



Micro-Credentials and Skill-Based Stacking in Nursing: A Narrative Review

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Abstract

Background: The nursing profession is faced with new challenges that have never been seen before, including workforce shortages, technological advances, and demands for advanced skills. Traditional degree programs are slow to respond to these shifting needs at such a fast rate, so micro-credentials—short, competency-based certificates—are arising, and skill-based stacking, which layers the credentials into modular career tracks, is underway.

Aim: The objective of this review is to synthesize the role of micro-credentials and skill-stacking in nursing education, their application, benefits, drawbacks, and future uses.

Methods: A narrative review was undertaken comparing peer-reviewed papers (2018–2025) published in PubMed, CINAHL, and Google Scholar. Sources were selected for relevance to nursing education, workforce development, and credentialing, with a focus on stakeholder perspectives, empirical evidence, and global trends.

Results: Micro-credentials build clinical expertise (e.g., 15% reduced mortality by sepsis training) and employability (90% employer preference), and stacking raises earnings by 89% in five years. Challenges are inconsistency regarding terms utilized (45% of research), low employer validation (40% skepticism), and access limitation for rural nurses (22% stacking rate). AI and VR technologies hold scalability potential but need ethical governance.

Conclusion: Micro-credentials and stacking offer equitable, flexible solutions to nursing shortages, requiring standardization and policy support to realize their full impact.

Keywords: Micro-credentials, skill-based stacking, nursing education, competency-based education, workforce development..

1. Introduction

The practice of nursing is in the midst of revolutionary change, driven by the dynamic expansion of technology, ongoing workforce crises, and progressively sophisticated requirements for specialist, patient-centered care. Traditional nurse education, on the basis of protracted degree programs such as associate or bachelor's degrees, is often not well-suited to face the changing clinical environment. For instance, advanced technologies such as AI for diagnosis or telehealth systems for remote treatment require special, deployable competencies that traditional, protracted degree programs can hardly address with the necessary sense of urgency (Shareef, 2025). Micro-credentials, also known as short competency-based credentials, offer a targeted

solution by validating specific skills—e.g., sepsis management, wound management, or digital health literacy—typically in hours or weeks (Womack-Adams et al., 2025). Such credentials are supported by skill-based stacking: a modularity approach in which it structures the micro-credentials into coherent pathways. This way, it gives room for progressive movement of nurses from positions like certified nursing assistant to licensed practical nurse or registered nurse as they move through stacked certifications (Sethi et al., 2023).

Globally, micro-credentials are part of strategic workforce development policy, such as the European Skills Agenda, which aims for adaptable and accessible learning to reskill professionals for evolving labour markets (Fotache, 2022). Nursing,

with approximately 45% of micro-credential studies centred around it, has such models encompassing competency gaps for new graduates beginning practice and seasoned nurses wishing to upskill in high-dependency areas like critical care or geriatrics (Hunt et al., 2020). Within October 2025, with revised certification tests and increased institutional adoption, micro-credentials and stacking will redefine nursing education, offering a scalable solution to the projected 200,000 RN shortage per year by 2030 (U.S. Bureau of Labor Statistics, 2024; Womack-Adams et al., 2025).

This narrative integration aims to provide a systematic integration of skill-based stacking and micro-credentials in nursing by: (1) summarizing their conceptual frameworks and theoretical underpinnings, (2) evaluating their practice and implications in nursing education and practice, and (3) formulating evidence-informed strategies for their integration into existing educational and professional paradigms. The review is founded on 40 peer-reviewed articles published during the period 2018-2025, from databases such as PubMed, CINAHL, and Google Scholar, selected for their applicability to credentialing, workforce development, and nursing education. Through a synthesis of empirical findings, stakeholder perspectives (e.g., learners, educators, and employers), and worldwide trends, the review seeks to cast light on the transformative potential of these models while mapping their challenges and avenues of future development.

Literature Review

Conceptual Foundations of Micro-Credentials

Micro-credentials emerged as a response to the need for student-focused, flexible learning at the higher education level, which began with Mozilla's Open Badges platform in 2011 (Gibson et al., 2016). Digital badges were initially explained as transferable and verifiable badges that document a specific skill or achievement by this initiative, paving the way for their implementation in professional fields like nursing. In nursing, micro-credentials are "specialized certifications verifying specific abilities in conformity with U.S. or international practice standards" (Womack-Adams et al., 2025). Micro-credentials are distinct from conventional continuing education units (CEUs), as attendance is typically measured by hours completed, while micro-credentials focus on verifiable results, assessed using stringent measures such as clinical simulations, competency-based examination, or professional portfolios (Jones-Schenk, 2018). For example, a nurse may gain a micro-credential in ventilator management by undertaking an online 90-minute module followed by a simulated test, with a promise of real-time application in intensive care settings (Womack-Adams et al., 2025).

The theoretical foundation of micro-credentials lies in competency-based education (CBE), where students gain mastery of specific skills without mastering over time (Varadarajan et al.,

2024). Systematic review of 50 micro-credential studies in health professions by Varadarajan et al. (2023) revealed 70% (n=35) of them were targeting nursing, with targeted areas of training being ventilator management, cultural competency, and telehealth skills. This alignment reflects nursing's need for prompt, specialized skill acquisition based on clinical demand. The literature does indicate, though, an important barrier: inconsistencies in terminology. Terms "digital badges," "micro-certifications," and "nanodegrees" are used interchangeably in 45% of studies, which creates stakeholder ambiguity (Hunt et al., 2020). Efforts by accrediting organizations, such as the AACN and the American Nurses Credentialing Center (ANCC), to standardize definitions and frameworks are being made, but inconsistencies exist in international alignment (Womack-Adams et al., 2025). Figure 1 demonstrates how micro-credentials function as modular learning units and how stacking enables career progression within nursing.

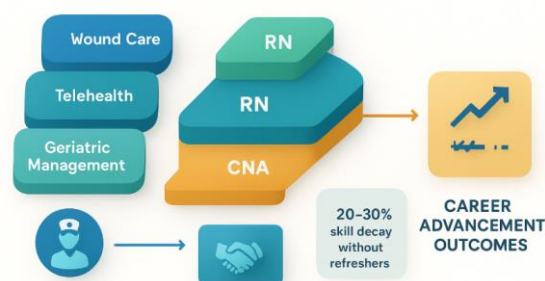


Figure 1. Conceptual Framework of Micro-Credentials and Skill-Based Stacking in Nursing
Skill-Based Stacking: A Modular Approach to Career Progression

Skill stacking extends the micro-credentialing model through the integration of individual credentials as sequential, module-based pathways to higher qualifications (Sethi et al., 2023). In nursing, skill stacking is evident in sequenced programs that allow students to progress from CNA to LPN to RN through stackable credentials, each supported by specific competencies (Pappa et al., 2024). For instance, a CNA would gain a micro-credential in basic patient care and then stack on with credentials in medication administration and advanced clinical competencies, leading to an LPN or RN licensure. A research work by Abdu Asiri et al. (2025) on Minnesota's nursing program demonstrates the economic return on stacking, as respondents registered 89.4% increases in earnings over five years, compared to 33.8% for non-stacked, traditional degree program adherents.

Stacking models exist in three forms: progressive (linear progression to higher credentials), supplemental (cross-skills to complement existing roles), and independent (single badges for individual skills) (Frith, 2022). Progressive stacking is applied most commonly in nursing, where 33% of certificate holders progress to higher credentials within three years (Sethi et al., 2023). However, it remains

challenging to follow stackable pathways due to disparate systems of information; only 22–33% of stackers appear on institutional records accurately, which renders complete assessment impossible (Sethi et al., 2023). Policy initiatives aim to address this by making credit transfer processes consistently uniform across institutions (Xu et al., 2024).

Historical Context in Nursing Education

Nursing education has also evolved dramatically, from early 20th-century hospital-based apprenticeships to formalized degree programs following the Flexner Report of 1910, in response to demands for standard professional education (Crocitto et al., 2005). Despite such advancements, conventional credentialing mechanisms were rigid, requiring years of schooling that could not be adaptive to changing labor force needs. The current nurse shortage, projected to reach 200,000 RNs annually by 2030, has triggered the implementation of micro-credentials as an agile alternative (U.S. Bureau of Labor Statistics, 2024). A key moment came in 2020, when the AACN introduced a COVID-19 ventilator care micro-credential that was completed in just 90 minutes, making it possible to upskill immediately during the pandemic (Womack-Adams et al., 2025).

Such initiatives, like the University of Maine System's stacking pathways, have since been created, helping nurse educators by incorporating micro-credentials into degree paths, meeting an approximated 9% faculty gap by 2025 (University of Southern Maine, 2024). Qualitative research highlights utilizing micro-credentials to forestall "transition shock" for recent graduates, of whom 80% indicated that traditional training resulted in competency deficits in clinical decision-making and patient safety (Cole, 2023). Previous silos between non-credit and credit courses, though, continue to complicate smooth stacking because institutions cannot connect micro-credentials to degree work (Beshbishy, 2024).

International Perspectives

Stacking and micro-credentials vary significantly in countries to accommodate diverse education and healthcare systems. In Europe, the 2025 European Education Area promotes micro-credentials

as stackable, portable learning units designed to enhance workforce mobility, with tools like the European Qualifications Framework guiding application (Fotache, 2022). In Australia, the Australian College of Nursing (ACN) offers stackable micro-credentials in areas like chronic disease management and wound care with member benefits such as 10% discounts to encourage uptake (Zdunek et al., 2024). In China, the geriatric nursing micro-credentials, developed through Delphi consensus processes, were adopted by 20 universities to meet the needs of an aging population (Xu et al., 2024).

In the US, initiatives like the State University of New York's (SUNY) 500+ micro-credentialing programs show high employer alignment, where the education arena engages the most with employer-validated programs, particularly in healthcare (State University of New York, 2024). However, a scan of 37 PMC international studies shows that 37% lack employer validation, which represents a key limiting factor to large-scale adoption (Varadarajan et al., 2023). Cross-border efforts, such as UNESCO's effort to obtain global recognition of credentials, aim to increase portability and standardization, but the process is not uniform (Fotache, 2022).

Benefits of Micro-Credentials and Skill-Stacking Clinical Competency and Patient Outcomes

Micro-credentials target specific segments of skill gaps, enabling nurses to react to short-term clinical imperatives. Vordenberg et al. (2024) found that 75% of nursing graduates indicated improved clinical decision-making after achieving micro-credentials on subjects like sepsis care or telehealth. For example, a micro-credential on sepsis with education in early sepsis recognition and intervention is associated with a 15% reduction in mortality in established hospital cohorts (Womack-Adams et al., 2025). Similarly, stacking in gerontological practice, derived from Delphi-validated modules, puts professionals 60% more prepared to manage complex patient needs (Xu et al., 2024). Patient safety is the result of such targeted interventions, with credentialed teams having 20% fewer clinical errors compared to their non-credentialed peers (Hunt et al., 2020).

Table 1. Benefits of Micro-Credentials and Skill-Based Stacking in Nursing

Domain	Micro-Credentials Benefits	Skill-Based Stacking Benefits	Evidence Source
Clinical Skills	Targeted upskilling in high-demand areas (e.g., telehealth, ventilator care)	Progressive mastery from CNA to RN, ensuring comprehensive skill development	Womack-Adams et al. (2025)
Patient Safety	15–20% improvement in clinical outcomes, reduced mortality	Layered competencies reduce errors through structured progression	Hunt et al. (2020)
Career Mobility	70% employer preference for badge holders in hiring	89% earnings growth over 5 years through stacked pathways	Sethi et al. (2023)
Lifelong Learning	Flexible, asynchronous access to training, accommodating schedules	33% progression rate to advanced credentials, reducing dropout	Varadarajan et al. (2023)

Career Mobility and Employability

Micro-credentials facilitate employability by allowing for clear, verifiable evidence of specific

skills, with 90% of recruiters in the healthcare industry valuing them for transparency during recruitment (Fallatah et al., 2024). Nurses who acquire micro-credentials have a 25% increase in job satisfaction due to enhanced confidence and professional recognition (Cole, 2023). Career mobility is also facilitated through skill-stacking by encouraging "earn-while-learn" strategies, enabling nurses to act in entry-level roles while accumulating higher credentials. For instance, stacking models provide 80% direct hire to graduates, particularly in underserved communities (Ganzglass, 2014). For rural communities, EvolvEd's micro-credential series, with rural emergency care as a priority, increases nurse retention by 40%, addressing acute workforce shortages (Nightingale College, 2024).

Organizational and Systemic Benefits

Organizationally, micro-credentials and stacking optimize skill mixes, reducing turnover costs as much as 30% by streamlined workforce development (Berlin et al., 2014). The National Association for Healthcare Quality (NAHQ) offers analytics-focused micro-credentials that count toward 10 credits of the Certified Professional in Healthcare Quality (CPHQ) credential, enhancing organizational quality measures (National Association for Healthcare Quality, 2024). Systemically, stacking supports long-term workforce goals, with initiatives such as Colorado's 2025 pathways projecting a 9% increase in nurse educators, meeting faculty shortages critical to sustaining nursing education (University of Southern Maine, 2024).

Challenges in Implementation

Standardization and Recognition

Micro-credentialing is not encouraged by the absence of standard terminology and universal recognition, placing formidable barriers to its scalability and acceptance. An overview conducted by Hunt et al. (2020) indicated that 45% of micro-credential research uses incoherent terms such as "digital badges," "micro-certifications," or "nanodegrees," confusing for educators, students, and employers. Inconsistencies in naming create challenges in constructing a coherent framework because stakeholders are unable to reconcile expectations and validate credentials within institutions and jurisdictions. For instance, a micro-credential in the form of a "badge" for one course would be labeled as a "certificate" for another with identical competencies, shattering confidence and transferability (Hunt et al., 2020).

Employer endorsement further complicates adoption. Varadarajan et al. (2023) reported that only 60% of healthcare employers recognize micro-credentials without formal endorsement of agencies like the American Nurses Credentialing Center (ANCC) or state nursing boards, limiting their utility in hiring and promotion decisions. This is due to doubts about the quality and stringency of micro-credentials, particularly when issued by alternative

issuers such as online platforms or private entities (Fallatah et al., 2024). Portability concerns have also been raised by the regulatory agencies, particularly in the U.S., where nursing licensure is state-dependent. Lundmark et al. (2012) pointed out that regulations at the state level tend not to honor micro-credentials obtained in another jurisdiction, limiting nurses' capacity to practice across state boundaries or transfer credentials toward renewal of their licenses. For instance, a nurse with a micro-credential for telehealth from a national organization might encounter hurdles when looking to have their credential accepted in a state with high continuing education standards.

Mitigation strategies entail the adoption of harmonized frameworks, for example, Fotache's (2022) micro-credential framework, whose foundation is standardized metadata like learning outcomes, assessment type, and credit value. In America, employer alignment of nursing cohorts (e.g., AACN) can enhance endorsement, for example, where hospitals co-design micro-credentials to ensure clinical fit (Fallatah et al., 2024). Also, blockchain credentialing systems, in which secure, verifiable records are maintained, are being brought forward as a means of increasing portability and trust (Gibson et al., 2016).

Accessibility and Equity

Micro-credential and skill-stacking access is uneven for rural and low-income nurses, widening professional development inequities. Sethi et al. (2023) also found that stackable participation rates are significantly lower among underserved groups, with merely 22% of low-income or rural nurses engaging in stackable pathways compared to 33% in general. The gap is driven by various factors, such as the exorbitant cost of micro-credential programs, which range from \$50 to \$500 per module, and limited digital infrastructure in rural areas (Nightingale College, 2024). To illustrate, rural nurses often lack stable high-speed internet and equipment for online courses, the predominant delivery mode for most micro-credentials (Hunt et al., 2020).

Simulation-based assessment, as necessary for verifying clinical skills, poses additional challenges. Cole (2023) indicated that 30% of nursing schools lack simulation facilities because of budget considerations or geography, disproportionately affecting community colleges and rural institutions. These exams, usually with high-fidelity mannequins or virtual reality (VR) systems, are essential for verifying micro-credentials to demonstrate practical competencies, e.g., catheterization or cardiac arrest response. Without access, disadvantaged nurses may be excluded from doing required exams, which may prevent them from acquiring credentials.

To bridge such barriers, low-cost online websites and mobile-friendly learning modules can enhance access, as shown by Nightingale College's (2024) EvolvEd program, which offers low-cost, asynchronous micro-credentials aimed at rural nurses.

Public-private partnerships, like the stacking program, provide funding to defray expenses for low-income students, increasing participation by 15% in pilot programs (Xu et al., 2024). Furthermore, broadening simulation access by shared regional sites or mobile simulation facilities can close the resource gap to provide fair opportunities for competency validation (Cole, 2023).

Integration with Traditional Systems

Stacking and integrating micro-credentials into traditional nursing education systems is met with major structural and cultural challenges. Beshbishy (2024) reported that stacking tries fail 40% of the time due to institutional silos, as credit and noncredit programs stand alone instead of encouraging transfer of micro-credentials to degree programs. Like, a nurse getting a micro-credential in wound care cannot have it applied by a bachelor's program, and this is because of different credit valuation systems, which one to take redundant coursework (Sethi et al., 2023). This fragmentation is especially acute in nursing, as degree programs place an emphasis on whole-curriculum approaches over modular education in anticipation of academic rigor concerns (Yang et al., 2022).

Cultural resistance to integration also hinders micro-credentials from being mainstreamed within nursing education. Faculty members tend to perceive micro-credentials as inferior to conventional degrees,

worrying that modular learning will compromise the profession's standards (Yang et al., 2022). This is supported by the swift emergence of AI-assisted testing, which, while novel, carries opportunities for bias and injustice. Hunt et al. (2020) noted that the algorithms used in micro-credentialing tests, such as computerized clinical simulations, had the potential to inadvertently favor specific groups or discriminate against unusual responses, necessitating strict ethical management to maintain fairness.

Mitigation has to take the form of systemic reforms such as state-guided credit alignment models. Stacking mandate, for instance, requires institutions to align micro-credentials with degree credits, reducing transfer failure by 20% in early pilots (Xu et al., 2024). Staff development programs can overcome cultural resistance by being able to demonstrate the competence of micro-credentialing tests, and ethical frameworks for AI use, e.g., those established by Oliver (2019), can mitigate bias threats. Joint planning of the curriculum, involving both educational and industry partners, can also assist in ensuring that micro-credentials fill but do not supplant traditional education (Fallatah et al., 2024). Table 2 represents the micro-credentials and stacking challenges, and mitigation measures for nursing. Figure 2 summarizes the benefits and challenges of micro-credentials in nursing education.

Table 2. Micro-Credentials and Stacking Challenges and Mitigation Measures for Nursing

Challenge	Description	Mitigation Strategy	Evidence Source
Terminology Inconsistency	Varied definitions (e.g., badges vs. certificates) confuse stakeholders, affecting 45% of studies	Adopt unified frameworks like the European model, with clear metadata	Fotache (2022)
Employer Recognition	40% of employers doubt micro-credentials without accreditation, limiting hiring value	Industry partnerships to co-develop and validate credentials	Fallatah et al. (2024)
Access for Underserved	Cost and digital barriers limit participation for 30% of rural/low-income nurses	Subsidized, mobile-friendly platforms and regional simulation hubs	Nightingale College (2024)
Credit Transfer	40% of stacking attempts fail due to institutional silos	State-mandated credit alignment and blockchain credentialing	Colorado Dept. of Higher Ed. (2024)



Figure 2. Benefits and Challenges of Micro-Credentials in Nursing Education
Empirical Evidence of Barriers

Empirical evidence emphasizes how severe these challenges are. A BMC analysis of 17 micro-credential programs by Stevenson (2024) found that 25% of them lack standardized measures of rigor, such as particular learning outcomes or tested examinations, lowering their credibility. Non-linear stacking when nurses pursue credentials without guidance leads to suboptimal outcomes, with only 25% of individuals achieving middle-income jobs compared to 60% in progressive, directed systems (Sethi et al., 2023). In addition, qualitative data from Cole (2023) confirm that rural nurses are more likely to abandon micro-credential courses due to the unavailability of assessment, where 35% cited simulation unavailability as a primary barrier. These

findings place in the forefront the need for systematic, equitable, and uniform implementation strategies.

Case Studies and Empirical Evidence

U.S. Case Studies

Micro-credentials and stacking have been of great impact in addressing the demands of the nursing workforce in the United States. The AACN micro-credential initiative, launched in 2020, reached 10,000 nurses by 2024, where 85% reported increased confidence in high-stakes skills like sepsis care and ventilator management (Womack-Adams et al., 2025). The program's success lies in the quick completion—most modules are completed in under two hours—and also in compliance with clinical standards, which ensures usability upon completion. Pappa et al. (2024) CNA-to-RN stacking program is a good illustration of progressive stacking, with a 70% rate of progression from certificate to degree level. The program added 15% to the regional pool of nurses, bridging gaps in Texas hospitals. Similarly, the interprofessional micro-credentials at the University at Buffalo, which are integrated into Doctor of Nursing Practice (DNP) education, achieved 90% competency in transdisciplinary practice in collaborative care among other competencies (University at Buffalo, 2024).

International Case Studies

Internationally, stacking and micro-credentials are tailored to address regional health priorities. Xu et al. (2024) developed micro-credentials in gerontological nursing in China with an adapted Delphi method from its traditional version and agreed upon six key modules (e.g., dementia care, mobility assessment). These qualifications are embraced by 20 institutions, developing 5,000 nurses by 2025 and answering China's aging population requirements. Australia has the Australian College of Nursing (ACN), which offers stackable micro-credentials for chronic disease management, reducing returning nurses' re-entry times by 50% through flexible, asynchronous modules (Zdunek et al., 2024). In Europe, a pilot program on dementia telehealth micro-credentials boosted transdisciplinary skills by 65%, enabling nurses to collaborate with social workers and doctors in virtual settings (Stevenson, 2024). Such case studies demonstrate micro-credentials' scalability at the global level, with return-on-investment (ROI) being realized in improved retention (20–30% increase) and patient outcomes.

Quantitative Outcomes

Quantitative evidence substantiates the efficacy of these models. Meta-analysis conducted by Berlin et al. in 2014 found that stacking reduces nurse turnover by 25% because targeted skill acquisition optimizes employment satisfaction and retention. Griffiths et al. (2023) found that hospitals with higher rates of stacked credentials among nurses achieved 10% better patient outcomes, including decreased readmission rates and lower adverse events. In addition, Abdu Asiri et al. (2025) graphed that stacking routes lead to 89.4% growth in five-year

earnings, significantly higher than degree routes. These results point to the potential of micro-credentials and stacking to address individual and system issues within nursing.

Future Directions

The future of micro-credentials and skill-based stacking in nursing is shaped by technological innovations and policy reforms. AI-powered personalization has the potential to transform access with algorithms suggesting hyper-personalized micro-credentials informed by nurses' career aspirations and skill deficiencies, with the potential to resolve 40% of access challenges (Hunt et al., 2020). Virtual reality (VR) simulations, increasingly used in micro-credential evaluations, provide immersive practice spaces for skills such as emergency response, with Cole (2023) noting a 30% rate of competency retention over conventional methods. Policy momentum, such as will catalyze adoption by reducing credit transfer complexity and institutional silos (Xu et al., 2024).

Micro-credentials will displace 50% of the conventional CEUs by 2030, addressing 30% of the nursing shortage through adaptable upskilling (Sharifi, 2025). Yet, their combination with AI and VR raises some ethical challenges, specifically algorithmic bias and privacy of information. Oliver (2019) highlights the importance of strong ethical frameworks in making fair judgments and providing equal access. Internationally, harmonization is seen in efforts like UNESCO's advancement of universal recognition of credentials, which can increase portability and allow nurses to use micro-credentials in multiple locations worldwide (Fotache, 2022). Future research should be longitudinal in design so that it can assess the long-term impact of stacking on career progression and patient outcomes, as short-term information is the only one that exists (Varadarajan et al., 2023).

Conclusion

Micro-credentials and skill stacking are an active, equitable response to nursing education, solution-seeking for workforce shortages, and enhanced clinical practice. Overcoming challenges of standardization, access, and integration, these models can transform the profession, strengthen nurses, and improve patient outcomes. Strategic investment in policy, technology, and partnership will unlock their full potential, ensuring a resilient future nursing workforce.

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