REVIEW

# The essential role of professional nurses in the U.S. healthcare workforce: Challenges, innovation, and opportunities

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## ABSTRACT

Professional nurses, defined in this paper as licensed registered nurses, are a cornerstone of the U.S. healthcare workforce, serving as frontline caregivers and advocates across diverse settings. This is a narrative synthesis which examines the multifaceted challenges currently facing the nursing profession, including workforce shortages, burnout, and inflexibility in skill distribution, which are issues magnified by the COVID-19 pandemic and other public health crises. We examine how demographic shifts, such as an aging population and retiring nurses, along with rapid technological advancements, particularly in digital health and artificial intelligence, are reshaping nursing roles and responsibilities. The evidence presented highlights the critical importance of industry partnerships in addressing these challenges, emphasizing collaboration between nurses and stakeholders in healthcare technology, pharmaceuticals, and medical device manufacturing to develop tools and resources that align with evolving care needs. Additionally, we discuss opportunities for innovation in nursing education, workforce development, and entrepreneurial endeavors aimed at improving workplace conditions and patient outcomes. By analyzing current workforce composition, educational trends, and pathways for strengthening professional practice, the authors aim to inform policy makers, healthcare leaders, and educators about strategies to enhance the future of nursing and ensure the resilience of the broader healthcare system.

**Key Words:** Healthcare innovation, Industry partnerships, Nursing education, Nursing practice, Nurse workforce, Workforce shortages

## 1. INTRODUCTION

Professional nurses, defined in this paper as licensed registered nurses, are a cornerstone of the U.S. healthcare workforce and comprise its largest group, playing a central role in delivering safe, effective, and compassionate care.[1] Serving at the frontline, professional nurses are licensed registered nurses (RNs) who are uniquely embedded in the patient experience, often spending more time in direct contact with patients and families, whether at the hospital bedside, home, community, or virtually, than any other healthcare professional.[2] They are uniquely present in health care as advocates for patients and families and as firsthand assessors, evaluators, and conduits of information for decision-making among teams of providers such as physicians, therapists, pharmacists, and laboratorians.[3] They are accountable for many patient safety, care coordination, and quality outcomes

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across a time continuum and care settings.

Today, the U.S. and global nursing profession is facing an inflection point with potentially long-lasting repercussions. The COVID-19 pandemic intensified existing workforce challenges and consequently revealed known yet undermined systemic vulnerabilities, including widespread burnout, staffing shortages, inflexibility in skill distribution, and limitations in nursing education capacity.[4,5] During the COVID-19 pandemic, the increased rates of CAUTI (catheter associated urinary tract infections) and CLABSI (central line associated bloodstream infections), both of which rely on nursing led prevention bundles, elucidated a larger problem, namely that during times of care disruption and related surge capacity, nursing bandwidth was already at a breaking point.[6] In fact, as far as disruptive external forces go, the COVID-19 pandemic could be the greatest workforce disruptor to healthcare since World War II. Prior to COVID-19, the HIV and Hepatitis C epidemics of the 1990s also disproportionately affected nursing workflows due to a resultant increase in total patient care time in order to mitigate the risk of exposure to blood borne pathogens. These pandemics in aggregate have shown how critical nursing work is, while also exemplifying how outcomes are intrinsically tied to overall nursing responsibilities. Moreover, the extrinsic factors of an aging population, endemic chronic illness in populations, the rapid integration of digital health technologies and data-driven models, the rapidly expanding potential of artificial generative intelligence and a retiring nursing workforce with a growth of new graduates needing mentorship has been reshaping the profession.[7,8]

In this evolving global landscape, partnerships between the nursing profession and industry stakeholders, including healthcare technology companies, pharmaceutical firms, and medical device manufacturers, are becoming increasingly vital. For instance, the aforementioned public health crises were only clinically manageable through the synchronous efforts of industry-led innovations with clinician input and public health guidance. This same paradigm should not be exclusive to public health emergencies; industry partners also play a key role in co-developing tools and technologies that align with nursing workflows, ultimately enhancing care delivery, and improving patient outcomes.[9] Home care, skill flexibility, and innovative health settings are needed. It stands to reason that continuing proactive collaborations with these same stakeholders can support new modalities and therapeutic delivery options in clinical practice, expand access to continuing education, and provide resources for workforce development. Such actions would help adapt to current pain points while simultaneously preparing for the next big disruptor.

Therefore, the authors employed a narrative synthesis approach to explore the current state of nursing in the United States with a focus on workforce composition, educational trends, entrepreneurial opportunities, and improving workplace conditions with the goal of improving nursing's innovative capacity to augment and improve health outcomes. By identifying key questions, challenges, and highlighting innovative pathways forward, the authors aim to inform stakeholders and a wider audience regarding policy, practice, and academic strategies that can strengthen the nursing profession and, by extension, the broader healthcare system.

## 2. Current nursing workforce composition

### 2.1 Demographics

There are nearly five million registered nurses in the U.S, making up the largest segment of healthcare workers.[1,10] The median age of the nursing workforce is 46 years, and a significant portion of nurses are approaching retirement.[11] There are significant variations in the distributions of nurses across U.S. regions, where urban areas tend to have higher nurse supply while rural communities may struggle to recruit and retain qualified staff.[12]

The overall diversity of the nursing workforce appears to be gradually changing. As of 2022, 80% of RNs identified as White, 7.4% Asian, 6.3% Black or African American, and 6.9% identifying as Hispanic. The proportion of men in nursing has increased, rising from 9.4% in 2020 to 11.2% in 2022.[1]

### 2.2 Educational attainment

Most registered nurses enter practice with either a baccalaureate degree from a four-year college or university or an associate degree from a community college.[1] As of 2022, 71.7% of the RN workforce held a baccalaureate or higher degree as their highest level of nursing education. Employers increasingly favor baccalaureate-prepared nurses; according to the latest American Association of Colleges of Nursing (AACN) survey on the employment of new nurse graduates, nearly 28% of employers require a bachelor's degree, while 72% strongly prefer it.[1] Advanced education among nurses is also growing, with 17.4% of registered nurses holding a master's degree and 2.7% holding a doctoral degree in 2022.[1] However, the demand for nurses with graduate-level preparation for advanced practice, clinical specialties, teaching, and research roles continues to far exceed the available supply.

Within the last fifteen years, nursing education has embarked on repositioning the focus of nursing education from quantitative standards of hours of education to a competency-based

education approach in which students demonstrate not only that they have learned material and skills but that they also have reflective knowledge of how to learn, apply, and develop lifelong learning.[13–15] In 2021, baccalaureate nursing programs in the U.S. have been re-engineering their curriculum and clinical experiences through the AACN Essentials program to achieve competency-based education.[13] Simultaneously, new approaches to highlight and prioritize academic and practice partnerships to ensure better transitions from graduation to practice. This is especially important in pre-licensure education programs where it is well known that new nursing graduates face barriers to transitioning to highly complex work environments and are at risk of burnout or leaving nursing positions. Academic-practice partnerships between schools of nursing and health care systems are increasingly formalizing ways to work together on curriculum development, short-term module courses, immersion in technologies, and shared faculty appointments for academic faculty to have practice opportunities and practicing nurses who serve as preceptors to be engaged in student academic learning.[16]

Among the important accomplishments of the AACN Essentials program is the standardization of domains of nursing education across the U.S.[17] These new nursing education changes and recommendations emphasize quality and safety, informatics and healthcare technology, systems-based practice, and interprofessional partnerships that are particularly relevant to potential nursing partnership with industry. Other relevant concepts within the domains include a revised nursing curriculum that nursing would bring to partnerships with tech/engineering are competencies in communication, ethics, clinical judgement, and advocacy through health policy.

Increasing enrollment in schools of nursing to address the workforce shortage is hampered by shortages of nursing faculty and clinical settings for learning.[18] Academic-practice partnerships have brought solutions directly to these problems. Investment from health systems who employ nurses is increasing but not yet at a level that will completely address shortages, particularly in rural and less populated areas. Evidence shows that patient and system outcomes are better with a nursing workforce prepared with a baccalaureate education.[19,20] To address movement toward career ladders for licensed RNs prepared with associate degrees or diplomas, nursing for several decades has successfully grown accelerated bachelor's and master's degree programs for RNs and for those with bachelor's minimum degree in other fields.[21] These efficient fast-tracked programs are highly enrolled and along with the traditional baccalaureate programs have low acceptance rates.[20] Employers have been highly receptive to graduates from such accelerated programs due to the breadth of general work experience that they bring to initial practice.[22]

## 3. Current nursing workforce shortage and challenges

### 3.1 Overview

Nurses today face unprecedented pressure from overlapping challenges such as workforce instability, patient complexity, technological advancements, and the adoption of artificial intelligence platforms to enhance care. Ongoing staffing shortages, widening skill gaps, and systemic underinvestment in nursing infrastructure have created moral distress and operational inefficiencies across care settings.[9] These practice pressures explicitly reveal gaps in the workforce pipeline and educational capacity, leading to increased burnout and attrition. Nursing's role in high-acuity, technology-driven care environments now demands adaptive, ethical, and evidence-based leadership to ensure safe and effective practice.

Although the primary focus was on the U.S., the authors examined global perspectives on nursing shortages, both current and historical. One recent paper highlights the importance of addressing ongoing nursing workforce shortages to develop effective and sustainable solutions.[9] Despite cyclical fluctuations in nursing workforce numbers, most regions worldwide continue to experience persistent shortages due to an aging population and post-pandemic turnover. These shortages differ by region, with rural areas and safety-net hospitals often being the most impacted because of limited recruitment options and lower wage competitiveness. Further, states and regions where there is limited access to nursing education programs and fewer clinical training opportunities tend to experience ongoing staffing shortages.[12]

Forecasts indicate ongoing national deficits through 2037, with a 10% Registered Nurse (RN) workforce shortage projected by 2027, gradually decreasing over time.[23] Regionally and in some states, vacancy rates are a greater concern, with Human Resources and Service Administration projecting shortages in multiple states, including at least 10 states with RN vacancy rates of 17% or higher. Vacancy rates continue to surpass pre-pandemic levels, reflecting retirements and poor retention among early-career nurses.[24] The World Health Organization (WHO) highlights persistent global inequities in the nursing workforce and calls for coordinated international efforts to build a more resilient and equitable system; in fact, the WHO predicts a shortage of 4.5 million RNs by 2030.[24] Priorities include expanding nursing roles in underserved areas, strengthening education and regulation, improving working conditions and pay equity, protecting and advancing women in the profession, and preparing nurses to

lead in fields such as digital health and climate-responsive care.[25] These actions collectively aim to develop a well-prepared, equitably supported, and globally distributed nursing workforce for the future. Industries throughout the world rely on the health of local workers and could be supportive of nursing education and retention of nurses in local regions. This section explores drivers of nursing workforce instability, which are summarized in Table 1.

**Table 1.** Drivers of workforce instability

| Driver | Description/Impact |
|---|---|
| Workforce Shortages | Persistent deficits due to aging workforce, retirements, and post-pandemic turnover. |
| Burnout & Moral Distress | Increased stress from high patient complexity, staffing gaps, and operational inefficiencies. |
| Faculty Shortages | Limits nursing school enrollment and restricts pipeline of new graduates. |
| Early Retirements | Accelerates loss of experienced nurses, increasing turnover. |
| Transition Challenges | Novice and foreign-educated nurses face barriers to practice, worsening attrition. |
| Chronic Illness Burden | Growing patient complexity and comorbidities increase demands on nurses. |
| Workplace Violence | Up to 70% of nurses affected annually by physical, verbal, and digital harassment. |
| Inflexibility in Skill Distribution | Regional disparities in nurse supply, especially in rural and safety-net hospitals. |
| Compensation & Employment Shifts | Rise of gig/contract nursing, changing pay models, and demand for autonomy/flexibility. |
| Technological Advancements | Rapid adoption of AI, digital health, and new devices creates ethical dilemmas and workflow disruptions. |
| Underinvestment in Infrastructure | Systemic lack of resources and support for nursing roles and education. |
| Limited Leadership Representation | Fewer than 25% of hospital leadership roles held by nurses, limiting influence on policy and innovation. |

### 3.2 Contributing factors

An aging workforce, early retirements, moral distress, and the appeal of flexible options like travel nursing and remote roles contribute to attrition. Transition challenges for novice and foreign-educated nurses worsen turnover.[26,27] Faculty shortages further restrict the number of new graduates and there has been a corresponding decline in nursing school enrollment.[1,28] In fact, approximately 138,000 nurses have left the workforce since 2022 and an additional 40% of nurses have recently reported that they plan to leave the workforce over the next five years.[29] At the same time, it is projected that over 200,000 new nurse positions will be created each year over the next decade which contributes to an increasing gap in workforce sustainability.[30] Given this gap, the US Bureau of Labor Statistics estimates that an additional 275,000 nurses will be needed by 2030 to meet the demand.

The growing burden of chronic illnesses and complex comorbidities increases demands on nurses, especially in acute and community settings. Moreover, all health care professionals are confronted by emerging diseases and widespread care needs of a growing population with chronic illnesses manifesting at a younger age.[8] As patient dependency grows, nurse–patient ratios are strained, and relational care diminishes. In the past, nurses in acute care settings earned higher fiscal compensation than those in ambulatory care clinics.[31] However, in some organizations, this is no longer true, and nurses now realize they can contribute professionally for the same pay while maintaining a balanced life, shifting away from the traditional work-life balance model.

Through technological advancement and the individual patient's desire to pursue extensive life-saving measures, ethical dilemmas are often created involving futile care, resource scarcity, and inequitable access, which may erode moral resilience.[32] These pressures increase compassion fatigue and contribute to workforce instability. Nurses are often at the forefront of these challenging patient and family discussions, which further contributes to burnout.

Recently, most health care facilities, including acute care settings and outpatient clinics, have experienced a sharp increase in workplace violence. This problem remains widespread, impacting up to 70% of nurses annually, and includes physical assaults, bullying, and digital harassment.[33,34] Evidence-based prevention programs are still adopted unevenly.[35] New cyber risks, such as online harassment of nurses, are emerging, with some harassers going to extremes that include attempts to publicly humiliate their victims.[36]

Nurses who lack sufficient resources at work often seek employment elsewhere. Kohnen et al. identified several key factors that support nurse retention.[37] These include job resources, work engagement, constructive feedback, autonomy, and growth opportunities, all of which are vital for retaining nurses. However, the most important factor is the relationship

between the nurse and their immediate leader.[38] In Raso, Fitzpatrick, and Masick's nationwide U.S. study involving nearly 1800 RNs, they found that authentic leadership by the leader significantly improves healthy work environments and supports nurse well-being.[38] This underscores the importance of healthy relationships that foster two-way communication, trust, and ethical leadership.

### 3.3 Employment structures

The current nurse workforce is experiencing a significant shift as professionals increasingly seek flexibility, autonomy, and opportunities to shape their own careers. These trends are reflected in the rise of the "gig or contract nursing workforce," as Dr. Sherman describes.[39] Generational changes, especially among Generation Z nurses, are fueling a move toward work-life balance and personal agency, diverging from traditional salaried and shift-based roles. This disruption is visible in the rise of entrepreneurial ventures such as nurse-led clinics, teleconsulting services, and health innovation advisory roles, all of which are characteristic of what Sherman and others have described.

Simultaneously, value-based payment models are transforming reimbursement by linking compensation to patient outcomes instead of labor input. This encourages healthcare systems to incorporate aggregate quality of care outcomes into employee payment models in an attempt to better reflect the measurable impact of nursing on quality and safety. In response, the profession must develop strong frameworks to capture which activities are specific to the profession and bill for nursing contributions within payer systems. Unfortunately, the U.S. has not explored this in depth, but international studies are emerging.[40] A scoping review by Di Nitto et al. shows many efforts to understand how to unbundle nursing care costs, but due to complexity, none have succeeded.[40] The authors identified one study that created a nursing relative value unit, similar to a provider model, but much work remains to shift to a nurse's billing system. Only when a model like this is adopted will payers, administrators, and the public truly see and hence understand nursing's clear value to healthcare.

Porter-O'Grady, Rollins, and Bailey argue that traditional hierarchical structures threaten the social responsibility and professional autonomy of nurses, advocating instead for models that promote full accountability and collaborative practice.[41] Nurses should have agency over their scope of practice, and the path for this is through professional governance models where true collaboration exists between nurses and their leaders. In such models, nurses are not merely participants but hold decision-making authority over their practice, thereby transforming staff into professionals, empowered with ownership and accountability for outcomes. These structures shift the locus of control from top-down managerial edicts to the nurse as an expert in the field, aligning governance with nursing's social contract and its obligation to advance care, quality, competence, and knowledge. When implemented effectively, professional governance fosters an environment of equality, so that nurse leaders and clinical nurses work interdependently rather than in silos, reinforcing shared accountability and collaborative practice. Ultimately, this shift supports not just nurse empowerment but better patient outcomes, higher nurse engagement, and organizational resilience. When nurses govern their practice, they bring expertise closer to decision-making and practice innovation.

Technological advancements are also transforming the field, with artificial intelligence (AI), big data, and industry partnerships improving clinical decision-making, remote monitoring, and patient safety.[42–44] Nurse innovators are leading efforts to create user-friendly tools that are designed to fit seamlessly into workflows, though ethical implementation and human oversight remain essential to maintain compassionate care.[45] Meanwhile, professional organizations continue to shape policy, advocating reforms in staffing, pay, licensing, and education to address the faculty shortage and ensure the profession's sustainability and growth. Coordinated policy efforts at both state and federal levels will be crucial to support these emerging practice models while preserving nursing values.

### 3.4 Nursing education

Faculty shortage persists, resulting in nearly 66,000 nursing students being turned away for the 2023-2024 academic year.[46] To overcome this, fundamental changes will be needed on both the academic and practice sides of the equation. Academic-practice partnerships require a significant transformation to develop a robust model that yields positive outcomes for both partners and supports the RN pipelines. In one study, Jarosinski et al. found that nursing program administrators face challenges like those of their practice partners, including faculty burnout, overburdening, and pay disparities.[29]

Harder et al. emphasized the importance of advancing nursing education through artificial intelligence and enhanced virtual reality (AI-VR) to supplement adequate hands-on patient care and real-world experience.[47] Using AI-VR with standardized patient scenarios improves nursing education by supporting communication skills, clinical relevance, realism, and learner engagement. An AI-VR approach provides students with a structured, non-judgmental environment that encourages the development of empathy and authentic interpersonal communication skills. Students perceive it as

a psychologically safe space for learning. Overall, a balanced curriculum combining both modalities, supported by faculty training and ongoing assessment, can enhance learning outcomes, strengthen communication skills, and prepare students for complex clinical interactions.

## 4. The future of the nursing workforce: Opportunities and outlook

Nurses comprise the largest segment of the healthcare workforce, but high-quality patient care is not delivered in isolation. It depends on effective collaboration across the entire health system, including finance, human resources, operations, and executive leadership. Decisions made in these areas directly influence workforce stability, patient outcomes, and organizational performance. As the chief nurse leads the nursing enterprise within this broader system, creating and sustaining a healthy work environment requires intentional investment. One example is the Magnet® designation process through the American Nurses Credentialing Center. While Magnet requires upfront resources, the return on investment is well documented. Magnet-designated organizations consistently demonstrate lower nurse turnover, reduced burnout, higher workforce engagement, and improved patient outcomes.[48,49]

These outcomes translate into measurable organizational benefits: lower recruitment and onboarding costs, improved quality metrics, stronger patient experience scores and enhanced organizational reputation. As a result, initiatives that support nursing excellence are not nursing-specific priorities; they are enterprise-wide strategies that advance financial performance, operational stability, and long-term sustainability.

The U.S. Health Resources and Services Administration (HRSA) projections of a continued nursing workforce shortage estimate a peak in 2027 with a potential surplus by 2035.[23] However, as discussed in this article, nurse workflows are heavily intertwined with physician, pharmacist and laboratorian workflows and outputs. With a physician shortage anticipated to only increase by up to 120,000 in 2030, nurses and nurse practitioners will be in increased demand.[50] Compensatory new care paradigms that absorb the shifting demographics of available clinicians will ideally and proactively focus on building resilience, ensuring professional sustainability, and fostering partnerships with technology and data science to help inform expedited patient care decision making. Future practice might by necessity to rely on restructured staffing models, contractual arrangements with nurse groups, flexible career pathways, and investment in digital fluency. Finally, as one pathway to foster health practitioner retention, employers and payers must foster supportive environments that value clinical judgment and provide meaningful engagement in innovation and decision-making. This section explores a framework for nursing workforce opportunities, which are summarized in Table 2.

**Table 2.** Future opportunities framework

| Opportunity Area | Strategic Actions/Solutions |
|---|---|
| Academic-Practice Partnerships | Expand collaborations between schools and health systems for curriculum, clinical training, and faculty. |
| Competency-Driven Education | Implement standardized, competency-based curricula (e.g., AACN Essentials) and lifelong learning models. |
| Innovative Employment Structures | Develop flexible career pathways, split faculty roles, and support nurse-led clinics and entrepreneurial ventures. |
| Industry Collaboration | Engage nurses in technology design, product development, and workflow optimization; foster scholarships and innovation workshops. |
| Digital Fluency & Technology | Invest in AI, virtual reality, and digital health training to enhance clinical decision-making and patient safety, where appropriate. |
| Professional Governance | Empower nurses through shared decision-making, authentic leadership, and collaborative practice models. |
| Nurse Scientist Integration | Embed nurse scientists in clinical settings to drive research, protocol design, and evidence-based innovation. |
| Resilient Staffing Models | Create adaptable staffing frameworks, contractual arrangements, and support for work-life balance. |
| Advocacy & Policy Reform | Promote nurse representation in executive leadership, policy development, and ongoing advocacy for the profession. |
| Inclusive & Equitable Practice | Address diversity, pay equity, and support for nurses in underserved regions and vulnerable populations. |

### 4.1 Role of health systems in nursing education

In response to the growing nurse faculty shortage, health systems are increasingly stepping into the educator role by formalizing split nurse faculty positions.[51] These dual-role models allow experienced nurses to divide their time between clinical practice and academic instruction, thereby expanding nursing school capacity without requiring nurses to leave the bedside. This approach not only addresses faculty shortages but also enhances the quality of nursing education by integrating real-time clinical insights into academic curricula. Nurses who teach while practicing are better equipped to prepare students for the realities of bedside care, improving student readiness, and retention in the profession. Moreover, these models offer flexible career pathways for nurses at various stages, including those nearing retirement and early-career professionals interested in education. By leveraging their workforce as a teaching resource, health systems can play a pivotal role in sustaining the nursing pipeline and strengthening academic-practice partnerships essential to the future of healthcare delivery.

### 4.2 Role of private industry organization partnerships and nursing practice

One of the greatest responsibilities of industry organizations is to provide innovative tools that are clinically intuitive, easy to use, and designed to help clinicians improve patient outcomes in a workflow-efficient manner. Recent examples include minimally invasive laparoscopic surgery, more efficient tissue biopsy sampling, and rapid deployment of novel diagnostics, therapeutics and enablement of unprecedented large-scale vaccine delivery during COVID-19, the worst pandemic within the last century.[52,53] However, most of those examples are geared toward physician decision making workflows and use cases. Given that nurses spend the most time with patients, especially those with complex needs, they also have a crucial role in patient outcomes. This presents a unique opportunity for industry to have renewed focus on supporting nursing workflows. By prioritizing time efficiency, ease of use, and continued education on instructions for use (IFU)-based teaching modalities, industry organizations can help address key challenges facing the nursing workforce, including staffing shortages, limited bandwidth, and burnout - all of which may adversely affect patient outcomes. Industry leaders can also increase partnership with nursing education leaders to develop scholarships for career paths in industry, innovation workshops in simulation centers, or engage with nursing faculty and students in product development.

This demand for more efficient and effective medical technology also poses an important opportunity for nursing professionals. Industry organizations are increasingly seeking nurse input early in the innovation process to ensure that there is alignment with nursing workflows and patient care needs. As a result, nurses may serve as needed on advisory boards or in a consultant role; some nursing professionals have decided to transition from the bedside into full time roles in science or engineering.[54] The expansion of nurses into these adjacent and viable alternative professions is increasingly vital to the innovation process as it fosters partnerships between nursing professionals and industry organizations to positively affect patient outcomes. Given that nurses are often the primary end users of many medical devices, their participation in the creation and acceptance of new innovations will organically help drive a culture of change toward clinical and operational viable solutions that tend to have delayed adoption in healthcare. As an example, nurses represent the fulcrum of physician, pharmacist, and laboratory workflows. They deliver the care designed by physicians and prepared by pharmacists; therefore, nursing input and adoption of innovative product solutions can only help drive culture change toward creating new care paradigms that are also operationally compatible with how healthcare is delivered in a team-based approach.

### 4.3 Innovative care delivery and implications on nursing practice opportunities

A recent systematic medical literature review on major forces and barriers driving healthcare innovation reiterated that the integration of innovative medical devices, artificial intelligence, and novel healthcare delivery models, are predicated on culture change, from a traditional treat the illness goal to one that also includes population health.[55] Nurses are uniquely positioned to influence this evolving care paradigm, especially for vulnerable patients who are affected by social determinants of health, as part of nursing care involves post-care outreach and medication adherence programs designed for these high-risk demographics.[56,57] One example of nurse partnership is in the emergence of new non-acute care areas, where nursing care will be needed to help monitor patients and their response to therapy. Another example is in the emergence of virtual rounds where an experienced nurse may provide mentorship to newer nurse graduates for specialty acute care, such as ICUs, to help address the nurse shortage and lack of clinical experience in new nursing graduates.[58] A third example is the growth of virtual reality training in nursing led bundles to prevent deleterious outcomes such as the mandatory reportable hospital acquired infections CAUTI (catheter associated urinary tract infection) and CLABSI (central line associated bloodstream infection). While these are just a few current examples, they highlight the significant opportunity for nurse professionals to create solutions and carry out practice in these innovative care set-

tings.[59–61] Collaborating directly with nurses is critical to ensure that new technologies are clinically relevant, easy to implement, and designed for rapid adoption and optimal use.

### 4.4 Growth of nurse scientists roles: intersection of health system and industry practice

The emergence of nurse scientist roles within health systems marks a transformative shift in the integration of research and clinical practice.[54] Traditionally rooted in academia, doctoral-prepared nurse scientists are increasingly embedded in hospital and community care settings, where they contribute to evidence-based innovation, protocol design, grant writing, and professional development. This migration is largely driven by the American Nurses Credentialing Center's Magnet Recognition Program(R) designation's emphasis on clinical nurse-led research, which has elevated the visibility and value of nurse scientists in clinical environments. Several health systems are expanding their nurse scientist programs, recognizing their capacity to bridge bedside care with scholarly inquiry. These professionals not only lead independent research initiatives but also mentor staff, influence national research priorities, and contribute to policy development. Their presence enhances institutional credibility, supports strategic planning, and fosters interdisciplinary collaboration. As hospitals seek to articulate the value of nursing and improve patient outcomes, nurse scientists are becoming indispensable agents of change, shaping the future of healthcare through inquiry, leadership, and innovation.

## 5. Conclusion

The future of nursing, both in the U.S. and globally, hinges on the coordinated efforts of educators, policymakers, health systems, and industry partners to address the multifaceted challenges facing the profession. Despite nurses being the largest group of healthcare professionals, a 2018 study found that fewer than 25% of hospital leadership roles were held by nurses.[62] To align institutional initiatives with solutions that mitigate these issues, nurses must have a strong presence in health system executive leadership, actively participate in vendor evaluations, and benefit from infrastructures that enable sharing of best practices and innovation across care settings.

As explored throughout this article, professional nurses remain the cornerstone of healthcare delivery, yet persistent workforce shortages, demographic shifts, evolving educational requirements, and rapid technological advancements continue to reshape their roles and responsibilities. The COVID-19 pandemic and other public health crises have exposed and magnified systemic vulnerabilities, underscoring the need for resilient staffing models, flexible career pathways, and investments in digital fluency. As automation and innovation reshape care delivery, the human and relational dimensions of nursing remain indispensable. Integrating technology ethically and strategically will depend on nurses' leadership in shaping the systems they inhabit.

To ensure a sustainable and thriving nursing workforce, it is imperative to expand academic-practice partnerships, foster inclusive and competency-driven educational programs, and develop innovative employment structures that prioritize nurse autonomy, well-being, and professional growth. Industry collaboration must move beyond episodic innovation to actively engage nurses in the design and deployment of technologies that enhance workflows and care outcomes. The integration of nurse scientists into clinical settings and the growth of nurse-led entrepreneurial ventures further demonstrate the profession's capacity for leadership and transformative impact.

Ultimately, the resilience of any healthcare system depends on the ethical, relational, and evidence-based practice of registered nurses, who must remain at the forefront of care delivery and innovation. By embracing change, investing in the next generation, and leveraging strategic partnerships, stakeholders can strengthen the nursing profession and secure its foundational role in advancing public health and patient well-being. The path forward demands a collective commitment, from policy makers to industry partners, to elevate ongoing advocacy, drive policy reform, support innovation, and create environments where nurses can flourish, ensuring that compassionate, high-quality care remains accessible to all.

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