

# Building Nursing Knowledge to Meet the Needs of Disruptive Technology Healthcare Re-Design

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**Abstract.** This paper provides a discourse based upon the key development of nursing in response to the emerging 4Ds of health technology re-design. Building informatics capability among health professionals is a workforce issue necessitated through the increasing prevalence of information technology and digitization of healthcare affecting the entire health workforce, specifically front-line nurses. The key concepts will be explored of Digitization, Distribution, Disruption and Diversity, a framework recognising the tsunami of technology such as Big Data analytics, comprehensive decision support systems for nursing, nanobots, robotics, and pharmacogenomics and the impact these have upon the nursing workforce.

**Keywords.** Health technology re-design, nursing workforce

## 1. Introduction

Digital technology affects many aspects of everyone's life and in the world of work; digital transformation requires managing in order to prevent a skills mismatch [1]. The emergence of the Fourth Industrial Revolution [2] and the movement beyond the information society to that of the imagination society (Society 5.0) will present opportunities, challenges and threats to everything we currently do in our lives; but at the center will always be the need for compassion and humanity. Society 5.0 paves the way for imagination and creativity of diverse people as digitization transforms our world, it is planned to offer decentralization, resilience, diversity, value creation and sustainability. All healthcare professionals need to be active in realizing this transformation and nursing is no exception [3].

It was stated in 1989 in the document 'A Strategy for Nursing' [4] that 'Accountable practitioners must be more than passive recipients of information. They will need to acquire the analytical skills to ask the right questions, to know where to seek answers to them, and to reach informed decisions on the basis of the fullest knowledge available.' Some 30 years later there remains a paucity of activity in the preparation of nurses to play a pivotal role in the design and use of new technologies. It would appear that acknowledgement of the words of Stonier ([5]: p17) have generally been disregarded,

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‘An educated workforce learns how to exploit new technology; an ignorant one becomes its victim’. Nursing needs to be at the forefront of the digital technology innovations and transformational practices these will bring to healthcare in order to provide 21<sup>st</sup> Century care in a meaningful, effective and compassionate way.

It is time to recognize the potential impact of the digital transformation change upon the nursing workforce and put in place clear and practical strategies to ensure future patient care is delivered with compassion supported appropriately by technology. *‘Looking ahead, it is clear that we need to climb out of our policy silos and reach across them to better understand how digital transformation is reshaping our lives, how we can exploit it, and how we can help those in danger of being left behind’* ([1]: p88). It is clear that not only is there basic digital literacy knowledge and skills required amongst the nursing workforce but also wider involvement with the emerging digital innovations to support citizens in maintaining and managing their own health and care.

The recently published Topol Review [3] supports the development of the health and social care workforce in digital literacy both during their professional preparation and throughout their careers. The review goes further and suggests that health and social care professionals, when dealing with those in their care, should *‘... assess the level of digital literacy of patients and carers, including the skills to triage a patient or carer, with their consent, by assessing their capacity and willingness to engage ...’* ([3]: p25).

## 2. Discussion

As digital healthcare technology innovation progresses and the role of the professional workforce changes it could be argued that the current influencers for managing informatics competence across nursing, and more generally healthcare professional workforce are four vortices, these are under the heading of the 4 D’s and are based upon the premise that **D**igitization within society has brought about **D**issemination across time and communities, which in turn has caused **D**isruption to the ‘normal’ systems and structures and this has resulted in **D**iversity of actions/activities. Digitization in healthcare is more than the electronic health record and demands of nurses to expand their ability to take a leading role in the emerging innovations for the benefit of those in their care.

### 2.1. Digitization

Since the 1960’s computers have been gradually introduced to healthcare, usually in the form of essential record keeping tools, as this was the main perceived role for computer technology particularly in large organizations, even now this mentality continues with the behemoths that are the ‘controllers’ of the electronic health record most commonly found in acute hospital settings. But things are changing. The speed of technology device and infrastructure adoption across health care is unprecedented [6,7,8]. The analogue world is diminishing fast and being replaced by a digital world that seemingly knows very few boundaries. It would be naïve to presume that health care will be unaffected by these innovations.

The reliance today by many people upon digital devices, such as the smart phone which only entered the market place 12 years ago, is due in part, to perceived usefulness of such devices to meet the needs of life across different social interfaces in the early part of the 21<sup>st</sup> Century. The growth in the use of computer/information and communications

technology in the cars we drive, the way we stream video and audio to ensure personalization of entertainment, the way we shop, the way we do our banking, the way we book our holidays, the use of smart home devices, the ease of connectivity to our family and friends, the way we can find answers to questions at the touch of a 'virtual' button or voice command to a digital assistant have all led to a growing acceptance of the usefulness to our lives that technology can offer.

## 2.2. Dissemination

No longer do we have to wait to hear/see what is going on in the world, we can live across the world in real-time. There is a growing value in immediate information, the concept of waiting is reducing and yet at the same time within health care this is not always the case leading to feelings of frustration amongst those who need care and those who provide care [9]. It is now commonplace to share thoughts, conversations and images with millions through social media and this can produce a feeling of connectivity, however, as a new technology there is still a need for some appropriate societal embedding so as to reduce 'trolling' and 'cyber bullying' [10] and the publicized growth in emotional validation as reported in 'Life in 'Likes'' [11]. As understanding increases around the absolute connectivity becoming available to all through mobile technology there is a growing lack of understanding as to why healthcare does not share such connectivity, even though documentation has been identified as a core competence there often remains, at the patient point of contact with the healthcare professionals, a lack of sequenced reporting of a patient's care history which results in repartition, disorder and delay in diagnosis, treatment and rehabilitation.

## 2.3. Disruption

Disruption: The digital advances across society are causing significant questions to be asked of health care and although it is acknowledged that most countries are trying to use digital disruption as a positive change agent, nursing is caught up in many of the technology driven decisions with little or no educational support [12] resulting in limited opportunity to influence developments for the benefit of patient care.

According to Goel [13] there are a number of disruptive emerging trends in digital healthcare which will impact the way in which care is received and delivered over this year, these are:

- The use of telemedicine to help individuals access specialist healthcare providers,
- The Internet of Medical Things (IoMT) alongside the accepted Internet of Things will include the communication across the cloud particularly of wearable devices,
- Digital Assistants to Clinicians (Chatbots), interacting with individuals and helping in the management of long term conditions,
- Artificial Intelligence in Healthcare, the use of AI in helping with diagnoses and treatments,
- Big data analytics potentially improving patient satisfaction through streamlining workflow.

The potential of the emerging 'person at the center of their healthcare' concept [14] is moving away from ownership of health records solely by the health professionals

towards people being in control of their own healthcare records, just as they are for their life records such as financial control, shopping control and entertainment control. At the end of the day, healthcare is just one aspect of a life, for some it is a big aspect and for others it is a small aspect as we progress through the various stages of our lives. The collected personal record could include information harvested from, for example, wearable technology, social media, internet of things or general internet connectivity, all of which begs the question of what is healthcare documentation?

#### 2.4. Diversity

The final 'D' could be considered as variety of opportunity both in terms of healthcare provision and healthcare consumption. Advances in healthcare interventions, greater integration of people generated information and exploration of independent needs assessment will present further challenges to all of us. The ability to move individual skill competence towards that of skills transferability across a range of domains might require a change from competencies to capabilities as the latter is set to ensure readiness for future challenges.

An individual has choice, the degree to which an individual employs such choice depends upon many variables, and one such variable is having an understanding of what is available within a given set of circumstances. Nursing is in a prime position to help with the navigation through choice across healthcare for the enquiring individual. Align this shift in citizen culture with the growing collection of data to aid in understanding the health needs in the population [15], there seems to be a fissure opening which previously would have filled by the local 'wise woman' or 'sage' and this gap is currently being occupied by search engines such as Bing™ or Google™ but would more sensibly suit nurses as the 'glue' or information broker between individuals and healthcare provision.

### 3. Digital Competencies/Capabilities

There is general acknowledgement that there is much work to be done to ensure that nurses are prepared for the increasingly digitized working environment and that those already registered and in practice are supported to advance their knowledge and skills in and beyond basic digital literacy. There are many nursing informatics competencies available around the world all of which appear to have commonalities within them, a collective global set of competencies has been provided through the development of the Technology Informatics Guiding Education Reform (TIGER) Nursing Informatics competencies [16,17]. Some 26 countries are members of the TIGER International Task Force and they support these competencies and embed them within their own culturally appropriate nursing informatics education. TIGER has provided a common set of international core competencies that will ensure that nurses can emerge as active participants in the design and development of technology solutions that will benefit patient care and assist in the workforce transformation required.

As part of the research undertaken by Hübner et al [17] the top 10 competencies were identified by five different health roles including quality management in IT and co-ordination of interprofessional care, the similarities along with differences across the roles offer a way forward for technology re-design for integrated care and integrated systems with nursing.

The core competencies as reported by Hübner et al [17] are culturally driven through the world-wide case studies used to inform the research, this accounts for differences in rankings of the responses from the professional groups. In the results it was interesting to note that there were many similar core competence areas listed for the top ten rankings [17: p34] as given by the professional groups, for example Nursing Documentation (including terminologies) appeared in the top three competencies as stated by Clinical Nursing (Direct Patient Care) it was ranked 1; by Quality Management it was ranked 3; by Coordination of Inter- professional Care it was ranked 3; by Nursing Management it was ranked 1, but for those responding in the category IT Management in Nursing the core competency of Nursing Documentation was ranked 10 and last with the highest ranked being Information and Communication Systems (including interoperability). Still documentation competencies were regarded rather high which hints at the need to improve documentation and related knowledge and skills. But there is more to it: documentation is only the basis for more advanced skills leading the way to decision support, data analytics and big data – all competencies described in the TIGER Framework.

Debate and discussion around how to move forward could carry on for some time yet but the competencies for undergraduate nursing education have been defined [17] such basic competencies need to be implemented at a national level with academic input and update to maintain currency in today's rapidly developing digitally intensive world.

Those individuals who are already members of the workforce need to be supported to make the transition from viewing digital healthcare as relating only to the input of information into the electronic health record towards that of diverse expansion of digital solutions to enhance current and near future practice. They will need to use data to analyze the impact of their care and to ensure that the documentation burden is not adversely affecting the nurses' ability to be effective in their place of work as is being reported in the United States [18].

#### **4. Conclusion**

The advancing digital health technologies are demanding of nursing that the profession takes a lead in the uses of innovative digital practices to benefit patient care, it would unwise to take another 30 years to raise the knowledge and skills of nurses. The Topol Review [3] acknowledges the need for 'digital readiness' and certainly this is essential for the future functioning of health and social care as digital disruption will continue to challenge current practice.

There is no crystal ball to aid us in viewing the future, but the momentum being generated in the developments of, for example, nano technologies, personalized medicine, genomics, robotics and artificial intelligence in health care are unlikely to stop, it is clear that there needs to be an educated cultural shift towards these digital innovations.

## References

- [1] Organisation for Economic Co-operation and Development [OECD]. Going digital in a multilateral world. OECD Publishing, Paris, France (2018).
- [2] World Economic Forum, Our shared digital future: Building and inclusive, trustworthy and sustainable digital society. Insight Report. Geneva, Switzerland. (2018) Available online at: [http://www3.weforum.org/docs/WEF\\_Our\\_Shared\\_Digital\\_Future\\_Report\\_2018.pdf](http://www3.weforum.org/docs/WEF_Our_Shared_Digital_Future_Report_2018.pdf)
- [3] Health Education England. The Topol Review: Preparing the healthcare workforce to deliver the digital future. An independent report on behalf of the Secretary of State for Health and Social Care. February. (2019).
- [4] Poole A. A strategy for nursing: A report of the Steering Committee. Department of Health, London (1989).
- [5] Stonier T. The wealth of information. London, England: Thames-Mathuen (1987).
- [6] Maguire D, Evans H, Honeyman M, Omojomolo D. Digital change in health and social care. The Kings Fund, London, UK (2018).
- [7] Department of Health and Social Care. The future of healthcare; our vision for digital, data and technology in health and care: A policy paper (2018). Online at: <https://www.gov.uk/government/publications/the-future-of-healthcare-our-vision-for-digital-data-and-technology-in-health-and-care/the-future-of-healthcare-our-vision-for-digital-data-and-technology-in-health-and-care#cs10-main>
- [8] NHS England. The NHS Long Term Plan. NHS Publication (2019) available online at: <https://www.longtermplan.nhs.uk/wp-content/uploads/2019/01/nhs-long-term-plan.pdf>
- [9] Organisation for Economic Co-operation and Development [OECD]/EU Health at a Glance. Europe 2018: State of health in the EU cycle. OECD Publishing, Paris, France (2018)
- [10] Sathyanarayana Rao TS, Bansal D, Chandran S. Cyberbullying: A virtual offense with real consequences. *Indian journal of psychiatry*, 60(1), 3-5. (2018)
- [11] Children's Commissioner. Life in 'likes': Children's commissioner report into social media use among 8-12 year olds. (2018) Online at: <https://www.childrenscommissioner.gov.uk/2018/01/04/children-unprepared-for-social-media-cliff-edge-as-they-start-secondary-school-childrens-commissioner-for-england-warns-in-new-report/>
- [12] Health Education England/Royal College of Nursing, Improving Digital Literacy. (2017) Online at: <https://www.rcn.org.uk/professional-development/publications/pub-006129>
- [13] Goel A. Digital transformation trends that will reshape healthcare in 2018. (2018) Online at: <https://www.kellontech.com/kellton-tech-blog/8-emerging-trends-digital-healthcare-industry-2018-limitless-opportunities-vis-vis-challenges-ahead>
- [14] NHS England. Integrated care pioneers. (2018) Online at: <https://www.england.nhs.uk/integrated-care-pioneers/>
- [15] Outcomes Driven Health. 2018 Population Health Management Survey: Are health plans ready for the age of innovation? Outcomes Driven Health Inc. (2018).
- [16] Honey ML, Skiba DJ, Procter P, Foster J, Kouri P, Nagle LM. Nursing informatics competencies for entry to practice: The perspective of six countries. In: Forecasting Informatics Competencies for Nurses in the Future of Connected Health. Murphy, J., Goossen, W and Webber, P. (Eds) *Studies in Health Technology and Informatics* Volume 232. IOS Press. ISBN 978-1-61499-738-2 (online) pp51-61 (2017).
- [17] Hübner U, Shaw T, Thyé J et al. Technology Informatics Guiding Education Reform - TIGER. *Methods of Information in Medicine* [20 Jun 2018, 57(S 01):30- 42] doi: 10.3414/ME17-01-0155 (2018)
- [18] Ommaya AK, Cipriano PF, Hoyt DB et al. Care-centered clinical documentation in the digital environment: Solutions to alleviate burnout. *NAM Perspectives*. Discussion Paper, National Academy of Medicine, Washington, DC. doi: 10.31478/201801c (2018)