As such, Green Work Engagement serves as a vital catalyst for achieving sustainable, people-centered healthcare transformation.

**Moderating and Mediating Factors Influencing Green Work Engagement**

Managerial support and green-oriented organizational culture act as key moderators, amplifying or constraining employees' participation in sustainable practices (Gupta & Jangra, 2024). Meanwhile, intrinsic motivation and perceived environmental impact serve as mediators, linking institutional support to individual green behaviors through psychological engagement (Bayraktar & Baykal, 2022).These mechanisms highlight the nuanced interdependencies that shape the success of Green Work Engagement initiatives in healthcare.

**Assessment of Research Quality on Green Work Engagement in the Healthcare Industry**

While current studies on Green Work Engagement in healthcare offer valuable insights, they vary significantly in methodological rigor and scope (Firend, 2020). Many lack longitudinal depth and standardized frameworks, limiting their ability to capture long-term impacts (Kania, 2024). This *Systematic Literature Review* followed PRISMA guidelines (Kamioka, 2019), using structured keyword strategies across *Scopus*, *Web of Science*, *PubMed*, and *ScienceDirec*t. A rigorous screening and coding process ensured analytical consistency and relevance. The synthesized findings critically inform future research directions and strategic applications in healthcare sustainability.

**Research Gaps and the Need for a Systematic Literature Review**

Research on Green Work Engagement in healthcare remains limited, with critical gaps in conceptual clarity, empirical validation, and understanding of its antecedents, outcomes, and mediating variables. Most existing studies lack a unified framework, limiting their practical and theoretical impact. This *Systematic Literature Review* (SLR) addresses these deficiencies by consolidating current findings, clarifying core constructs, and offering strategic insights for future research. Its aim is to position Green Work Engagement as a catalyst for environmental sustainability, institutional resilience, and enhanced patient care in healthcare systems.

**Research Objectives**

This study aims to deliver a comprehensive *Systematic Literature Review* (SLR) on Green Work Engagement in the healthcare sector to bridge gaps in environmental sustainability and employee involvement. The first objective is to categorize current research on green initiatives and their influence on employee engagement and organizational performance (Berniak-Woźny & Rataj, 2023a). The review also investigates the effectiveness of behavioral interventions in reducing clinical carbon emissions (Batcup et al., 2023) and examines barriers and enablers in fostering green practices, especially the role of education and sustainability culture (Environmental Sustainability, Healthcare Workers and Healthcare Students: A Literature Review of Attitudes and Learning Approaches, 2023).

Furthermore, the SLR explores how Green Work Engagement impacts clinical outcomes and patient care (Rodríguez-Jiménez et al., 2023), while identifying methodological gaps, such as the need for standardized environmental impact assessments ("Sustainability in Healthcare: Methods and Tools for the Assessment,"

2023). It consolidates insights on the influence of leadership and organizational infrastructure in supporting Green Work Engagement (Chairunnisa et al., 2023; Yoong et al., 2023), and underscores the strategic importance of waste reduction and decarbonization in healthcare facilities (Lattanzio et al., 2022). Ultimately, this review offers critical recommendations for enhancing sustainability and workforce engagement in healthcare systems (Duindam, 2022).

**Research Questions**

This study seeks to address the central question: **"How does Green Work Engagement influence sustainability practices and reduce the environmental impact of healthcare organizations?"** Given that healthcare contributes approximately 4%–5% of global GHG emissions—primarily through indirect sources like disposable items and pharmaceuticals (Rodríguez-Jiménez et al., 2023)—this question explores how employee engagement can catalyze the transition to sustainable healthcare. The review investigates how perceived organizational support, leadership, and environmental awareness influence employees' participation in green practices (Chairunnisa et al., 2023; (*Environmental Sustainability, Healthcare Workers and Healthcare Students: A Literature Review of Attitudes and Learning Approaches*, 2023). It further considers the role of the 5R waste framework (Lattanzio et al., 2022), cloud technology adoption (Arega & Sharma, 2023), and decarbonization strategies (Duindam, 2022) in shaping environmentally responsible behavior. Leadership emerges as a vital driver of climate-neutral operations, with green leadership being instrumental in institutionalizing sustainability ((Berniak-Woźny & Rataj, 2023b) (Soares et al., 2023). In addition, the integration of research engagement, inclusive practices, and DEI (*Diversity, Equity, Inclusion*) frameworks enhances not only clinical innovation but also sustainable transformation across healthcare systems (Yoong et al., 2023; Samuel & Ramli, 2024; Jadotte et al., 2023). This review thus aims to uncover how Green Work Engagement functions as a strategic mechanism for embedding environmental stewardship in healthcare settings.

**Formulating Key Research Questions: Unpacking the Dimensions of Green Work Engagement**

This study formulates six high-impact research questions to advance the understanding of Green Work Engagement in the healthcare sector. **First,** it seeks to define the core components of Green Work Engagement—encompassing cognitive, emotional, and behavioral elements of environmentally responsible work (Baffoe-Djan & Smith, 2020; Novianti & Ramli, 2023; Beauregard & Henry, 2009). **Second,** it explores key antecedents such as perceived organizational support, environmental awareness, leadership style, and team dynamics (Gokhale, 2023) (Lee & Lee, 2022). **Third,** the study examines the outcomes of Green Work Engagement on job satisfaction, organizational sustainability, and patient-centered care (Sypniewska et al., 2023) (Wee & Lai, 2022). **Fourth,** it identifies mediators and moderators—such as motivation, culture, and leadership—that shape Green Work Engagement's effectiveness (Aungsuroch et al., 2024) (Marini et al., 2023). **Fifth,** it assesses methodological rigor and conceptual clarity in the current literature, identifying gaps in theoretical integration and research design (Skinner et al., 2024; Kurniawati & Ramli, 2024; Schaufeli, 2012). **Finally,** this study offers future research and practical recommendations, advocating for robust theoretical models and evidence-based institutional strategies—such as sustainability leadership training and green HR practices—to embed Green Work Engagement across healthcare systems ((Elsayed et al., 2024).

**Grand Theory**

This grand theory provides an integrative framework to understand how Green Work Engagement can drive environmental sustainability within healthcare systems. Situated at the intersection of sustainability, employee engagement, and organizational behavior, it emphasizes healthcare's urgent need to mitigate its environmental footprint—accounting for 4%–5% of global emissions (Berniak-Woźny & Rataj, 2023b; Rodríguez-Jiménez et al., 2023). Central to this theory are green servant leadership and green talent

management, which inspire pro-environmental behaviors and embed sustainability into organizational culture (Rahmayanti et al., 2024a).Technological infrastructure—such as cloud computing and green IT—is seen as a strategic enabler for energy efficiency and carbon reduction (Arega & Sharma, 2023). Complementing this is the green hospital paradigm, which integrates 5R principles and clinical decarbonization to minimize ecological impact (Lattanzio et al., 2022) (Duindam, 2022). Employee engagement, fueled by organizational support, CSR, and continuous education, is viewed as the catalyst for lasting transformation (Chairunnisa et al., 2023) (Xu et al., 2022). Leadership at all levels is essential in aligning vision, mobilizing resources, and sustaining momentum (Lee & Lee, 2022). Altogether, this grand theory constructs a comprehensive model for embedding Green Work Engagement as a lever to advance low-carbon, high-impact healthcare transformation.

**Conceptual And Theoretical Framework**

This framework positions Green Work Engagement at the intersection of environmental sustainability, employee involvement, and healthcare quality. Given the sector's responsibility for 4–5% of global GHG emissions, adopting low-carbon strategies—such as waste reduction, energy optimization, and sustainable procurement—is imperative (Rodríguez-Jiménez et al., 2023) (Buttigieg et al., 2023) (Duindam, 2022). Grounded in *Total Quality Management* (TQM), the framework emphasizes leadership commitment, staff training, and performance monitoring as enablers of green transformation (Lee & Lee, 2022).

Integrating the circular economy model further promotes resource efficiency and ecological resilience (Buttigieg et al., 2023). Technologies like cloud computing play a critical role in advancing energy-efficient systems and supporting data-informed sustainability decisions (Arega & Sharma, 2023). Green engagement is also shaped by organizational culture, environmental awareness, and continuous education ((Yoong et al., 2023). Guided by PRISMA standards, this review identifies thematic gaps and reinforces the need for behavioral change and system-wide resilience, especially in the wake of COVID-19's impact on medical waste and resource pressure ((Lattanzio et al., 2022) (*Environmental Sustainability, Healthcare Workers and Healthcare Students: A Literature Review of Attitudes and Learning Approaches*, 2023). Collectively, the framework offers a comprehensive foundation for integrating sustainable practices into healthcare through a GWE lens.

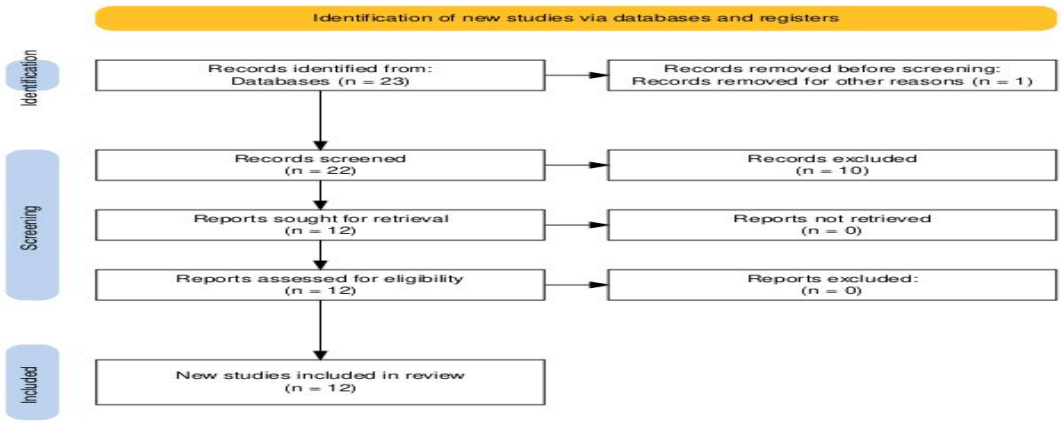
**METHOD**

This study adopted a Systematic Literature Review guided by PRISMA protocols (Rodríguez-Jiménez et al., 2023), targeting Q1 *Scopus*-indexed articles published between 2012–2022. A structured search across *Medline*, *Web of Science*, *CINAHL*, and *Cochrane* identified studies focused on healthcare workers' sustainability engagement and educational interventions ((Berniak-Woźny & Rataj, 2023b). Data were extracted using a standardized framework, and thematically analyzed to identify key enablers—such as leadership support, sustainability training, and employee motivation (Lee & Lee, 2022) (Yoong et al., 2023). Findings highlight the strategic role of institutional commitment in fostering Green Work Engagement and call for more intervention-based, empirically robust research to guide sustainable policy and practice (Duindam, 2022; Batcup et al., 2023).

**Application Of Methodology: The Use Of Prisma**

This study employed the PRISMA framework (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*) to ensure methodological rigor, transparency, and reproducibility in conducting the systematic literature review. PRISMA 2020 offers an updated 27-item checklist that guides researchers in reporting systematic reviews with clarity and precision, reflecting recent methodological advancements in review science i (Rethlefsen et al., 2021; Page et al., 2021b). The implementation of PRISMA-S further reinforces the quality of literature search strategies by promoting transparency in data sources and retrieval processes (Rethlefsen et al., 2021). Moreover, its adaptability across

disciplines—ranging from diagnostic accuracy (PRISMA-DTA) to evolutionary biology (PRISMA-EcoEvo)—demonstrates its essential role in maintaining reporting standards across various scientific fields (Cohen et al., 2021). Widely recognized in biomedical and health services research, PRISMA facilitates the production of reliable, evidence-based reviews that inform practice and policy (Gates et al., 2022) Traversari et al., 2022a). In this context, PRISMA serves not only as a methodological scaffold but also as a quality benchmark, empowering authors, reviewers, and editors in developing systematic reviews that are both impactful and reproducible (Rauzika Altasa et al., 2023).




Picture 7.1 PRISMA Application in Green Work Engagement

**Year and Search Criteria:** this systematic review analyzed literature from 2014 to 2024 to ensure relevance in the evolving domain of Green Work Engagement (Baffoe-Djan & Smith, 2020; Marini et al., 2023). Studies were selected based on clear alignment with keywords such as "Green Work Engagement," "Organizational Citizenship Behaviour," and "Trust in Leader," ensuring thematic precision and conceptual rigor (Frare et al., 2022; Baquero, 2023).

**Search Limitations:** the review was limited to English-language, open-access publications to guarantee clarity and replicability (Marini et al., 2023). Searches focused on healthcare-related business disciplines and employed specific terms like "Vocal Variable" and "Locus," drawing from global sources to capture diverse contextual insights (Miah et al., 2024)).

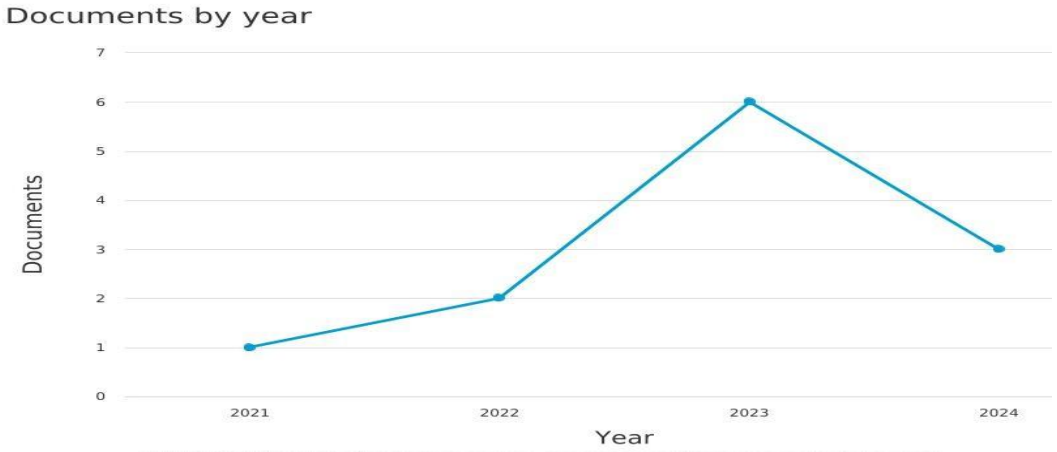



Figure 7.2: PRISMA Application in Green Work Engagement, Documents by Year

**Study Selection, Data Synthesis, and Reporting Process:** A rigorous two-stage screening process was conducted using databases such as *PubMed*, *Scopus*, *Web of Science*, and *Google Scholar* to ensure high-quality peer-reviewed literature (Guimarães et al., 2024) (Kolaski et al., 2023). Studies were appraised using PRISMA and standardized tools, with data extracted through structured templates and synthesized thematically via qualitative and quantitative approaches (Abdullah et al., 2023) (Sriganesh et al., 2016). The results were

reported following PRISMA guidelines, with comprehensive analysis and recommendations for future research (Robinson et al., 2020) (Kunisch et al., 2023).

**Study Identification and Inclusion Criteria:** from an initial pool of 23 articles, 12 Q1-indexed studies published in 2024 met strict inclusion criteria, focusing on Green Work Engagement in healthcare using validated empirical methods (Johnson & Hennessy, 2019) (Marini et al., 2023). Non-empirical or irrelevant studies were excluded. The synthesis identified core variables, methodological strengths, and critical research gaps.

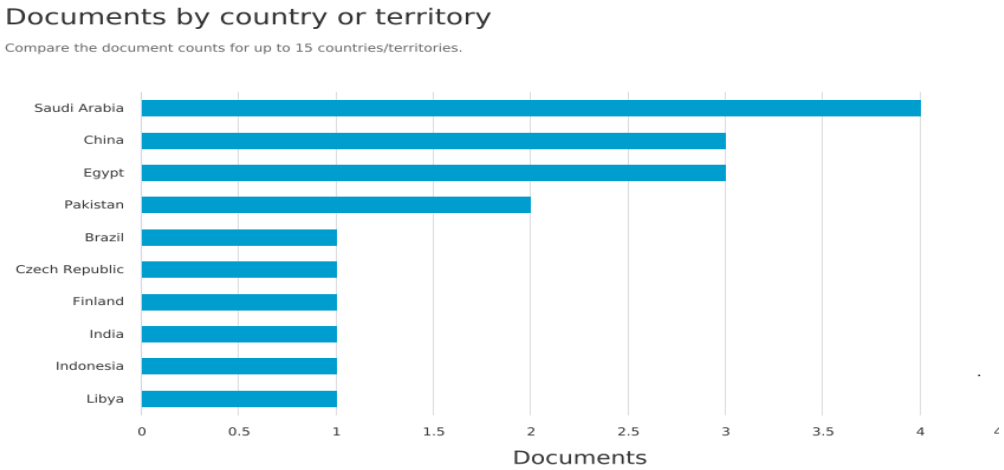



Figure 7.3. PRISMA Application in Green Work Engagement: Document Distribution by Country

**Geographical and Document-Based Search Strategy:** to ensure contextual precision, this study applied geographical filters and strategic keyword combinations—such as "vocal variable," "locus," Green Work Engagement, Organizational Citizenship Behaviour, Trust, and Leader-Follower Congruence—to refine search results. Literature was initially screened by title, abstract, and keywords, followed by full-text evaluation based on methodological quality and thematic relevance. In strict adherence to PRISMA protocols, only high-quality, geographically aligned studies were retained, forming a robust evidence base that underpins the conceptual framework (Kolaski et al., 2023).

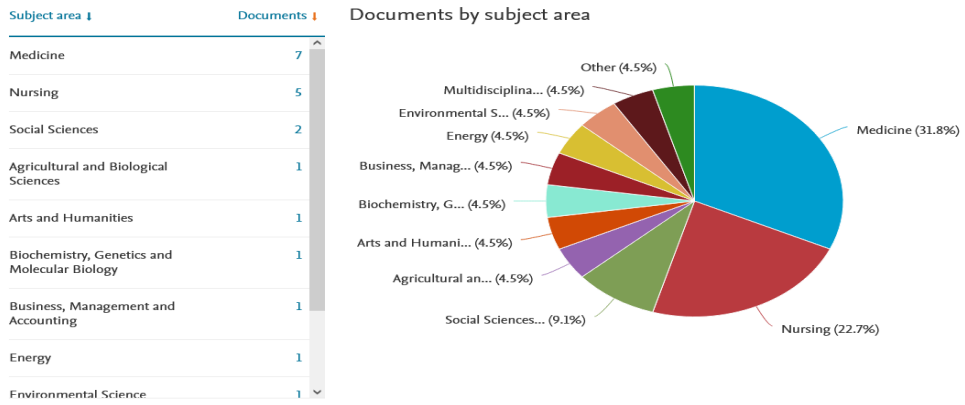



Figure 7.4. PRISMA Application in Green Work Engagement: Document Distribution by Type

**Quality Appraisal Application Of The Mixed Mthods Appraisal Tool (Mmat)**

*The Mixed Methods Appraisal Tool* (MMAT) was employed to rigorously evaluate the methodological quality of studies concerning Green Work Engagement in the healthcare industry. This tool integrates criteria across qualitative, quantitative, and mixed-methods research designs. High-quality quantitative studies demonstrated strong internal validity,

precise sampling techniques, and robust statistical analysis aligned with the construct of Green Work Engagement (Christian et al., 2011; Adisa et al., 2023; (Nasir & Sukmawati, 2023). Outstanding qualitative research was distinguished by credibility, contextual richness, and systematic thematic analysis, offering deep insights into employee perceptions and green practices (Andersen & Chen, 2002); (Lee & Lee, 2022).

Mixed-methods studies of excellence exhibited coherent integration between qualitative and quantitative data streams, alongside transparent research procedures and alignment with research questions (Syafitri & Etikariena, 2023; Aungsuroch et al., 2024; (AlKetbi & Rice, 2024). Moreover, several critical quality dimensions emerged, such as the pivotal role of top management in sustaining green initiatives i (Lee & Lee, 2022), the strategic use of EFQM and Baldrige frameworks for continuous performance assessment (Kamal, 2023), and the influence of green talent management and green servant leadership in enhancing innovative behaviors and environmental outcomes (Rahmayanti et al., 2024b). Despite significant progress, methodological gaps persist—especially in measuring sustainability outcomes rather than determinants (Flynn et al., 2022), and in standardizing environmental impact assessments for telemedicine and energy-saving interventions in hospitals ("Sustainability in Healthcare: Methods and Tools for the Assessment," 2023) (Sholeh & Chalidyanto, 2021).

Additionally, healthcare professionals' attitudes and limited organizational support affect the efficacy of sustainable practices (Environmental Sustainability, Healthcare Workers and Healthcare Students: A Literature Review of Attitudes and Learning Approaches, 2023). The NHS's NetZero strategy illustrates the importance of institutional commitment and learning from prior sustainable success (Sholeh & Chalidyanto, 2021). Future research should focus on refining study designs, enhancing analytical precision, and ensuring greater sample representativeness to improve generalizability and policy relevance (Buttigieg et al., 2023) (Naqshbandi et al., 2024) (Razali & Vasudevan, 2024).

## RESULTS AND DISCUSSION

This systematic review confirms that Green Work Engagement in healthcare is deeply influenced by leadership, green-oriented HR practices, and environmental culture. Green talent management and servant leadership drive eco-innovation and employee engagement, positioning leadership as a key agent of organizational sustainability (Rahmayanti et al., 2024b). Despite its public health mission, the healthcare sector significantly contributes to environmental harm, highlighting the urgency of systemic reform (Berniak-Woźny & Rataj, 2023b). Technological advancements such as cloud computing offer green potential but remain underutilized in developing regions (Arega & Sharma, 2023).

Essential enablers of green transformation include sustainable HR practices, clinical decarbonization, and behavioral interventions—particularly in waste and energy management (Duindam, 2022). The pandemic further amplified the demand for sustainability training in clinical settings (*Environmental Sustainability, Healthcare Workers and Healthcare Students: A Literature Review of Attitudes and Learnin*g Approaches, 2023). Top management commitment—via education, monitoring, and cultural alignment—is fundamental for embedding pro-environmental behavior across operations (Lee & Lee, 2022).

### Expert Verification and Evaluation

Expert validation was conducted with a panel of ten doctoral-level scholars with proven expertise in HRM, healthcare, and sustainability. Selected based on stringent criteria—such as Q1/Q2 publications and global affiliations—their insights enriched the study's credibility and academic merit (Khalid Alrashedi, 2024) (Piwowar-Sulej, 2021). Using questionnaires and in-depth interviews, the process combined quantitative rigor with qualitative depth, supported by thematic coding, factor analysis, and triangulation (Mun, 2022) (Shang, 2023). Experts emphasized the importance of constructs like Organizational Citizenship Behavior, Perceived Sportsmanship, and Trust in Leadership,

while advocating the inclusion of contextual variables such as policy and culture (Marini et al., 2023) (Otoo, 2024). The mixed-methods approach received high praise, with suggestions for improved sampling design. Overall, the findings were affirmed as valid, impactful, and essential for advancing the discourse on Green Work Engagement in healthcare (Kolaski et al., 2023).

**Managerial Implications**

The healthcare sector must simultaneously uphold public health and transition toward sustainability to reduce its substantial environmental impact. Green talent management and servant leadership are instrumental in fostering employee innovation and commitment to sustainability (Berniak-Woźny & Rataj, 2023b; Rahmayanti et al., 2024a). Effective execution of green initiatives hinges on top management's commitment to continuous education, strategic oversight, and value-driven leadership (S. M. Lee & Lee, 2022; Kerse, 2024).

Evidence-based approaches are essential to address indirect carbon emission hotspots across healthcare operations (Rodríguez-Jiménez et al., 2023). At the ground level, leadership style and job resources influence engagement in green practices, such as implementing the 5R principles and promoting eco-efficiency even in high-intensity units like surgery (Szilvassy & Sirok, 2022) (Kwakye et al., 2011). Green HRM frameworks integrating culture, education, and sustainable design further reinforce low-carbon strategies (Uslu et al., 2022), while cross-functional teams supported by leadership and training improve both clinical outcomes and environmental innovation (Yoong et al., 2023).

**Research Limitations**

This review highlights significant gaps in the empirical foundation of Green Work Engagement within healthcare. Many studies remain descriptive and narrowly focused—often limited to waste or energy management—lacking systems-level perspectives and robust experimental designs (Yoong et al., 2023) Duindam, 2022; Lattanzio et al., 2022), The potential of digital tools like cloud computing is underexplored, particularly in low-resource settings (Arega & Sharma, 2023).

The COVID-19 pandemic further disrupted sustainability efforts and research consistency, amplifying medical waste and weakening employee engagement due to fluctuating job satisfaction and support *(Environmental Sustainability, Healthcare Workers and Healthcare Students: A Literature Review of Attitudes and Learning Approaches, 2023;* Chairunnisa et al., 2023). Moreover, behavioral interventions often lack control groups, limiting causal inferences (Batcup et al., 2023). Future research must adopt more integrated, evidence-based methodologies to address climate-health interdependencies and strengthen green healthcare resilience (Berniak-Woźny & Rataj, 2023a).

**Future Research Directions**

Future research on Green Work Engagement in healthcare must explore the interconnection between environmental sustainability and health outcomes, addressing the sector's dual role as both a care provider and environmental polluter (Berniak-Woźny & Rataj, 2023a) (Hoop et al., 2022). Leadership remains a critical driver, and future studies should identify which styles most effectively promote green practices while reducing non-clinical burdens (Dun & Uittenbogaard, 2017; Szilvassy & Sirok, 2022).

Inclusive workplace strategies and *Total Quality Management* approaches should be examined for their role in fostering employee creativity and sustainability (Luasa et al., 2023) (Lee & Lee, 2022). Additionally, the mediating role of employee engagement in the relationship between Green HRM and retention, along with the long-term impact of COVID-19 on remote sustainability practices, deserves greater attention ((Al-Hajri, 2020). Embracing participatory, interdisciplinary methodologies will help advance more robust, context-sensitive frameworks for green transformation in healthcare (Hoop et al., 2022).

## CONCLUSION

This systematic review underscores the urgent need for integrated organizational and individual strategies to advance Green Work Engagement in healthcare, a sector accountable for up to 5% of global greenhouse gas emissions (Buttigieg et al., 2023) (Rodríguez-Jiménez et al., 2023). Interventions targeting clinical behavior—such as reducing anesthetic gas use—are promising yet often lack methodological robustness (Batcup et al., 2023).

Sustaining such green practices depends heavily on employee engagement, supported by stress-reduction programs, mindful leadership, and organizational reform (Pignata et al., 2023). Frameworks like GreenEd and community toolkits offer scalable models but require stronger leadership backing and evaluative mechanisms (He et al., 2023) (Wicklum et al., 2023). Research engagement—via cross-functional teams and continuous training—fosters innovation (Yoong et al., 2023). In conclusion, leadership style, organizational climate, and systemic support are pivotal in unlocking Green Work Engagement's transformative potential. A holistic, evidence-based approach is essential to aligning healthcare with broader sustainability imperatives (Szilvassy & Sirok, 2022).

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