International Journal of Health Systems Resilience

INJHSR
International Journal of Health Systems Resilience

Role of Healthcare Leaders in the Digitalization of Health System: A Review

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Submitted: 08/01/2023   https://doi.org/10.51595/INJHSR22/018

Published: 05/02/2023

Abstract

Digitalization of health system is defined as adaption of digital technology in health care service to offer high quality patient care. WHO has directed to implement digital system to health care service in order to achieve sustainable development goals. However, digitalization of health care system is lagging behind compared to other business environment due to poor leadership skills of the health care leaders. The objective of this review is to identify the roles and attributes of the health care leaders in order to perform in digital world. Best 30 articles were referred from the 80 articles related to digitalization of health care and leadership to write this review. Leaders need to come out of their comfort zone and understand the rapidly changing business field with the digitalization. Healthcare leaders are advised to go beyond their traditional leadership style and develop new leadership skills. The transformational leadership theory was identified as the starting point for 'new-genre leadership' models emphasizing that a leader's style should be visionary, ideological, and participative, servant, or authentic where digital leader needs to perform. Leader-member exchange theory focuses on the nature and quality of the relationship between leaders and their team members which is the ideal for implementation of the digital health. Therefore, digital leader need to be flexible and adaptable to new ideas, intellectual curiosity, having transformative vision, forward-looking perspective, change-oriented, open minded, adaptable, innovative and a hunger for new knowledge. They need to be maintained a more egalitarian and results-oriented approach unlike previous traditional leaders. In addition, healthcare leaders need to developed better skills to manage finances, understanding of project management timeline and alternative options before digitalization of the health system. Digital leaders need to developed attributes such as the ability to influence, inspiring a shared vision, being proactive, and ability to avoid blaming others, being visionary and being innovative. They need to develop their analytics capability of the health care leaders are essential to ensure effective professional leadership. Delegation of work and effective communication are very important attributes a leader should perform when dealing with the digital health. To effective digitalization of health system to improve patient care service health care, leaders need to develop new leadership skills.

Key words: *Leadership, Digital leadership, Health care quality*

1. Introduction

Digital transformation is defined as incorporation of computer-based technologies into an organization's products, processes and strategies to create new or modify existing business processes, culture, and customer experiences to meet changing business and market requirements (1,2). Digital health, or digital healthcare, is a broad, multidisciplinary concept that is an intersection between technology and healthcare. It includes mobile health (mHealth) apps, electronic health records (EHRs), electronic medical records (EMRs), wearable devices, telehealth and telemedicine, as well as personalized medicine (3). Terms related to digital health include health information technology (health IT), healthcare tools, health analytics, healthcare informatics, hospital IT and medical technology.

The World Health Organization (WHO) defines digital health as the field of knowledge and practice associated with any aspect of adopting digital technologies to improve health, from inception to operation (5). Currently most of the countries in the world are adapting Health Information Technology (HIT) to patient care services in order to improve quality, safety and efficiency of health care service (6,7). COVID-19 pandemic contributed to speed up the new technology innovation in recent years (8). Programs conducted in recent years highlighted the importance of having information technology to face current challengers in the health care service such as aging, communicable diseases and environmental sustainability (9,10). The government of the United Kingdom (UK) is expected solve such health care challenges through digitalization of health care by giving one of three top priorities in their parliamentary report (11). Currently digital technology is used in health care in different dimensions such as maintaining of electronic medical records, diagnostics, issuing and administration of medicine, 3D printing, artificial organs design, robotic surgery and virtual reality (telehealth) which improve health and patent safety (12). National Health Service (NHS) in UK uses information technology (IT) for planning, monitoring, inventory management and procurement to improve efficacy and effectiveness (13)

Most of the developed countries have adapted IT to their health system to offer efficient and effective quality health care to end users and has become an integral part of the health system to improve operational efficiency with regard to standard of care (13). Digital technology has been used in many areas in the health care include,

1. Improved access to medical information and data: Digital health has the ability to store and access data from any ware easily within few minutes and able to share with other specialties to provide optimum care to the patient.

2. Big data: Digital health allow clinicians to collect big data within few minutes which can be used for epidemiological studies, research or clinical trials. Therefor these data can be used for health professionals to take preventive measures more efficiently.

3. Improved lines of communication: Digital technology allow health provider to communicate with the patient very easily via emails, smartphones, and text messaging and test result without coming to hospital. Medical professionals can make their own webinars, videos and use online platforms and social media using new technology to communicate with other professionals to provide efficient and effective service to people.

4. Electronic health records: This allows to make the paperless system to manage patient in virtual file. This prevent movement of large files to different places in the patient management pathways. Storage and retrieval are very easy any time.

5. Telemedicine/telehealth: This allow to provider to service even in rural areas where specialized care is not available. For example, radiological images can be sent to the distant places to take decisions from the experts. Telecommunication is used to conduct training and education programs for more people at a time cost effectively.

6. Online education: Health care associated degrees can be conducted using digital technology. It allows students to get their degrees according to their choice by recognized organization nationally or internationally.

7. Health apps: The digital revolution has also resulted in the development of hundreds of health apps. It can be used to monitor health of the patient. Patient can be educated regarding their heath regularly. Patient can receive their test result through these app without going to laboratories.

In most of the developed countries such as UK, Australia and Singapore, information technology has been adapted to offer high quality of health care service. Most of the developing countries including Sri Lanka are still at their early stage of embracing digital technology due to varies barriers such as lack of access to information, inadequate information, lack of knowledge on usefulness and usability of the technologies, cost and technical problems (14). However, the business world is applying new concepts such as just-in-time, lean production, kaizen, business reengineering or total quality management with the help of Information Technology (IT) (15). This emphasises the importance of digital leadership to implement above concept to business world (15). World leading business organizations emphasise that all barriers are not due to technological crisis but mainly due to leadership crisis. Therefore, leadership is essential competency in the current digital era for the adoption of IT in the modern healthcare industry (16). This review aims to identify the requirements of a current health leaders to implement digital technology within the health systems in order to improve health care service and patient safety efficiently and effectively.

2.   Methodology

A literature search was performed using the databases Medline, Google Scholar and PubMed. Search terms used are 'Leadership, Digital leadership, Quality health care service and role of digital leaders in health care service. The literature search was confined to articles in the English language. Since there were few numbers of articles on the topic, a specific time period was not considered for the literature review. About 80 relevant articles were studied and among them 30 directly related articles were selected to this review.

3.   Results

Role of the health leader is an essential component in order to face the digital era and all the leaders are needed to out of their comfort zone and understand the fast changing business environment (16). The main differences between digital leader and non-leader or traditional leaders are their different skills, attitudes, knowledge, and professional and personal experiences (17).Therefore, digital leader need to be flexible and adaptable to new ideas, intellectual curiosity, having transformative vision, forward-looking perspective, change-oriented, open minded, adaptable, innovative and a hunger for new knowledge (17). They seek solutions and challenges globally and are hungry for continuous learning.

Leadership style of a health care leader

Studies have found that leadership style is influencing to implementation of digital health successfully (18). The transformational leadership theory was identified as the starting point for 'new-genre leadership' models emphasizing that a leader's style should be visionary, ideological, and participative, servant, or authentic where digital leader needs to perform (19). Whatever the leadership style, the main focal point is the relationship between the leader and the follower on the project. This is well explained in the leader-member exchange theory (LMX)(20). Leader-member exchange theory focuses on the nature and quality of the relationship between leaders and their team members. The studies on digitalization and leadership, identified four main relationships; the relationship between e-leaders and organizations, how leaders adopt technology to solve complex organizational problems; the impact of digital technologies on ethical leadership and the leader's use of digital technologies to influence social movements on digitalization (20).

Capacity development role of a digital leader

As a digital leader, he/she need to mobilize the organization through generating proper digital awareness (21). In order to possess the digital power to influence over the people in digital health, he/she must obtain more knowledge and skills in the digital field (22,23). Capacity building program on the digital health information on the health care

leaders is needed to be a priority in the organization to fulfil the demand (16). Digital leader needs to develop creativity, innovation and willingness to investigate new way of using technology to improve quality and effectiveness of the service (24). It is highlighted that digital leaders must developed their image on the employee through professional development in order to digital culture in the organization (15). In many occasions health care leaders have failed to maintain the sustainability of the digital project as well as fail to deliver service timely according to the demand (25, 26). Therefore, it has recommended to ensure competency in clinical healthcare service, proper management and adequate knowledge of digital technology related to health information among the health care leaders (26,27,28). And healthcare leaders need to develop better skills to manage finances, understanding of project management timeline and alternative options before digitalization of the health system (29). In order to move to digital health, leaders need to offer new carrier opportunity to engage in digital health training for health workers (30).

Data analytical capacity in essential component when leaders need to get more befits from digitalization of health service and which was a common barrier (31). Therefore, development of analytics capability of the health care leaders are essential to ensure effective professional leadership (32). Most of the time leaders are facing challengers to develop digital skills among the clinicians and lower-level managers, when introducing digital health (33). Therefore, arranging digital ready workforce program should be the top priority of the leaders in the health care service (32).

Interpersonal relationship of a digital leader

As a digital leader, he should be capable enough to develop skills to maintain inter-professional and inter-sectoral collaboration in order to perform on the digital world (34). Specially they should attempt to work with external leaders with deep digital transformation experience who can provide the necessary expertise and perspective (35). The quality of this relationship, which is characterized by trust, respect, and mutual obligation, is thought to predict individual, group and organizational outcomes (36). This will develop positive impact on the employee on IT information sharing (16).

Leaders need to understand that followers are changing compared to the past and there is less hierarchical distance between leader and member because digitalization democratizes information (37).

Delegation skills a digital leader

Healthcare leaders need to understand that digital leaders would come from a range of backgrounds and may not follow a traditional path but one that may still offer significant value (30). Research findings proved that IT and digitalization have an impact on tasks and practices. Delegation of work is a very important attribute a leader should perform when dealing with the digital health (32) while participation with the followers (participative e-leader) to maintain the sustainability of the digital system (38). A study has identified that nursing leaders seem to be very active in planning the implementation of digital health service and held the chief responsibility since they are often more involved in the early stage of implementation (34).

Planning and project management of a digital leader

Some digital projects have been unsuccessful due to faulty planning process, inability to identify the scope of the project, failure to identify the correct stakeholder and lack of effective communication among the team members (39,40,41). Because of fragmentation of the NHS, they have face to seriousness difficulties to implement digital system to patient care management (42). UK National health service has developed a long-term plan which places digital developments at the heart of steps to improve health care and deliver services in a sustainable way and escaped from the above barriers faced through fragmentation (32). Therefore, leaders need to focus on development long-term plan to implement digital health rather than going to short term plan.

Decision making role of digital leader

An e-leader should be able to select suitable technology to their organization as well as capable enough to transiting a positive attitude to employees about their adopting of new technology (43). They maintain a more egalitarian and result-oriented approach unlike previous traditional leaders (17). On individual level digital leaders

develop their skills to think on how organization can transform using technology according to customer needs (44) and take decisions accordingly.

Other leadership Skills of digital leaders

Digital leaders need to develop attributes such as the ability to influence, inspiring a shared vision, being proactive, and ability to avoid blaming others, being visionary and being innovative (16). It is said that digital leadership is cross-hierarchical, fast, team oriented and cooperative (45). Health care leaders must use personal competences, their mind-set as well as their ability to apply new methods in digital health (17). Therefore, it is suggested to leaders to improve their skills and knowledge on effective communication, information management, coaching, knowledge management, collaboration and decision-making performance in digital health (46, 47).

Identification of barriers in the implementation of digital health

Leaders need to identify the main barriers of implementing information technology to health system in order to its adoption (14). Previous researchers have identified main six primary barriers, the cost, legality, time, fear, usefulness and complexity (48, 49). The most important barrier to adoption of new technology is the cost, which is very difficult to assess cost and benefits because of the high capital cost and maintenance cost (50). Because of complexity of the health care system conceptualizing leadership in digital health is important guidance for service development (34).

4.   Discussion

Because of complexity in the health care system leadership in digital health services has been scrutinized in relation to issues HIT adoption and implementation (51). According to the Avolio and Kahai implementation of information technology in health care system has lagged behind compare to other business. This was mainly due to poor leadership in the health care service (52).This implies health care leaders need to change their leadership style in order to successful implementation of digital technology to offer high quality and efficient service. Conceptualization of leadership is the best suggestion given to capture digital health to health system (34). According to

the WHO recommendation digitalization of health service is an essential criterial to achieve universal health coverage (53). Therefore health care leaders need to improve their leadership qualities to face new digital world. It was identified that leadership is the main contributing factor to transform healthcare digitally (16). Therefore, health care leaders need to develop their leadership style beyond the traditional style, especially health care leader should be a strategic manager and effective communicator (16). Leader is the someone who can influence others to achieve organizational goal. Therefore he is considered in a key position in dealing with digital health (17). Knowledge power is an essential attribute to influence other on the digitalization. So health care leader must update their digital knowledge to fulfil the organizational requirements. They need to participate IT training program, workshops and study visits at digitalized health care organization to improve their knowledge. Leader must developed Interpersonal relationship with the professional digital leaders in order to improve their knowledge on the digital health. Digital solution group in NHS, England consist of heath care leaders, Administrators and professional digital leaders and conducting regular meeting locally as well as nationally and discuss future digital health care solutions to the country. It updates the knowledge, skills of the health care leaders regularly through this group. Establishment of such a framework to health service beneficial to develop the health care leaders in future digitalization. By identifying the importance of development of digital leaders in healthcare, NHS digital academy was established aiming to train future digital health leaders (54). This academy planned to give more knowledge on essentials of health systems, implementing strategy and transformational change, health information systems and technologies, user-centred design and citizen-driven informatics, decision support, knowledge management and actionable data analytics (27). That type of educational institute will be helpful to developed future health care leaders to adapt for digital transformation. It is not easy to implement digital system in the hospitals due to its complexity. There are many barriers block the transformation. Barriers to implement digital health in NHS UK mitigated through development of digital strategic long term plan. Therefore health care leaders need to develop long term digitalization plan to their organization. Capital cost

for implementation of the digital health is very high. Therefore, health care leaders must plan to identify clear budget line to maintain the implemented project to get expected benefits to the service. Relationship of the leaders and employees are an essential feature to implement and maintain the digital health. Resistance to implement of digital system coming from the employee due to poor digital skills. Therefore, leader need to organized regular training program to employees in the organization to develop their digital skills. Regular communication with the employees will help to identify the barriers of new digital project which can be resolve at the beginning. Delegation is an essential feature to develop by the digital leaders. Leaders should have identify the key people in the organization and delegate the authority to implement the digital health. Nursing leaders play a key role in implementing the digital health at the very begging (34). Therefore nursing leaders need to develop their knowledge and skills related to digital health. Health care leaders should facilitate to develop digital leaders in nursing field for implementation and monitoring of the digital projects. Hierarchy is one of limiting factor to implement the digital health. Therefore, leaders need to develop good relationship with the employees without considering hierarchal level to implement digital system successfully.

5.   Conclusions

Leaders play a main role in digitalization of the health care system. Use of digital technology in the health care system is lagging behind compared to the other business environment because of poor leadership skills in the health care leaders. Therefore, health care leaders need to go beyond from their traditional leadership style to a new transformational leadership style. Successful leaders in the digital health shows good interpersonal relationship, effective communication, risk taking ability, delegation of authority, self and organizational capacity development ability, innovation ability and knowledge on good project management.

References

Pratt MK. Sparapani S. What Is Digital Transformation? Ultimate guide to digital transformation for enterprise leaders. BMC helix. Available at: https://www.techtarget.com/searchcio/definition/digital-transformation.Accessed on 18/09/2022.

Benioff M. What Is Digital Transformation?. Salesforce. Available at: https://www.salesforce.com/eu/products/platform/what-is-digital-transformation/.Accessed on 18/09/2022.

Bernstein C. digital health (digital healthcare).Tec target. Available at: https://www.techtarget.com/searchhealthit/definition/digital-health-digital-healthcare.Accessed on 18/09/2022

World Health Organization (2019, March 26). Draft global strategy on digital health 2020-2024. Author: Geneva, Switzerland. Retrieved from: https://extranet.who.int/dataform/upload/surveys/183439/files/Draft%20Global%20Strategy%20on%20Digital%20Health.pdf.

Sheikh A, Sood HS, Bates DW. Leveraging health information technology to achieve the "triple aim" of healthcare reform. J Am Med Inform Assoc 2015; 22:849–56.

Jha AK, Doolan D, Grandt D, et al. The use of health information technology in seven nations. Int J Med Inform 2008; 77:848–54.

Lynn M, Manal K, Karen F. Digital Health in Canadian Schools of Nursing—Part B: Academic Nurse Administrators' Perspectives. Quality Advancement in Nursing Education.2020; 6(3): 1-27.

The Digital Transformation of Healthcare. European Commission. 2018.Available at: URL: https://ec.europa.eu/commission/presscorner/detail/en/MEMO_18_3367 [accessed 2022-08-08]

Obama B. United States health care reform: progress to date and next steps. J Am Med Assoc 2016 Aug 2;316(5):525-532 [FREE Full text] [doi: 10.1001/jama.2016.9797] [Medline: 27400401].

Asthana1 S, Jones R, Sheaff R. Why does the NHS struggle to adopt eHealth innovations? A review of macro, meso and micro factors. BMC Health Services Research.2019; 19(984): 1-7.

Bouronikos V. Importance of Technology in Healthcare. Institute of entrepreneurship Development.2020. (Available at: https://ied.eu/blog/importance-of-technology-in-healthcare/. Accessed on 08/08/2022).

Hull and East Yorkshire Hospital NHS. Digital Strategy 2018- 2023.Hey Digital statergy 2018 (Available at: https://www.hey.nhs.uk/downloads/digital-strategy-2018-2023/. Accessed on 08/08/2022).

Health management. The Impact of Digital Technology on Healthcare.2020. Available at: file:///C:/Users/Susantha.fernando/Downloads/the-impact-of-digital-technology-on-healthcare.pdf. Accessed on 18/09/2022.

Garrett P, Brown A, Hart-Hester S, Hamadain E , Pierce W, Rudman WJ. Identifying Barriers to the Adoption of New Technology in Rural Hospitals: A Case Report. Perspectives in Health Information Management.2016; 3(9): 1- 11.

Breuer S, Szillat P. Leadership and digitalization: contemporary approaches towards leading in the modern day workplace. E-Journal.2019.

Alanazi AT. Digital Leadership: Attributes of Modern Healthcare Leaders. Open accesses Journal.2022. DOI. 107759/cureus.21969.

Gun I, Aslan O. Digital Leadership In Healthcare Organization. Health Sciences Current Researches And New Trends-3.2021.

Sosik, J. J., Kahai, S. S., and Avolio, B. J. Transformational leadership and dimensions of creativity: motivating idea generation in computer-mediated groups. Creativity Res.1998. J. 11, 111–121, doi: 10.1207/s15326934crj1102_3.

Richter, A. and D. Wagner, "Leadership 2.0: Engaging and Supporting Leaders in the Transition Towards a Networked Organization", in: Proceedings of the 47th Hawaii International Conference on System Sciences, 2014.

Cortellazzo L, Bruni E, Zampieri R. The Role of Leadership in a Digitalized World: A Review. Frontiers in Psychology.2019.Available at: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01938/full. Accessed on 07/09/2022.

Westerman G, Bonnet D, McAfee A: Leading Digital: Turning Technology into Business Transformation .Harvard Business Publishing, Brighton, MA; 2014.

Sheridan PT, Watzlaf V, Fox LA: Health information management leaders and the practice of leadership through the lens of Bowen theory. Perspect Health Inf Manag. 2016, 13:1d.

Anak Agung Sagung, M. A., & Sri Darma, G. Revealing the digital leadership spurs in 4.0 industrial revolution. Asri, AASMAN, & Darma, GS, Revealing the digital leadership spurs in.2020: 4; 93-100.

Bolden, R., O'Regan, N. (2016). Digital Disruption and the Future of Leadership: An Interview With Rick Haythornwaite, Chairman of Centrica and MasterCard. Journal of Management Inquiry.2016; 25 (4): 438- 446.

Carol KS: Leadership roles, competencies, and education: how prepared are our nurse managers? J Nurs Adm. 2003, 33:451-455.

Desveaux L, Soobiah C, Bhatia RS, Shaw J: Identifying and overcoming policy-level barriers to theimplementation of digital health innovation: qualitative study. J Med Internet Res. 2019, 21:e14994.10.2196/14994.

Abdullah T. Alanazi. Digital Leadership: Attributes of Modern Healthcare Leaders.2022. Cureus 14(2): e21969. DOI 10.7759/cureus.21969.

Sood H, NcNeil K, Keogh B: Chief clinical information officers: clinical leadership for a digital age. BMJ.2017, 358:j3295. 10.1136/bmj.j3295.

Sheridan PT, Watzlaf V, Fox LA: Health information management leaders and the practice of leadership through the lens of Bowen theory. Perspect Health Inf Manag. 2016, 13:1d.

Shah S. Digital health leadership: carving a new pathway. Future Healthcare Journal 2020;7(3): 199–201.

Bardsley M, Understand analytic capability in health care, Health Foundation, 2016, https://www.health.org.uk/publications/ understanding-analytical-capability-in-health-care. Accessed 06/09/ 2022.

Scobie S, Clarke SC. Implementing learning health systems in the UK NHS: Policy actions to improve collaboration and transparency and support innovation and better use of analytics. Policy Analysis.2019. DOI: 10.1002/lrh2.10209.

Health Education England, 2019, The Topol review: preparing the healthcare workforce to deliver the digital future,2019. Available at: https://topol. hee.nhs.uk/ content/uploads/HEE-Topol-Review-2019.pdf. Accessed on 6/09/2022.

Laukka E, Pölkki T; Heponiemi T, Kaihlanen A, Kanste O. Leadership in Digital Health Services: Protocol for a Concept Analysis. JMIR. 2021;10(2): e25495) doi: 10.2196/25495.

Kane, G. C., Phillips, A. N., Copulsky, J., & Andrus, G. (2019). How digital leadership is (n't) different. MIT Sloan Management Review.2019;60(3): 34-39.

Gerstner, C. R., and Day, D. V. (1997). Meta-analytic review of leader-member exchange theory: correlates and construct issues. J. Appl. Psychol. 82, 827–844. doi: 10.1037/0021-9010.82.6.827

Hesse A. Digitalization and Leadership – How Experienced Leaders Interpret Daily Realities in a Digital World. Proceedingsofthe51st Hawaii International Conferenceon System Sciences j 2018;1854-63.

Avolio, B. J. and S. S. Kahai, "Adding the ‚e' to e-Leadership: How it may Impact your Leadership", Organizational Dynamics, 31(4), 2013, pp. 325-338.

Pinto JK, Mantel SJ: The causes of project failure. IEEE Trans Eng Manag. 1990, 37:269-276.10.1109/17.62322.

Taylor A: IT projects: sink or swim. Computer Bulletin. 2000, 42:24-26. 10.1093/combul/42.1.24

Ingebrigtsen T, Georgiou A, Clay-Williams R, et al.: The impact of clinical leadership on health information technology adoption: systematic review. Int J Med Inform. 2014, 83:393-405. 10.1016/j.ijmedinf.2014.02.005.

Asthana1 S, Jones R, Sheaf R. Why does the NHS struggle to adopt eHealth innovations? A review of macro meso and micro factors. BMC Health service Reasearch.2019. https://doi.org/10.1186/s12913-019-4790-x.

Avolio, B. J., Kahai, S., and Dodge, G. E. E-leadership: implications for theory, research, and practice. Leader.2000, Q. 11:615–668.

doi: 10.1016/S1048-9843(00)00062-X

Crummenerl, C., Kemmer, K. Digital Leadership Führungskräfteentwicklung im digitalen Zeitalter. Capgemini Consulting (2015).

Abbu, Haroon; Kwiatkowski, Alexander; Mugge, Paul and Gudergan, Gerhard. (2020). Digital Leadership-Character and Competency Differentiates Digitally Mature Organizations, 2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC).

Haas, M. R., Criscuolo, P., and G. George, "Which Problems to Solve? Online Knowledge Sharing and Attention Allocation in Organizations", Academy of Management Journal, 58(3), 2015, pp. 680-711.

Zhao, D., Zuo, M., and X. Deng, "Examining the Factors Influencing Cross-Project Knowledge Transfer: An Empirical Study of IT Services Firms in China", International Journal of Project Management, 33(2), 2015, pp. 325-340.

Lawton, R., and D. Parker. "Barriers to Incident Reporting in a Healthcare System." Quality & Safety in Healthcare 11 (2002): 15-18.

Uribe, C. L., et al. "Perceived Barriers to Medical-Error Reporting: An Exploratory Investigation." Journal of Healthcare Management 47 (2002): 263-279.

Gans, D., J. Kralewski, T. Hammons, and B. Dowd. "Medical Groups' Adoption of Electronic

Health Records and Information Systems," Health Affairs 24 (2005): 1323-1333.

Laukka E, Huhtakangas M, Heponiemi T, Kanste O. Identifying the roles of healthcare leaders in hit implementation: ascoping review of the quantitative and qualitative evidence. Int J Environ Res Public Health 2020 Apr 21;17(8):- [FREEFull text] [doi: 10.3390/ijerph17082865] [Medline: 32326300].

Van WHA, Wortelboer HM, van der Greef J. Grip on health: a complex systems approach to transform health care. J Eval Clin Pract 2018 Feb;24(1):269-277 [FREE Full text] [doi: 10.1111/jep.12679] [Medline: 28032412].

Orton M, Agarwal S, Muhoza P, Vasudevan L, Vuc A. Strengthening Delivery of Health Services Using Digital Devices. Global Health: Science and Practice. 2018; 6 :561-71.

Farrell, D., & Sood, H. The NHS Digital Academy–learning from the past to look ahead. Future Healthcare Journal.2020; 7(3):185.