FUTURE OF NURSING

How the nursing profession should adapt for a digital future

Transformation into a digitally enabled profession will maximize the benefits to patient care, write **Richard Booth and colleagues**

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Cite this as: *BMJ* 2021;373:n1190
http://dx.doi.org/10.1136/bmj.n1190
Published: 14 June 2021

Digital technologies increasingly affect nursing globally. Examples include the growing presence of artificial intelligence (AI) and robotic systems; society's reliance on mobile, internet, and social media; and increasing dependence on telehealth and other virtual models of care, particularly in response to the covid-19 pandemic.

Despite substantial advances to date, challenges in nursing's use of digital technology persist. A perennial concern is that nurses have generally not kept pace with rapid changes in digital technologies and their impact on society. This limits the potential benefits they bring to nursing practice and patient care. To respond to these challenges and prepare for the future, nursing must begin immediate transformation into a digitally enabled profession that can respond to the complex global challenges facing health systems and society.

Many exemplars show how digital technologies already bring benefit to nursing practice and education.[1] For instance, telehealth programs where nurses provide daily monitoring, coaching, and triage of patients with several chronic diseases have helped reduce emergency department admissions.[2] Mobile devices, in particular smartphones and health applications, are enabling nurses to offer remote advice on pain management to adolescent patients with cancer[3 4] and supplement aspects of nursing education by providing innovative pedagogical solutions for content delivery and remote learning opportunities.[5]

The development and application to nursing of systems based on AI are still in their infancy. But preliminary evidence suggests virtual chatbots could play a part in streamlining communication with patients, and robots could increase the emotional and social support patients receive from nurses, while acknowledging inherent challenges such as data privacy, ethics, and cost effectiveness.[6]

Challenges persist

Digital technologies may, however, be viewed as a distraction from, or an unwelcome intrusion into, the hands-on caring role and therapeutic relationships that nurses have with patients and families.[7] This purported incompatibility with traditional nursing ideals, such as compassionate care, may explain some nurses' reluctance to adopt digital approaches to healthcare.[8 9] In addition, nursing's history was as structurally subordinate to other healthcare disciplines,[10] and the profession is still cementing its relationship and leadership in health systems.

The specialty of nursing informatics has long advocated for the integration of technology to support the profession, but it has comparatively few practitioners globally. Nursing informaticians are predominantly based in the United States, where the discipline seems to have originated, but many other countries and regions are expanding their digital nursing workforce and involvement with informatics.[11 12]

Slow progress in some areas has been due to a lack of leadership and investment that supports nurses to champion and lead digital health initiatives. Globally, uncertainty remains regarding the next steps the nursing profession should take to increase and optimize its use of digital technology. This challenge is exacerbated by the global diversity of the profession, including unequal access to resources such as technological infrastructure maturity and expertise. Huge differences exist among countries and regions of the world in terms of the digitalization of healthcare processes, access to internet connectivity, and transparency of health information processes.

Selected technologies: benefits and challenges

The nursing literature contains many analyses of digital technologies used to support or extend the profession, including practice (eg, hospital information systems, electronic health records, monitoring systems, decision support, telehealth); education (eg, e-Learning, virtual reality, serious games); and, rehabilitative and personalized healthcare approaches (eg, assistive devices sensors, ambient assisted living).[1] Table 1 summarizes the potential benefits, challenges, and implications of emerging innovations to practice.

Table 1 | Benefits, challenges, and implications of selected digital technologies in nursing

Digital technologies	Examples of potential benefit	Examples of current challenges	Future implications
Artificial intelligence/big data	Use in decision support systems can improve the identification of infection[13] Pandemic/outbreak response using big data analytics to help in contact tracing and population health response[14]	Biases in current datasets can become ingrained in artificial intelligence (AI) algorithms[15] Techniques are complex and may unintentionally reduce nursing involvement in the development of these systems[16] Ethics and accountability of decisions generated by these systems, including transparency and privacy concerns[17]	AI based nursing in acute and primary care needs research Policies needed on professional accountability Educational and leadership competencies and opportunities related to AI and data analytics
Automation technologies (eg, robotics, drones)	Robots can support people with cognitive, sensory, and motor impairments; help those who are ill or injured; support caregivers; and aid the clinical workforce[18]	Technologists, researchers, providers, and users must collaborate to ensure success[18]	Emerging innovations coupling AI and robotics will have intended and unintended changes to nursing practice and its professional culture Nursing must assist in co-designing and developing these solutions to be complementary to practice Cost-benefit analysis of developing complex health technologies that use planetary resources is needed
Assisted living technologies or "smart homes" technology	Motion monitoring system in homes can help tailor care decisions for older adults with memory problems[19]	Privacy implications Variety and turnover of different technologies makes identifying suitable devices challenging[20] Technical and expense barriers[21]	Nurses should be involved in the design, development, and implementation of systems in collaboration with patients and carers
Clinical decision support systems	Systems can detect infectious disease and trigger appropriate actions[22]	Over alerting clinicians results in alert fatigue and workarounds[23] Owing to lack of research rigor, the impact and effectiveness in some clinical environments (eg, emergency departments) is unclear[24]	Nurses should be involved in design, development, and implementation Consider usability when designing systems that improve rather than disrupt decision making and workflow
Electronic health records (EHRs)	Nursing documentation is superior to paper based records in aspects of data completeness and structure, including legibility[25]	Weaknesses in documentation quality and quantity due to factors such as the time required or poor system or interface design[25]	Nurses need dedicated time and equipment and a supportive digital work culture AI driven clinical decision support integrated into the EHRs to facilitate decision making will be important to look for intended and unintended consequences Nursing leadership should redesign EHRs to reduce burden of documentation
Mobile health	Coaching patients via applications can improve short term outcomes[26]	Perceived lack of affordability and reliability of mobile applications for clinical decision support[27] Concerns over the professional image of nursing when using mHealth, particularly in hospital settings[28]	Need to develop policies and a professional culture that supports use of mobile devices in clinical practice. Where relevant, these should be integrated with EHRs and other related technologies
Telehealth/ telemedicine	Beneficial in nursing homes during outbreaks of infectious disease—eg, during the covid-19 pandemic to reduce isolation and keep residents and nursing staff safe[29]	Nurses' technical skills and negative attitudes towards telemedicine can be a barrier, as can their concerns around data privacy and confidentiality[30]	Nurses should support the co-design of telehealth systems and emerging virtual models of care with patients and carers
Personalized/ precision healthcare	Treatment tailored to individual patients enables nurses to deliver more personalized care[31]	Pace of technological change and equity issues related to technology access could undermine precision health developments[32]	Nurses should advocate for patients and families to have equitable access to their genomic health data for use in personalized and precision healthcare solutions
Social media and online information (internet)	Diverse pools of health information facilitate nursing processes and support patient and student education[33]	Quality and reliability of online health information, particularly on social media, varies, and it can be risky or unsafe[34]	Nurses should be educated about appropriate use of social media and online health information and support patients' use of these technologies to improve their self-management
Virtual and augmented reality	Virtual reality training can improve knowledge in nursing education[35] and be used in pediatric and adult populations as a treatment tool or clinical intervention[36 37]	Can cause simulation sickness, including dizziness and visual disturbances[38]	Low cost devices and software should be developed by nurses and educators that can integrate with existing mobile, internet, and other digital technologies

The table is not exhaustive, but the diversity of topics researched shows the profession recognizes the value and challenges of digital technologies. Given the evidence, for the profession to make further progress we recommend five areas for focused and immediate action. These recommendations should be qualified in light of regional context and professional background owing to global heterogeneity in nursing and the inclusion of digital technologies into healthcare.

Reform nursing education

We must urgently create educational opportunities at undergraduate and graduate levels in informatics, digital health, co-design, implementation science, and data science.[39] These should include opportunities to work with and learn from computing, engineering, and other interdisciplinary colleagues. For instance, nursing will

need a critical mass of practitioners who understand how to use data science to inform the creation of nursing knowledge to support practice. [40] These practitioners will also need savviness and courage to lead the development of new models of patient care enabled by digital technologies.[41 42]

Determining how, where, and why technology like AI should be used to support practice is of immediate interest and a growing competency requirement in health sciences and informatics education.[43] Nursing education should evolve its competencies and curriculums proactively for the increasing use of digital technologies in all areas of practice[39] while incorporating novel pedagogical approaches—for example, immersive technologies such as virtual and augmented reality—to deliver aspects of simulation based education.[44 45]

Recently, the American Association of Colleges of Nursing released core competencies for nursing education, explicitly identifying informatics, social media, and emergent technologies and their impact on decision making and quality as critical to professional practice.[46]

Build nursing leadership in digital health

All levels of nursing leadership must advocate more actively for, and invest resources in, a profession that is both complemented and extended by digital technology. The profession needs to evolve its use of digital technology by continuing to champion and support nurses to become knowledgeable in, and generate new scientific knowledge on, data analytics, virtual models of care, and the co-design of digital solutions with patients, differences across contexts and regions permitting.

Advancement of leadership competencies in existing informatics technologies, such as clinical decision support systems, electronic health records, and mobile technologies, is also essential: these kinds of systems will undoubtedly come with increasing levels of AI functionality. Possessing a critical mass of nursing leaders who understand the intended and unintended consequences as well as opportunities of these kinds of technologies is vital to ensure the quality and safety of nursing.

The increasing presence and recognition of the importance of chief nursing informatics officers is a step in the right direction.[47] Further, providing opportunities for nurses of all specialties to contribute to the development and implementation of digital health policies, locally and nationally, could increase future use of digital technologies in nursing.

Investigate artificial intelligence in nursing practice

The influence of AI on human decision making and labor are areas in need of immediate inquiry to support nursing practice for the next decade and beyond. AI technologies could provide the profession with huge benefits in data analytics and advanced clinical decision support.

Although many of the purported potential benefits of AI (eg, improved patient outcomes, streamlined workflow, improved efficiency) have yet to be fully shown in nursing research,[6] it is inevitable that AI technologies will be used more regularly to support and extend nurses' cognitive, decision making, and potentially labor functions.[15]

These opportunities bring new and dynamic practice considerations for nursing and interprofessional expertise. One example relates to the potential automation of inequity and injustice within systems and decision support tools containing AI[48 49]: self-evolving algorithms in systems sometimes unintentionally reinforce systemic inequities found in society.

Increased use of AI also brings novel policy, regulatory, legal, and ethical implications to the fore. The nursing profession must examine its role, processes, and knowledge against emerging ethical frameworks that explore the opportunities and risks that AI and similar innovations bring, while advocating for patient involvement in AI development and application. Floridi and colleagues offer tenets regarding AI development and the ethical considerations in using such innovations in their call to develop AI technology that "secures people's trust, serves the public interest, and strengthens shared social responsibility." [50] They also advocate that as guiding principles, AI should be used to enhance human agency, increase societal capacities, cultivate societal cohesion, and enable human self-realization, with an emphasis on instilling and reinforcing human dignity.[50] Further research, funding, and thought leadership in this domain are needed to help support the development of new practice policy, regulatory frameworks, and ethical guidelines to guide nursing practice.

Re-envision nurse-patient relationships

The profession must reframe how nurses interact with and care for patients in a digital world. The sheer variety of "do-it-yourself" health and wellness applications (eg, personalized genetic testing services, virtual mental health support), mobile and social media applications (eg, mHealth, wearables, online communities of practice) and other virtual healthcare (eg, telemedicine, virtual consultations) options available to consumers is impressive.

All this may seem antithetical toward the traditionally espoused nursing role—therapeutic relationships in physical interactions—but patients are increasingly empowered, connected to the internet, and demanding personalized or self-management healthcare models that fit their busy and varied lifestyles.

To maximize its impact on patient care, the profession should continue to develop virtual care modalities that exploit internet and mobile technology, drawing on its experiences with telehealth and remote models of care.[51] These care models might also be extended through virtual or augmented reality technologies or integrated with assisted living or "smart home" systems,[52] and potentially other precision and personalized healthcare solutions that leverage genomic and other biometric data.

Care approaches, interpretations of privacy, and technological interoperability functionalities should be co-designed among the interprofessional healthcare team, patients, and carers[53] and available where patients want them, ideally in both physical and digital realms. Deeper discussions and scientific research regarding access, cost, electronic resource use or wastage, and equity implications of the increasing digitalization of nurse-patient relationships will also need to be thoroughly explored.

Embrace digital practice

The profession requires a cultural shift. Its membership and leadership must demand the evolution of digital systems better to meet contemporary and emerging needs.

Too often, technology to support nursing is poorly configured, resourced, or not upgraded to respond to practice and societal trends. Nurses still commonly use practice systems that are lacking basic usability (eg, contributing to alert fatigue, reinforcing disruptive workflow processes) or generate added documentation burdens because of poor configuration and optimization.[54]

There is huge variation globally in access to, integration of, and sustainability of digital technology.[55-57] Solutions vary and are context specific. Renewed awareness of digital technology's use brought about by the covid-19 pandemic offers an impetus for change that nurses should embrace.

Tasks undertaken by nurses that do not add enough value to patient care present opportunities for partial or full divestment,[58] and may be better integrated into future technology enabled processes or delivered by other care providers.

The profession should revisit cultural interpretations of how technology such as drones, robots, and other AI enabled systems can be considered complementary to nursing practice and process, rather than as competition or adversaries. Collaboration with technology developers, providers, and patients will be essential to ensure success.

Although some outdated nursing activities and processes made redundant or less relevant will likely be missed by some in the profession, digital technology provides opportunities to support new models of care and approaches to nursing practice. We must not allow cultural and historical interpretations of nursing to upend or impede progress.

How nursing can stay relevant

Nurses entering the profession today will undoubtedly witness substantive disruption and change from digital technology by the time they are mid-career.[59] Without immediate action, the nursing profession stands to miss a remarkable opportunity to generate new roles, knowledge, and relationships within future health systems and societies saturated by digital technologies.

Nursing will continue to offer value and importance to healthcare systems in the coming decades. However, the profession must consider its role, knowledge, and relationships with technologies and patients to remain relevant in digitally enabled societies and healthcare systems and continue to provide compassionate care in a digital world. Without proactive strategic self-reflection, planning, and action, nursing will fail to control its trajectory across the chasm separating the past, present, and future of practice.

Key recommendations

- Nursing must accelerate the transformation to a digitally enabled profession by investing in informatics education, research, and practice
- Nurses should upskill in data science and other digital health topics to ensure emerging technologies such as AI are developed appropriately and safe for nursing practice and patient care
- Nursing must invest in and lead digital health developments and collaborate with others to develop and deliver digital tools that patients and the public need
- Nurses should champion informatics across all areas of professional practice, create leadership opportunities in digital health, and inform health policy in this area

Competing interests: We have read and understood BMJ policy on declaration of interests and have no relevant interests to declare.

Provenance and peer review: Commissioned; not externally peer reviewed.

This article is part of a series commissioned by *The BMJ* for the World Innovation Summit for Health (WISH). *The BMJ* peer reviewed, edited, and made the decision to publish. The series, including open access fees, is funded by WISH.

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