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Entrepreneurial Leadership, Attitudes Toward Artificial Intelligence, and Innovative Work Behavior Among Nurse Managers: A Systematic Review

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Abstract
Ensuring high-quality care in the modern healthcare environment demands innovation, flexibility, and effective leadership. In particular, nurse managers play a pivotal role in staff management, care delivery, and organizational change, which requires them to be competent in entrepreneurial leadership (EL), hold positive attitudes toward artificial intelligence (AI), and foster innovative work behavior (IWB). Considering how these factors influence IWB among nurse managers, this systematic review examined 16 studies published between 2020 and 2025. A comprehensive literature search was conducted in PubMed, Scopus, Google Scholar, and CINAHL, in addition to manual searches of the *Journal of Nursing Management*, using keywords related to EL, AI, IWB, nurse managers, and healthcare innovation. The included studies were original research articles with quantitative, qualitative, or mixed-method designs that specifically addressed nurse managers or frontline nurses in healthcare settings. Reviews, theses, and nonempirical studies were excluded. The findings indicate that EL fostered IWB by significantly enhancing nurse managers' decision-making, opportunity recognition, knowledge sharing, and creativity. In addition, positive attitudes toward AI act as predictive and mediating variables supporting technological adoption, workflow optimization, and problem-solving. Organizational support systems, including training, resources, and autonomy, are critical enablers that translate EL and attitudes toward AI into tangible innovation. The integration of EL, technological readiness, and contextual support collectively drives sustainable IWB. Future research should explore the longitudinal impacts of EL and AI-focused interventions, assess scalability across diverse healthcare contexts, and examine how systemic support can be optimized to further enhance nurse managers' innovative capacity and organizational performance.

Keywords: entrepreneurial leadership · artificial intelligence · innovative work behavior · nurse managers · healthcare innovation

1. Introduction

Innovation, flexibility, and effective leadership are vital for delivering high-quality care in the evolving modern healthcare environment [1]. Overseeing staff management, medical care delivery, and change initiatives, nurse managers occupy a strategic role in healthcare facilities [2]. Hence, nurse managers must develop a comprehensive understanding of management principles, particularly entrepreneurial leadership (EL), cultivate positive attitudes toward artificial intelligence (AI), and foster innovative

work behavior (IWB). These three factors jointly influence the evolution of healthcare management by shaping the strategies nurse managers employ to address organizational challenges and implement meaningful changes [3].

In particular, EL offers a distinct approach that integrates core entrepreneurial traits, such as opportunity recognition, taking initiative, and risk management, with leadership competencies, such as vision, influence, and drive [4]. Within the healthcare sector, this leadership style has been recognized for its ability to meet demands for flexibility and creative problem-solving [5]. Unlike traditional transactional or transformational leadership models, EL emphasizes generating innovative ideas that drive systematic transformation by improving processes [6, 7].

Entrepreneurial leadership differs from related leadership approaches, such as transformational leadership, by extending beyond vision and motivation to include opportunity recognition, calculated risk-taking, and innovation-driven actions aimed at improving organizational processes [6, 7]. In healthcare settings, EL does not imply uncontrolled risk; rather, it supports structured and evidence-informed innovation that aligns with clinical competence and patient safety [5]. Furthermore, EL encompasses several complementary styles, including the explorer, who identifies new opportunities, the builder, who operationalizes innovative ideas, and the architect, who designs sustainable systems, all of which are relevant to fostering adaptive and accountable leadership within healthcare organizations [8].

Entrepreneurial leaders often adopt a future-oriented perspective, which enables them to resolve organizational issues with novel solutions. In particular, nurse managers benefit from identifying areas for improvement while leveraging technological tools such as AI to enhance care delivery and professional practice [8]. By combining analytical thinking with emotional intelligence, nurse managers can exceed job expectations and lead effectively, even in uncertain or rapidly changing environments [9].

Building on the EL framework, nurse managers' positive attitudes toward AI have become a pivotal factor in fostering IWB. Like many other domains, the healthcare sector has been profoundly impacted by the introduction of AI tools, which have been involved in applications such as predictive analytics, decision-support systems, robotic surgery, and workflow optimization [10, 11]. Effective implementation of AI in healthcare relies not only on technological readiness but also on positive EL perception and support, which highlights the critical role of nurse managers in fostering staff acceptance and adoption of these innovative tools [12–14].

Nurse managers' attitudes toward AI are influenced by its usability, ethical considerations, trustworthiness, and perceived impact on human work [15]. Positive perceptions facilitate AI integration into healthcare processes, enhancing decision-making and improving operational efficiency, thereby encouraging the adoption of innovative practices. Conversely, nurse managers who perceive AI as a threat to their autonomy or as a replacement for skilled workers may hinder technological progress and innovation in healthcare [16]. Understanding and addressing these attitudes toward AI is crucial for creating an organizational support culture, aligning AI initiatives with strategic goals, and enabling nurse managers to lead innovative change effectively [17].

In their efforts to improve healthcare organizations, nursing managers foster IWB by encouraging and enabling creative problem-solving and the implementation of new ideas among nursing staff [18]. IWB is particularly crucial for healthcare settings because it contributes to system-level solutions, organizational development, and enhanced patient care [19]. As frontline leaders, nurse managers are responsible for fostering IWB and routinely innovating work practices in their teams. Nurse managers propose ideas, advocate for their adoption, and execute results-oriented improvements, which may include addressing inadequacies in patient care, enhancing policies or equipment, and optimizing workflows [19].

The relationship between EL, positive attitudes toward AI, and fostering IWB has profound implications for healthcare organizations. For example, EL shapes nurse managers' approaches to problem-solving, innovative practices, and adopting technologies, such as considering AI as a strategic tool for fostering creativity and improving care delivery rather than a threat [20]. Similarly, nurse managers' positive attitudes toward AI can enhance their capacity to generate and implement innovative solutions, particularly those involving technology integration, thereby supporting both clinical and administrative improvements [21].

The importance of this study lies in its potential to provide evidence-based insights into how EL styles and positive attitudes toward AI collectively influence innovative practices among nurse managers. Understanding the relationships between EL, positive attitudes toward AI, and fostering IWB can guide healthcare organizations in designing targeted training programs, promoting technology adoption, and fostering a workplace culture of continuous innovation. Therefore, this study systematically examines

nurse managers' cultivation of these relationships, ultimately offering guidance for enhancing EL effectiveness and organizational performance in healthcare settings.

2. Methodology

2.1. Search strategy

This systematic review aims to explore EL, positive attitudes toward AI, and IWB among nurse managers. Specifically, the aim of this study is to identify potential research gaps related to these three factors in the literature. This work focuses on published literature examining the determinants of IWB in healthcare settings and the roles of EL and perceptions toward technologies in shaping nurse managers' innovative practices.

2.2. Data sources

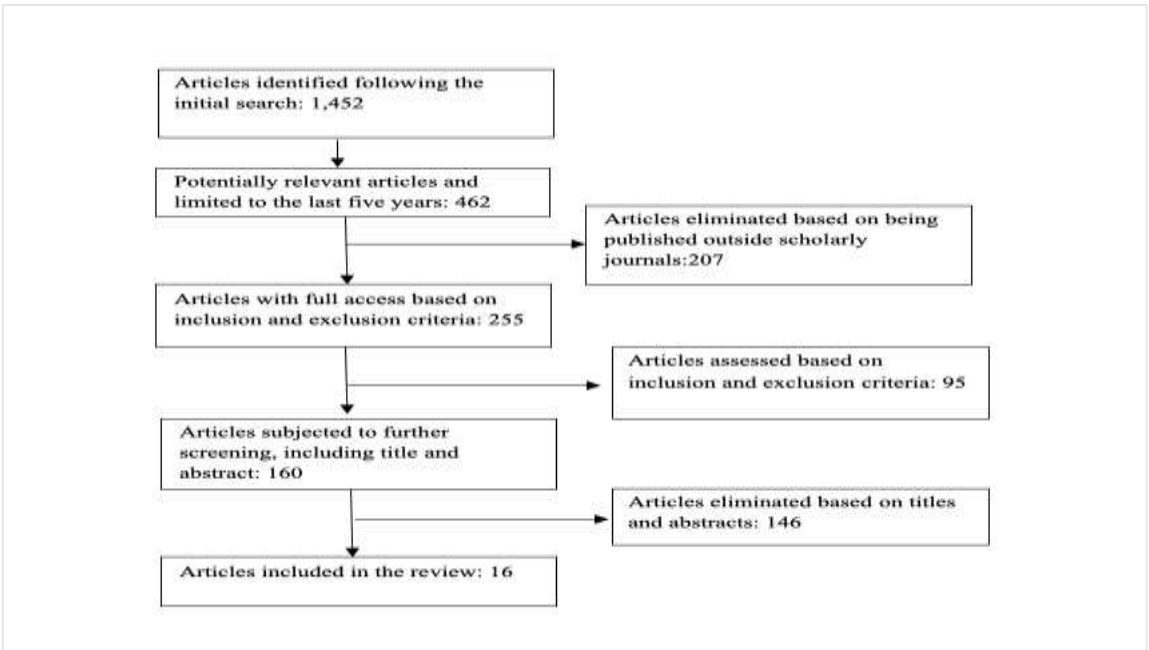
The publications included in this systematic review were identified through a comprehensive literature search using keywords combined with Boolean operators to identify studies related to "nurse managers" AND "healthcare innovation." The search terms included "entrepreneurial leadership," "artificial intelligence," "attitudes toward AI," "innovative work behavior," "nurse managers," and "healthcare innovation." PubMed, Google Scholar, Scopus, and CINAHL were searched to ensure comprehensive coverage of relevant literature.

2.3. Inclusion and exclusion criteria

To capture the most recent evidence on the topic, this systematic review focused on English-language studies published between 2020 and 2025. The inclusion criteria comprised original research studies with qualitative, quantitative, or mixed-method designs specifically examining nurse managers or, when nurse management studies were limited, frontline nurses within healthcare settings. To ensure originality and emphasize empirical findings, the exclusion criteria encompassed theses, dissertations, book chapters, and review articles, including conceptual or systematic reviews. In addition, studies were excluded if they were not published in English, contained opinion-based or nonempirical data, or were unrelated to healthcare contexts. All included studies were fully accessible and directly relevant to the objectives of this systematic review.

2.4. Screening procedure

The initial search yielded 1452 articles. After applying the inclusion and exclusion criteria, 462 studies were deemed potentially relevant. Of these, 207 were excluded because they were reviews, theses, dissertations, or book chapters. The remaining studies were evaluated in detail; duplicates were removed, and abstracts and full texts were assessed. Considering the limited number of studies focusing exclusively on nurse managers, studies on frontline nurses were also considered. Ultimately, 16 studies were included in the systematic review. Figure 1 illustrates the selection process using a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram [22].**Figure 1. PRISMA flowchart.**



2.5. Selected studies

This systematic review included 16 studies published between 2020 and 2025. The year distribution of the studies was as follows: one study in 2020 [23], three studies in 2021 [24–26], five studies in 2023 [27–31], three studies in 2024 [32–34], and four studies in 2025 [35–38].

Regarding their methodologies, 11 studies employed a quantitative survey design [23–27, 29, 32, 35–38] to examine relationships between leadership, attitudes toward AI, organizational support, and innovative work behaviors, as well as the impact of these factors on nurses' decision-making, job performance, and well-being in healthcare settings in relation to innovation. Some studies also explored mediating or moderating roles of variables such as innovative self-efficacy, work engagement, job control, and innovative knowledge. Two studies used a quasi-experimental design to evaluate the effects of structured interventions [28, 33]. One study employed a qualitative research methodology to explore perceived barriers to entrepreneurship in nursing [30]. One study was a scoping review that synthesized the evidence for employee-driven innovation in healthcare organizations [31]. Finally, in one study, a quantitative scale was developed and validated to measure attitudes toward AI at work [34].

2.6. Data extraction

The data extraction and analysis were conducted systematically across all studies to ensure consistency and comparability of the results. The extracted information included the author(s), year, country, aims, methodology, sample characteristics, instruments, and major findings of each study (see Appendix 1 for a summary matrix of the included studies). This structured approach enabled a thorough synthesis of the evidence for the influence of EL, attitudes toward AI, and the contextual environmental factors that contribute to fostering IWB among nurse managers. By classifying studies according to their designs, this systematic review highlights the robustness of quantitative evidence and the depth of insights from qualitative and quasi-experimental studies, which provide a comprehensive understanding of the factors driving innovation in healthcare settings.

The synthesis of findings was aligned with the three main themes of this systematic review: (1) effects of EL on IWB practices, (2) attitudes toward AI as predictive and mediating variables, and (3) the impact of contextual environmental factors, particularly organizational support systems, on IWB. These three themes collectively capture the individual, technological, and organizational dimensions that influence IWB among nurse managers in healthcare settings. This structured approach ensured that both the breadth and depth of evidence from all 16 studies were accurately represented to provide a comprehensive overview of current knowledge in this field.

3. Results

3.1. Effects of entrepreneurial leadership on innovative work behavior

Recently, EL has emerged as a pivotal factor in promoting IWB among nurse managers and healthcare professionals. Multiple studies indicate that leaders who demonstrate entrepreneurial qualities, including proactivity, opportunity recognition, and risk-taking, create an environment conducive to innovation. For example, Ahmed et al. [27] highlighted that managerial EL enhances decision-making effectiveness and knowledge-sharing behaviors, which are foundational elements of IWB. Similarly, Akbari et al. [23] found that EL positively impacted IWB, with creative self-efficacy and organizational support serving as mediating factors. This demonstrates that EL fosters both individual capabilities and a supportive environment, which together enhance innovation [23].

Further supporting this relationship, Alheet et al. [25] showed that EL styles significantly enhance employees' capacity to engage in innovative practices. This leadership style not only motivates staff but also creates psychological safety, allowing nurses to experiment with new solutions and share knowledge freely [25]. Complementing these findings, Kiran [35] observed that EL in technology-driven settings promotes not only IWB but also opportunity recognition, reinforcing the notion that proactive EL shapes both attitudes and behaviors conducive to innovation. In the context of nursing, Abdullah Mohamed et al. [28] showed that structured interventions inspired by entrepreneurial principles improved managerial competencies and flourishing at work, which are closely linked to increased engagement in innovative practices.

Radwan and Mohammed Khalil's [30] qualitative insights provided a nuanced understanding of the barriers faced by nurse managers in translating EL into fostering IWB, including a lack of organizational support, insufficient resources, and limited access to innovation-focused training. Addressing these barriers is crucial to ensuring that EL yields tangible innovation outcomes in healthcare settings [30]. In their scoping review, Cadeddu et al. [31] also emphasized that employee-driven innovation, when nurtured by EL support, is more likely to succeed if leaders proactively encourage experimentation and knowledge sharing. Hence, the combination of supportive EL and organizational mechanisms is central to fostering IWB [31].

While other studies focused on AI technologies, they also reinforced the importance of EL in innovative contexts. For example, Elkholy et al. [32] demonstrated that positive attitudes toward AI and supportive EL practices enhanced nurses' IWB, particularly when job control was high. Similarly, Elsayed and Sleem [26] found that nurse managers with prior exposure to leadership-driven initiatives were more receptive to adopting AI technologies, which indirectly supports innovative practices. Both Mohammed Gomaa Geneedy et al. [33] and Ghazy et al. [29] showed that educational interventions and EL engagement improved nurses' attitudes and perceptions toward AI, thereby fostering IWB.

Additional studies [36–38] have demonstrated that IWB in healthcare is not only a function of personal initiative but is highly influenced by EL and organizational cultures that support technological adoption and creativity. Park et al. [34] emphasized that workers' attitudes toward AI, when shaped by leaders who model and foster IWB, predict higher engagement in creative problem-solving and adaptation of new technologies, illustrating the broader organizational influence of EL.

These 16 studies collectively conclude that EL critically enables nurse managers to foster IWB through multiple pathways, including fostering knowledge sharing, promoting psychological safety, enhancing creative self-efficacy, and providing organizational support. Entrepreneurial leaders not only motivate nurses to innovate but also create the structural and cultural conditions necessary for sustained creative performance. Within the framework of this study, which systematically examines the relationships between EL, positive attitudes toward AI, and fostering IWB, these findings highlight that strengthening nurse managers' EL skills is fundamental to enhancing both their leadership effectiveness and organizational performance in healthcare settings.

3.2. Attitudes toward artificial intelligence as a predictive and mediating variable

Attitudes toward AI have emerged as significant predictors and mediators of IWB in healthcare settings. Studies have consistently demonstrated that positive perceptions and acceptance of AI technologies enhance nurses' engagement in innovative practices, particularly when supported by effective EL. For example, Elkholy et al. [32] found that nurses with positive attitudes toward AI demonstrated higher levels of IWB and that job control moderated this relationship. This suggests that both personal disposition toward technology and the ability to exercise autonomy in work tasks are critical in translating positive attitudes toward AI into concrete innovation outcomes [32].

Similarly, Elsayed and Sleem [26] highlighted that nurse managers' prior experience with AI and exposure to EL initiatives positively shape their attitudes toward adopting AI. These favorable attitudes were closely linked to an increased willingness to engage in creative and innovative practices, indicating that attitudes toward AI were both predictive and mediating variables in the innovation process [26]. Mohammed Gomaa Geneedy et al. [33] further demonstrated that structured educational programs designed to improve nurses' understanding and perceptions of AI significantly enhanced their attitudes toward AI, which in turn led to more proactive engagement in AI-related tasks and innovations. Ghazy et al. [29] similarly reported that nurse managers' positive attitudes toward AI were associated with a higher readiness to implement technological solutions and adopt innovative approaches, reinforcing the predictive role of attitudes toward AI in shaping behavior [29].

Additional evidence from Morales-García et al. [36] indicated that nurses with constructive attitudes toward AI achieved higher job performance when using AI technologies, suggesting that attitudes toward AI not only predicted innovation but also mediated the relationship between AI adoption and performance outcomes. Through their development and validation of an AI Attitude at Work scale, Park et al. [34] confirmed that employees' perceptions of AI encompassed multiple dimensions, including perceived usefulness, adaptability, and ethical considerations, which have been shown to directly influence IWB and readiness to adopt new technological solutions, further validating the mediating role of attitudes toward AI [34].

Furthermore, Huo et al. [37] showed that using AI improves work well-being and facilitates innovative practices by satisfying psychological needs. In this model, positive attitudes toward AI became a critical pathway to enhancing innovative engagement using AI, indicating that attitudinal factors mediate the effect of technology adoption on workplace innovation [37]. Studies that were not primarily focused on AI also indirectly support the idea that fostering positive perceptions of technological and organizational tools amplifies the impact of EL on fostering IWB [23, 27].

Taken together, attitudes toward AI are both predictive and mediating variables in fostering IWB among nurse managers. Leaders who cultivate positive perceptions of AI and grant the necessary support and autonomy to their workers can effectively translate these attitudes into measurable innovation outcomes. Within the scope of this systematic review, enhancing positive attitudes toward AI is therefore critical to fostering IWB and maximizing organizational performance in healthcare settings.

3.3. Contextual environmental factors, particularly organizational support systems

Contextual environmental factors, especially organizational support systems, play a crucial role in enabling nurse managers to foster IWB. The literature indicates that even when EL and positive attitudes toward AI are present, organizational support systems significantly determine the extent to which innovation is realized in practice. For example, Aldabbas et al. [24] demonstrated that perceived organizational support directly influences employee creativity and innovation, with work engagement mediating this relationship. This finding highlight that EL alone is insufficient, and organizational support frameworks are necessary to transform leadership and individual attitudes into IWB [24].

Similarly, Akbari et al. [23] found that organizational support serves as a mediating factor between EL and IWB. Nurses and managers are more likely to engage in creative problem-solving and implement new ideas when organizational policies, resources, and supervisory support align leadership practices, individual capacity, and the organizational environment to foster sustained innovative practices [23]. Similarly, both Mohammed Gomaa Geneedy et al. [33] and Ghazy et al. [29] showed that educational interventions and leadership-driven initiatives only translate into improved IWB when coupled with institutional support, such as adequate training, resources, and administrative backing.

Radwan and Mohammed Khalil's [30] qualitative insights indicated that nurse managers perceive a lack of organizational support, such as insufficient resources, limited autonomy, and inadequate training, as a primary barrier to implementing entrepreneurial practices and innovation. Addressing these structural limitations is critical to bridging the gap between potential and actualized IWB in healthcare settings [30]. In their scoping review, Cadeddu et al. [31] similarly concluded that employee-driven innovation in health organizations thrives when organizational support systems are robust, including clear policies, supportive EL, and recognition mechanisms. Conversely, environments lacking these supports often hinder innovation, regardless of individual motivation or leadership style [31].

Elkholy et al. [32] also observed that job control, as a key dimension of organizational support, significantly strengthened the effect of positive attitudes toward AI on fostering IWB. Accordingly, organizational systems that provide autonomy, flexibility, and access to resources function as critical enablers of innovation. Similarly, nurse managers' engagement in innovative activities is maximized when institutional policies and support systems facilitate AI adoption, educational programs, and skill development initiatives [26, 28].

Furthermore, organizational support systems influence the effectiveness of technological and educational interventions in promoting innovation [37, 38]. Well-structured environments that integrate psychological support, skill development, and technological infrastructure enable nurse managers to fully leverage their EL and positive attitudes toward AI, resulting in higher levels of IWB [37, 38]. Collectively, these findings underscore that contextual environmental factors, particularly organizational support, are indispensable in fostering innovation in healthcare. These factors operate synergistically with EL and individual attitudes to create a sustainable culture of innovation, directly aligning with the aim of this systematic review to examine how EL, positive attitudes toward AI, and supportive environments interact to foster IWB and enhance organizational performance among nurse managers.

3.4. Data synthesis

The 16 studies in this systematic review consistently presented evidence that EL is a critical driver of IWB among nurse managers. Leaders who demonstrate entrepreneurial traits, such as proactivity, opportunity recognition, and risk-taking, create an environment that motivates nurses to engage in innovative practices. For example, EL enhances decision-making, knowledge sharing, and creativity, all of which are essential components for fostering IWB [23, 25, 27]. Kiran [35] extended these findings to technology-driven contexts, showing that EL not only increases IWB but also facilitates opportunity recognition, illustrating the broad applicability of EL in healthcare and related sectors. Abdullah Mohamed et al. [28] demonstrated that structured interventions inspired by entrepreneurial principles improved managerial competencies and flourishing at work by linking EL to both personal and organizational outcomes.

Studies focusing on attitudes toward AI indicate that positive perceptions of AI function as both predictive and mediating variables in enhancing IWB. For example, Elkholy et al. [32] highlighted that favorable attitudes toward AI predict higher IWB, particularly when nurses have autonomy over their tasks. Elsayed and Sleem [26] and Mohammed Gomaa Geneedy et al. [33] emphasized that prior experience with AI and targeted educational programs improves nurses' attitudes toward technology, which in turn facilitates engagement in innovative practices. Morales-García et al. [36], Huo et al. [37], and Park et al. [34] further confirmed that attitudes toward AI directly influence job performance and innovation-related behaviors, demonstrating the mediating role of these attitudes in the relationship between technological adoption and practical implementation.

Contextual environmental factors, particularly organizational support systems, emerged as necessary conditions for translating EL and positive attitudes toward AI into real innovation. Perceived organizational support significantly mediated the relationship between EL and IWB, with well-structured systems enhancing creativity and engagement [23, 24]. Radwan and Mohammed Khalil [30] and Cadeddu et al. [31] also provided qualitative and review-based evidence that barriers, such as insufficient resources, limited training, and a lack of administrative backing, hindered the implementation of innovative practices. Job control, access to resources, and institutional support amplify the positive effects of EL and positive attitudes toward AI on fostering IWB [26, 32]. Similarly, organizational support system enhances the impact of technological interventions and educational programs on nurses' innovation and performance [37, 38].

Integrating the findings across these 16 studies demonstrates that the three thematic components interact synergistically. For example, EL motivates nurses to engage in innovation, positive attitudes toward AI predict and mediate engagement with new technologies, and organizational support systems provide the necessary infrastructure, autonomy, and resources to realize innovative practices. This convergence supports the aim of the current study: strengthening EL, cultivating positive attitudes toward AI, and optimizing organizational support can collectively enhance IWB and overall organizational performance in healthcare settings.

4. Discussion

The 16 studies in this systematic review have consistently shown that EL is a key driver of nurse managers' IWB. Leaders who demonstrate proactivity, recognize opportunities, and take risks enhance their decision-making, knowledge sharing, and creativity [23, 25, 27]; these leadership traits facilitate innovation in technology-driven contexts [35]. In particular, these findings are also aligned with previous research outside the current sample, such as Saleh et al. [39], who found that entrepreneurial nursing leaders significantly improved nurses' engagement in innovative projects, supporting the notion that EL styles directly motivate innovative practices.

However, other studies have presented conflicting evidence. For example, strong EL may not translate into innovation when organizational constraints, such as limited resources, rigid hierarchies, or policy restrictions, are in place [30, 31]. One study found that in hospital settings, leaders' entrepreneurial intentions had a minimal impact on innovation outcomes when staff autonomy was restricted. These discrepancies suggest that EL alone is insufficient and must operate within an organizational support system to be effective [40].

Positive attitudes toward AI are predictive and mediating factors for IWB [26, 32, 33]. For example, nurses with favorable perceptions of AI are more engaged with new technologies that improve their problem-solving and creativity [24, 36, 37]. These results are supported by recent international research, such as that of Hassan et al. [41], who found that positive attitudes toward AI among healthcare professionals correlated with faster adoption of digital innovations and higher innovation performance. Conversely, Ghazy et al. [29] observed that despite favorable attitudes toward AI, limited hands-on experience and insufficient institutional training constrained IWB. This aligns with Zhao and Huang [42], who reported that positive perceptions of AI alone did not predict innovation unless accompanied by practical training and access to technological resources. These findings suggest that positive attitudes toward AI must be paired with experiential learning and institutional support to translate into actionable innovation.

Organizational support systems were consistently highlighted as essential enablers of innovation across the 16 studies [23, 24, 32]. Job control, access to resources, and supportive policies amplified the effects of EL and attitudes toward AI on fostering IWB [26, 37, 38]. Studies excluded from this systematic review also reinforce this point. For example, Alsadaan et al. [43] found that hospitals with strong administrative support and resource allocation showed significantly higher rates of nurse-led innovation. In contrast, environments lacking structural support [30] hinder innovation, confirming that organizational factors are not merely facilitators but necessary conditions.

Synthesizing the findings across studies demonstrates a synergistic relationship between EL, attitudes toward AI, and organizational support systems. For example, EL provides vision and motivation, positive attitudes toward AI mediates technological engagement, and organizational support systems enable practical implementation, fostering IWB. Considering the international literature, these findings are largely consistent, although discrepancies highlight the moderating effect of contextual barriers, such as resource limitations and policy constraints. Taken together, this collective synthesis emphasizes that fostering IWB requires a holistic approach that combines EL development, AI education, and robust organizational support, thereby directly supporting the aim of this systematic review to enhance both nurse managers' innovation capacity and overall organizational performance.

4.1. Key implications

This synthesis of the 16 studies in this systematic review highlights that EL is foundational for fostering IWB and opportunity recognition among nurse managers. Leaders who demonstrate proactivity, risk-taking, and opportunity-focused behaviors cultivate motivating environments that enhance decision-making, knowledge sharing, and creativity [23, 25, 27, 35]. Positive attitudes toward AI also play a dual role; they predict nurses' engagement in innovative practices and mediate the effect of EL on practical implementation [26, 32, 33, 36]. These findings emphasize that EL effectiveness is closely intertwined with perceptions toward AI technologies in driving innovation in healthcare settings.

Furthermore, contextual environmental factors, particularly organizational support systems, are critical enablers that allow EL and positive attitudes toward AI to translate into tangible innovation. Access to resources, targeted training, autonomy, and institutional backing significantly amplify IWB [23, 24, 30, 38]. Consequently, interventions aimed at enhancing IWB should adopt an integrated approach that develops EL, cultivates positive attitudes toward AI, and strengthens the organizational support system. This holistic strategy aligns directly with this study's aim to systematically review the relationships between EL, positive attitudes toward AI, and fostering IWB, which ultimately guide the enhancement of EL effectiveness and overall organizational performance in healthcare settings.

5. Conclusion

This synthesis of 16 studies underscores the critical roles of EL, positive attitudes toward AI, and organizational support systems in fostering IWB among nurse managers. EL consistently emerges as a driver of innovation, enhancing decision-making, knowledge sharing, and opportunity recognition. Positive attitudes toward AI function as both predictive and mediating variables, facilitating engagement with new technologies and promoting creative problem-solving. Meanwhile, contextual environmental factors, particularly organizational support systems, provide the necessary resources, autonomy, and infrastructure that enable the translation of EL and technological attitudes into tangible innovative practices.

Taken together, these findings highlight that fostering IWB is not solely a function of individual initiative but rather the result of a synergistic interaction among leadership, technological perceptions, and environmental support, which underscores the importance for healthcare organizations to develop comprehensive strategies that integrate EL development, AI education, and robust organizational support systems to cultivate a sustainable culture of innovation.

In conclusion, strengthening EL, fostering constructive attitudes toward AI, and ensuring systemic organizational support constitute a strategic approach to enhancing both individual and organizational performance. These insights provide actionable guidance for nurse managers and healthcare administrators seeking to optimize innovation, improve patient care outcomes, and drive continuous improvement in complex healthcare environments. Future research should explore the longitudinal impacts of EL and AI-focused interventions, assess scalability across diverse healthcare contexts, and examine how organizational support systems can be optimized further to enhance nurse managers' innovative capacity and organizational performance.

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Appendix 1. Literature matrix

#	Study	Study aim	Study design	Instruments/data source	Main key findings	Strengths and limitations
1	Ahmed et al. [27], Egypt	To examine the relationship between EL, decision-making effectiveness, and knowledge-sharing behavior among nurse managers	Quantitative survey	Questionnaires measuring leadership styles, decision-making effectiveness, and knowledge-sharing behavior Sample size: 300 managers	EL positively affects knowledge sharing and decision-making effectiveness	Strengths: Large sample, validated instruments Limitations: Cross-sectional design, self-reported data
2	Akbari et al. [23], Iran	To investigate whether EL encourages IWB, with mediating roles of creative self-efficacy and organizational support	Quantitative survey	Questionnaires measuring EL, IWB, creative self-efficacy, and organizational support Sample size: 250 participants	EL positively influences IWB through mediation of creative self-efficacy and organizational support	Strengths: Mediation analysis conducted, validated instruments Limitations: Cross-sectional design, limited regional context
3	Aldabbas et al. [24], Jordan	To examine the influence of perceived organizational support on employee creativity, with work engagement as a mediating variable	Quantitative survey	Surveys exploring perceived organizational support, work engagement, and creativity Sample size: 200 employees	Perceived organizational support positively affects employee creativity via work engagement	Strengths: Mediation tested, validated instruments Limitations: Cross-sectional design, limited generalizability
4	Abdullah Mohamed et al. [28], Saudi Arabia	To assess the effect of an AI enhancement program on head nurses' managerial competencies and flourishing at work	Quasi-experimental study	Pre- and postintervention questionnaires on managerial competencies and flourishing at work Sample size: 120 head nurses	The AI program improved managerial competencies and flourishing at work among head nurses	Strengths: Intervention design, measurable outcomes Limitations: No randomization, small sample size

5	Alheet et al. [25], Saudi Arabia	To investigate the effect of different leadership styles on employees' IWB	Quantitative survey	Surveys assessing leadership styles and IWB Sample size: 180 employees	EL positively influence employees' innovative work behavior	Strengths: Clear associations, validated instruments Limitations: Self-report measures, cross-sectional design
6	Elkholy et al. [32], Egypt	To explore the relationship between attitudes toward AI and nurses' IWB, with job control as a moderating factor	Quantitative survey	Questionnaires on attitudes toward AI, IWB, and job control Sample size: 220 nurses	Positive attitudes toward AI predict IWB, moderated by job control	Strengths: Moderation analysis conducted, validated instruments Limitations: Cross-sectional design, limited context
7	Elsayed and Sleem [26], Egypt	To assess nurse managers' perceptions and attitudes toward using AI technologies in healthcare settings	Quantitative survey	Surveys measuring perceptions and attitudes toward AI among nurse managers Sample size: 150 nurse managers	Positive attitudes toward AI adoption, influenced by prior experience and training	Strengths: Targeted nurse manager population Limitations: Self-reporting, small sample size
8	Mohammed Gomaa Geneedy et al. [33], Egypt	To implement an educational program for operating room nurses to improve their perceptions and attitudes toward integrating AI in nursing practice	Quasi-experimental study	Pre- and postprogram questionnaires on AI perception and attitudes Sample size: 100 operating room nurses	Educational program significantly improved nurses' perception and attitudes toward AI	Strengths: Intervention study with measurable improvement Limitations: Small sample, short-term follow-up
9	Ghazy et al. [29], Egypt	To examine the perceptions and attitudes of nurse managers toward AI technologies in selected hospitals	Quantitative survey	Surveys measuring attitudes toward AI among nurse managers Sample size: 140 nurse managers	Positive correlations between experience and favorable attitudes toward AI adoption	Strengths: Focus on nurse managers Limitations: Cross-sectional design, limited generalizability

10	Radwan and Mohammed Khalil [30], Egypt	To explore the perceived barriers of entrepreneurship in nursing as experienced by nurse managers	Qualitative study	Semi-structured interviews with nurse managers Sample size: 20 participants	Identified barriers include lack of support, insufficient resources, and inadequate training	Strengths: Provides in-depth insights Limitations: Small sample, subjective data
11	Kiran [35], India	To examine the impact of EL on IWB and opportunity recognition in technology start-ups	Quantitative survey	Questionnaires on EL, IWB, and opportunity recognition Sample size: 200 participants	EL positively predicts IWB and opportunity recognition	Strengths: Direct measurement, validated instruments. Limitations: Cross-sectional design, limited to start-up context
12	Cadeddu et al. [31], Italy	To provide insights from a scoping review on employee-driven innovation in health organizations	Scoping review	Literature review of 45 relevant articles	Employee-driven innovation is enhanced by organizational support and leadership, but barriers include lack of resources	Strengths: Comprehensive review Limitations: Heterogeneity of the included studies
13	Morales-García et al. [36], Spain	To investigate the influence of attitude toward artificial intelligence on nurses' job performance when using AI	Quantitative survey	Surveys measuring AI attitude and job performance Sample size: 210 nurses	Positive attitudes toward AI predict higher job performance	Strengths: Validated scales Limitations: Cross-sectional design, self-report measures
14	Park et al. [34], South Korea	To develop and validate a scale measuring workers' attitudes toward AI at work	Quantitative scale development and validation	AI Attitude at Work scale Sample size: 2,841 participants in three groups	The AI Attitude at Work scale is reliable and multidimensional, capturing six attitude dimensions	Strengths: Large sample, validated instrument Limitations: Not specific to nursing, no predictive validity tests
15	Huo et al. [37], China	To explore healthcare professionals' work well-being when using AI through psychological needs	Quantitative cross-sectional survey	Questionnaires on AI use, psychological needs satisfaction, work well-being, and job	AI use positively affects work well-being through psychological needs satisfaction, while job	Strengths: Validated scales, moderation analysis conducted Limitations: Cross-

		satisfaction and job complexity		complexity Sample size: 280 healthcare professionals	complexity moderates some relationships	sectional design, self-report, single-country sample
16	Duzcu [38], Türkiye	To examine the relationship between health professionals' perceptions of IWB and their metaverse knowledge and awareness levels	Quantitative cross-sectional survey	Innovative Work Behavior scale and Metaverse Knowledge and Awareness scale Sample size: 253 healthcare professionals	IWB positively influences metaverse knowledge and awareness and demographic factors affect both IWB and metaverse awareness	Strengths: Validated scales, diverse healthcare sample Limitations: Cross-sectional design, single city, self-report measures

Abbreviations: AI, artificial intelligence; EL, entrepreneurial leadership; IWB, innovative work behavior.