Digital healthcare for child health nursing

Won-Oak Oh

Professor, College of Nursing, Korea University, Seoul, Korea

The remarkable development of artificial intelligence (AI) has led to dramatic changes in all aspects of our lives. In particular, the recent release of ChatGPT has received global attention as a historic event that is bringing the future we had only imagined much closer. Advances in various digital technologies, including AI, are fundamentally transforming healthcare into smart healthcare.

The COVID-19 pandemic has been a catalyst for promoting the application of digital healthcare. The adoption rate of telemedicine, the most representative manifestation of digital healthcare, was only at 9% in 2019 before the pandemic, but increased to 41% by 2022, just 3 years later [1]. Therefore, many digital technologies are being developed to deliver virtual services to the target population. While digital healthcare initially focused on prescriptions or interventions, it now encompasses predictive aspects. Therefore, various methods of implementing digital healthcare are being applied in child health nursing, spanning the domains of education, research, and practice.

1. What is Digital Healthcare?

Digital health or digital healthcare encompasses mobile health (mHealth), e-healthcare, health information technology (IT), wearable devices, telehealth, and personalized medicine [2]. It is a new and evolving field in the healthcare sector where innovations in digital technology are being integrated with medical technology to transform healthcare delivery and improve individuals' treatment, care, and well-being [3].

Corresponding author
Won-Oak Oh
College of Nursing, Korea University,
145 Anam-ro, Seongbuk-gu, Seoul 02841, Korea
TEL: +82-2-3290-4928
FAX: +82-2-3290-4928
E-MAIL: wooh@korea.ac.kr

Digital healthcare is sometimes referred to as mHealth apps, e-health, and even as smart healthcare. However, it is a subset of the larger healthcare framework, and its position within this framework is still somewhat ambiguous. Mobile healthcare, for which various applications have been developed in the nursing field, is included within the broader concept of digital healthcare and involves using smartphones, the internet, and other digital technologies [3]. It is common to consider digital healthcare and healthcare as two separate categories and acknowledge that there are overlapping areas between them, such as remote medicine and digital therapeutics (DTx) [2].

Nursing is also in a similar situation, insofar as there is some overlap between specialized nursing for the care, maintenance, and promotion of individuals', groups', families', and local communities' health, and mHealth nursing, which falls within the broader framework of digital healthcare. Molly, a virtual nurse developed by Sensely [4] for telenursing, is also a significant achievement in digital healthcare.

2. Use of Digital Technology in Child Healthcare and Nursing

Mobile healthcare is currently one of the most active areas of interest in nursing research and practice. Various apps have been developed, ranging from those that aim to prevent safety accidents for children in hospital settings [5,6] to those that support and promote health for children with chronic conditions such as pediatric cancer [7] or moyamoya disease [8]. Increasingly many studies are also integrating AI technology into chatbots for intervention or educational training. Chatbots have already shown considerable potential in the child health nursing field, as exemplified by the development of messengers that assist with vaccination consultations for children [9], and projects supporting children and caregivers with chronic conditions through chatbots in local communities [10].

Digital technology is particularly friendly to children and adolescents. Adolescents are digital natives, with over 95% owning smartphones [11]; in particular, the accessibility of digital healthcare is very high in South Korea, where 99.8% of

teenagers own smartphones [12]. Since children and adolescents are familiar with identifying themselves through virtual avatars, researchers are exploring the use of avatars in virtual worlds to prevent safety accidents and address health problems. Digital games can also stimulate children's curiosity, making digital game-based interventions a possible tool for managing children's health. Humanoid robots, similar to pets, are another digital technology that can be applied in a child-friendly manner, such as in research using humanoid robots to reduce pain and distress for children receiving vaccinations [13]. Since humanoid robots can interact with children in a very practical way, they are expected to be especially effective for children with developmental issues.

3. World Health Organization Guidance for Digital Health Research

The World Health Organization (WHO) has released a publication entitled "Recommendations on digital interventions for health system strengthening" to promote the effective integration of digital technology for medical advancement [14]. These recommendations for researchers conducting digital healthcare studies can be summarized as follows [15]: firstly, as most digital technology applications are currently being studied through experimental research, the research design is expected to become increasingly complex with consideration of the interactions and interdependence between digital and non-digital factors. Secondly, researchers must ensure objective effectiveness while guaranteeing the protection and security of personal information. Thirdly, barriers to digital technology application should be identified and addressed. Fourthly, knowledge, attitudes, and behaviors should be measured. Finally, if cost-effectiveness is enhanced in conjunction with these factors, a cultural reform in digital healthcare may become possible [15].

These recommendations can also be applied to digital healthcare studies in child nursing. In particular, as research on children under 18 requires the consent of guardians, researchers need to make efforts to ensure the children's health and safety. Furthermore, researchers applying mHealth apps are recommended to use the 16-item mHealth evidence reporting and assessment checklist developed by the WHO's mHealth Technical Evidence Review Group to plan and evaluate their research process [16].

4. Future Challenges

Nurses play a unique role in educating and communicating with patients about the functionality of digital health apps [17]. As such, child health nurses should monitor whether digital health technologies are effective for children and ensure there are no ethical issues related to data management. However, applying digital health to child health nursing is as risky as it is useful, and there is a lack of clear evidence regarding its usefulness and effectiveness from a child's perspective. Therefore, it is crucial to develop evaluation tools to investigate this issue.

Digital healthcare involves a multidisciplinary environment, including computer science, engineering, economics, social science, public health, epidemiology, and other fields [18]. Therefore, preparation for digital healthcare should be included in the child health nursing education curriculum. Innovative nursing education programs that go beyond traditional lecture-based, instructor-centered teaching methods and incorporate education and practice on how nursing students can collaborate effectively with other professional fields are necessary for the future of child health nursing education.

DTx, one of the new waves of AI healthcare, has recently been attracting significant attention in the global medical market. The Digital Therapeutics Alliance defines DTx as evidence-based therapeutic interventions that utilize software to prevent, manage, or treat diseases [19]. An example of DTx is Pear Therapeutics' ReSet, which has been approved by the Food and Drug Administration for drug addiction treatment. In Korea, DTx is defined by the Ministry of Food and Drug Safety as software as a medical device, similar to other countries [20].

Child health nursing researchers have already developed similar interventions such as mHealth apps, digital health nursing care, and digital healthcare devices aimed at improving patients' psychological status and self-management. Nonetheless, there is a lack of discussion on how nurses can receive the care cost when applying these interventions in nursing practice (clinical, family, and community settings). Active involvement and discussion by nursing-related organizations will be required in the future.

Digital healthcare has the potential to exacerbate health inequalities or disparities in children, particularly in countries with insufficient IT system support. Therefore, researchers developing digital healthcare should always consider alternative care solutions for vulnerable children in developing nations.

Nursing has traditionally been viewed as both an art and a science. While digital healthcare has gained prominence in recent years by emphasizing the importance of human touch, it remains uncertain how well it can embody the artistic aspects of nursing. In the field of child health nursing, human-centered development is needed for digital healthcare to meet the needs of children in practical settings by appropriately connecting virtual and real-world experiences [21].

Child health nurses must stay current with the latest technological advances and position themselves as specialists who can provide valuable feedback in the field. As primary caregivers entrusted with safeguarding children's well-being in healthcare settings, child health nurses should not blindly embrace new technologies, but instead possess the discernment to distinguish their benefits and drawbacks.

ORCID and Research ID

Won-Oak Oh   https://orcid.org/0000-0003-0156-3422
https://ResearchID.co/rid51093

Authors' contribution

All the work was done by Won-Oak Oh.

Conflict of interest

Won-Oak Oh has been an editor of *Child Health Nursing Research* since 2004. She was not involved in the review process of this article. No existing or potential conflict of interest relevant to this article was reported.

Funding

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

REFERENCES

1. Goodwin E. Adoption of telemedicine in the U.S. has flatlined [Internet]. CivicScience; 2022 [cited 2023 April 13]. Available from: https://civicscience.com/adoption-of-telemedicine-in-the-u-s-has -flatlined/

2. Bernstein C. Digital health (digital healthcare) [Internet]. TechTarget; 2021 [cited 2023 April 13]. Available from: https://www.techtarget.com/searchhealthit/definition/digital-health-digital-healthcare

3. Choi YS. Digital health care. Cloud 9; 2020. p. 38.

4. Sensely. Increasing access. Lowering costs. Improving health [Internet]. Sensely; 2023 [cited 2023 April 12]. Available from: https://sensely.com

5. Han J, Oh WO, Park IT, Lee A. Development and effects of a mobile application for safety incident prevention among hospitalized Korean children: a pilot study of feasibility and acceptability. Journal of Pediatric Nursing. 2020;51:e69-e76. https://doi.org/10.1016/j.pedn.2019.09.022

6. Park IT, Oh WO, Jang GC, Han J. Effectiveness of mHealth-safe kids hospital for the prevention of hospitalized children safety incidents: a randomized controlled trial. Journal of Nursing Scholarship. 2021;53(5):623-633. https://doi.org/10.1111/jnu.12693

7. Slater PJ, Fielden PE, Bradford NK. The oncology family app: providing information and support for families caring for their child with cancer. Journal of Pediatric Oncology Nursing. 2018;35(2): 94-102. https://doi.org/10.1177/1043454217741874

8. Oh WO, Park IT, Han J, Lee E. Development of a mobile application based on the salutogenic model for self-management in adolescents with Moyamoya disease. Journal of Pediatric Nursing. 2023. [Epub ahead of print] https://doi.org/10.1016/j.pedn.2023.04.008

9. Hong YJ, Piao M, Kim J, Lee JH. Development and evaluation of a child vaccination chatbot real-time consultation messenger service during the COVID-19 pandemic. Applied Sciences. 2021;11(24): 12142. https://doi.org/10.3390/app112412142

10. University of Washington. Developing a chatbot to support caregivers of children with chronic conditions [Internet]. University of Washington; 2020 [cited 2023 April 14]. Available from: https://www.washington.edu/populationhealth/2020/01/16/developing-a-chatbot-to-support-caregivers-of-children-with-chronic-conditions/

11. Radovic A, Badawy SM. Technology use for adolescent health and wellness. Pediatrics. 2020;145(Suppl 2):S186-S194. https://doi.org/10.1542/peds.2019-2056g

12. Korea Communications Commission (KCC). 2022 Broadcast media usage behavior survey [Internet]. KCC; 2023 [cited 2023 April 10]. Available from: https://kcc.go.kr/user.do;jsessionid=pOw9q2L_eabjPFEh0bohDIGd8rdXm3Aqw71R7IPc.servlet-aihgcldhome20?mode=view&page=A02060100&dc=K00000001&boardId=1027&cp=1&boardSeq=54472

13. Beran TN, Ramirez-Serrano A, Vanderkooi OG, Kuhn S. Reducing children's pain and distress towards flu vaccinations: a novel and effective application of humanoid robotics. Vaccine. 2013;31(25): 2772-2777. https://doi.org/10.1016/j.vaccine.2013.03.056

14. World Health Organization (WHO). WHO guideline: recommendations on digital interventions for health system strengthening [Internet]. WHO; 2019 [cited 2023 April 10]. Available from: https://www.who.int/publications/i/item/9789241550505

15. Jandoo T. WHO guidance for digital health: what it means for researchers. Digital Health. 2020;6:2055207619898984.

https://doi.org/10.1177/2055207619898984

16. Agarwal S, LeFevre AE, Lee J, L'Engle K, Mehl G, Sinha C, et al.; WHO mHealth Technical Evidence Review Group. Guidelines for reporting of health interventions using mobile phones: mobile health (mHealth) evidence reporting and assessment (mERA) checklist. BMJ. 2016;352:i1174.
https://doi.org/10.1136/bmj.i1174

17. Logsdon MC. Smart phone apps and maternal child nursing. MCN American Journal of Maternal Child Nursing. 2017;42(5):247.
https://doi.org/10.1097/NMC.0000000000000364

18. Jayaraman PP, Forkan ARM, Morshed A, Haghighi PD, Kang YB. Healthcare 4.0: a review of frontiers in digital health. Wiley Interdis-ciplinary Reviews: Data Mining and Knowledge Discovery. 2020; 10(2):e1350. https://doi.org/10.1002/widm.1350

19. Digital Therapeutics Alliance. What is a DTx? [Internet]. Digital Therapeutics Alliance; 2023 [cited 2023 April 10]. Available from: https://dtxalliance.org/understanding-dtx/what-is-a-dtx/

20. Yang HY. [Establishing regulatory criteria for software as a medical devices (SaMD) and developing medical practice codes]. Korea Health Industry Development Institute Brief. 2019;292:2-12. Korean.

21. Rowe JP, Lester JC. Artificial intelligence for personalized pre-ventive adolescent healthcare. Journal of Adolescent Health. 2020; 67(2S):S52-S58. https://doi.org/10.1016/j.jadohealth.2020.02.021