



# Digital Technology and Health Workers' Performance: A Case of Hospitals in Nigeria and South Africa

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## Abstract

Digital healthcare is a concept that creates an intersection between technology and healthcare in the healthcare system thus incorporating software, hardware and services. Digital technology plays an increasingly important role in healthcare today. Without doubt, the digital transformation of healthcare has raised several challenges that affect stakeholders especially healthcare workers and patients. However, effective adoption of digital technology enhances performance and increased efficiency. More so, it has made effective communication between healthcare providers and patients very easy the paper presents digital technology as a driver of change in the healthcare system especially in Africa and its positive impact on health care worker's performance.

**Keywords:** Digital Technology, Health care workers, Healthcare worker performance

## 1. Introduction

The increasing prioritisation of medical care quality across the six areas of safety, patientcentredness, efficiency, effectiveness, timeliness and accessibility

has given rise to rapid change in the creation of initiatives and the actualisation of set targets.<sup>1</sup> Despite the existence of numerous methodologies of digital transformation, their implementation in complex healthcare domain remains unclear. Digital transformation encompasses information and communication technology, and other internet facilities. Digital transformation or technological change is usually challenging in health care systems as a result of new discovery of diseases, complex health interventions, in-patient's management, and health information technology.<sup>2</sup> Implementation of the latter into the change model is one of the key challenges in healthcare organisations. This is because technologies are increasing the cost and complexity of healthcare.<sup>3</sup> The introduction of electronic patients' records, 3-D printed devices, and robotics for healthcare delivery require skilled and competent health care managers. Previous study has revealed that technological transformation is one of the causes of skills shortage in the healthcare industry, which affect employees' performance. However, there is a plethora of empirical studies on digital transformation as driver of change and employees' performance. For example, Kute & Upadhyay examined the relationship between technological changes and its impact on employee performance in commercial printing industry.<sup>4</sup> Their study found that technological changes affect employee performance in many ways such as staff turnover, job dissatisfaction, redundancy, and demotivation because technological changes affected skills and performance. On the contrary, the study conducted in Nigeria by Dauda & Akingbade found no significant relationship between technological changes and employee performance.<sup>5</sup> Despite this inconsistency, digital transformation in healthcare centres, such

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<sup>1</sup> Harrison, Reema, Sarah Fischer, Ramesh L. Walpola, Ashfaq Chauhan, Temitope Babalola, Stephen Mears, and Huong Le-Dao. "Where do models for change management, improvement and implementation meet? A systematic review of the applications of change management models in healthcare." *Journal of healthcare leadership* 13 (2021): 85.

<sup>2</sup> Davalos, Maria E., and Michael T. French. "This recession is wearing me out! Health-related quality of life and economic downturns." *Journal of Mental Health Policy and Economics* (2011).

<sup>3</sup> Figueroa, Carah Alyssa, Reema Harrison, Ashfaq Chauhan, and Lois Meyer. "Priorities and challenges for health leadership and workforce management globally: a rapid review." *BMC health services research* 19, no. 1 (2019): 1-11.

<sup>4</sup> Kute, Dattatraya, and Pooja Upadhyay. The Impact of Technological Changes on the Performance of the Employees in Commercial Printing Industry. *Journal for Contemporary Research in Management* (2014): 67-72

<sup>5</sup> Dauda, Yunus Adeleke, and Waidi Adeniyi Akingbade. "Technological change and employee performance in selected manufacturing industry in Lagos state of Nigeria." *Australian journal of business and management research* 1, no. 5 (2011): 32-43.

as telemedicine, remote diagnostic tools and advanced communication tools have been reported to improve the quality of care and reduce the cost of care.<sup>6</sup> It is instructive to note that the implementation of digital facilities has positive impacts on healthcare, but also comes with its challenges. Cases of destructive insulin overdose due to erroneous bar-coded wristbands;<sup>7</sup> and wrong prescription of medication as a result of computerised pick list.<sup>8</sup> It has been said that the efficacy and quality of digital system may not be harnessed except with change management in order to enjoy the benefits of digital health system.<sup>9</sup> It is in this sense that this study examined the implementation of digital facilities on employees' performance at selected hospitals with change management in Nigeria and South Africa.

## 2. Problem statement

There has been a lot of problem with systematic management of health records in developing contexts, which has led to continuous data corruption.<sup>10</sup> For instance, a qualitative study in South Africa revealed that the development of mobile health system is impeded by non-availability of digital technology and privacy of information or data.<sup>11</sup> South Africa is a middle-income country with free public health care provision by the government, with the aim to support poor rural areas, being the most burdened country with HIV/AIDS, and diabetes in Africa. Through the National Health Insurance scheme, the South

<sup>6</sup> Sukkird, Vatcharapong, and Kunio Shirahada. "Technology challenges to healthcare service innovation in aging Asia: Case of value co-creation in emergency medical support system." *Technology in Society* 43 (2015): 122-128.

<sup>7</sup> McDonald, Clement J. "Computerization can create safety hazards: a bar-coding near miss." *Annals of internal medicine* 144, no. 7 (2006): 510-516.

<sup>8</sup> Koppel, Ross, Joshua P. Metlay, Abigail Cohen, Brian Abaluck, A. Russell Localio, Stephen E. Kimmel, and Brian L. Strom. "Role of computerized physician order entry systems in facilitating medication errors." *Jama* 293, no. 10 (2005): 1197-1203.

<sup>9</sup> Adeleke, Ibrahim Taiwo, Adedeji Olugbenga Adekanye, Abdullahi Daniyan Jibril, Fausat Fadeke Danmallam, Henry Eromosele Inyinbor, and Sunday Akingbola Omokanye. "Research knowledge and behavior of health workers at Federal Medical Centre, Bida: A task before learned mentors." *Elective Medicine Journal* 2, no. 2 (2014): 105-109.

<sup>10</sup> Salleh, Mohd I. M., Raja A.R. Yaacob, and Mohamad S. Saleh. "The effect of performance impact on the integrity management of electronic medical records." *Australian Journal of Basic and Applied Sciences* 7, no. 6 (2013): 237-245.

<sup>11</sup> Leon, Natalie, Helen Schneider, and Emmanuelle Daviaud. "Applying a framework for assessing the health system challenges to scaling up mHealth in South Africa." *BMC medical informatics and decision making* 12, no. 1 (2012): 1-12.

African government implemented the use of Electronic Health Record system to improve and manage healthcare services.<sup>12</sup> Despite the implementation of various interventions focused at reinforcing primary health care, the impact on the population is limited. The implementation of EHR and other ICT tools in the public healthcare industry is associated with complexities and challenges.<sup>13</sup> It has been argued that 70% of intervention effort by the South African government failed to deliver the expected outcomes.<sup>14</sup> The major problem has been attributed to deficiencies in the health system, such as poor health information system, inadequate ill-trained medical personnel, under-resourced medical facilities, and the challenge of moving from paper-based system to electronic system.<sup>15</sup> In Similar vein, most health care organizations in Nigeria are predominantly on manual system;<sup>16</sup> health information documents are hugely on paper-based procedure;<sup>17</sup> and health providers have been reported to lack digital skills related to their profession.<sup>18</sup> Consequently, most of the public health organizations are burdened with delayed patients waiting time, and shortage of digitally-skilled physicians. Being the most populous country in Africa, the public healthcare industry does not have the capacity to provide essential medical service for the larger part of its people. Moreover, the health information system in Nigeria is

<sup>12</sup> Weeks, Richard Vernon. "Electronic health records: managing the transformation from a paper-based to an electronic system." *Journal of Contemporary Management* 10, no. 1 (2013): 135-155.

<sup>13</sup> Leon, Natalie, Helen Schneider, and Emmanuelle Daviaud. "Applying a framework for assessing the health system challenges to scaling up mHealth in South Africa." *BMC medical informatics and decision making* 12, no. 1 (2012): 1-12.

<sup>14</sup> Anderson, Dean, and Linda Ackerman Anderson. *Beyond change management: How to achieve breakthrough results through conscious change leadership*. Vol. 36. John Wiley & Sons, 2010.

<sup>15</sup> Schaay, Nikki, David Sanders, and Vanessa Kruger. *Overview of health sector reforms in South Africa*. DFID Human Development Resource Centre, 2011 [https://assets.publishing.service.gov.uk/media/57a08abc40f0b64974000740/overview\\_of\\_health\\_sector\\_reforms\\_in\\_south\\_africa.pdf](https://assets.publishing.service.gov.uk/media/57a08abc40f0b64974000740/overview_of_health_sector_reforms_in_south_africa.pdf)

<sup>16</sup> Adeleke, Ibrahim Taiwo, Adedeji Olugbenga Adekanye, Abdullahi Daniyan Jibril, Fausat Fadeke Danmallam, Henry Eromosele Inyinbor, and Sunday Akingbola Omokanye. "Research knowledge and behavior of health workers at Federal Medical Centre, Bida: A task before learned mentors." *Elective Medicine Journal* 2, no. 2 (2014): 105-109.

<sup>17</sup> Adeleke, Ibrahim Taiwo, Adedeji Olugbenga Adekanye, Kayode Abiodun Onawola, Alaba George Okuku, Samuel Adebowale Adefemi, Sunday Adesubomi Erinle, AbdurRahman Alhaji Shehu et al. "Data quality assessment in healthcare: a 365-day chart review of inpatients' health records at a Nigerian tertiary hospital." *Journal of the American Medical Informatics Association* 19, no. 6 (2012): 1039-1042.

<sup>18</sup> Adeleke, Ibrahim Taiwo, Adedeji Hakeem Lawal, Razzaq Adetona Adio, and Abdullateef Adisa Adebisi. "Information technology skills and training needs of health information management professionals in Nigeria: a nationwide study." *Health Information Management Journal* 44, no. 1 (2015): 30-38.

highly provoking and requires urgent adoption and implementation of digital facilities in order to improve patients waiting time, patients' profile information, scheduling of appointments, and provision of online medical services. Global references indicated that health information technology has the potential to assist in reducing these deficiencies and lowering transaction cost, by moving from manually driven system to automation system.<sup>19</sup>

### 3. Digital technology in the healthcare industry

Digital transformation of life and society in the healthcare industry has generated a wide discourse in recent times. Advanced information communication technology has given rise to progressive transformation of the healthcare industry.<sup>20</sup> Digital transformation has been described as the process of integrating technology into formerly held analogous process.<sup>21</sup> It refers to the transformation from partly digitised to completely digitised business models.<sup>22</sup> According to Iyawa, Herselman and Botha, digital health is the improvement in the provision of health care through information and communication technology to monitor and enhance the wellbeing and health of patients, and that of their families.<sup>23</sup> The definition supports the advocacy for change management in the healthcare industry, especially hospitals to focus on becoming more patients-centric in future.<sup>24</sup> This advocacy has led to many healthcare institutions especially in developed economies to deploy digital

<sup>19</sup> Feroz, Anam, Rawshan Jabeen, and Sarah Saleem. "Using mobile phones to improve community health workers performance in low-and-middle-income countries." *BMC Public Health* 20, no. 1 (2020): 1-6.

<sup>20</sup> Meske, Christian, Irete Amojó, Akira-Sebastian Poncette, and Felix Balzer. "The potential role of digital nudging in the digital transformation of the healthcare industry." In *International Conference on Human-Computer Interaction*, pp. 323-336. Springer, Cham, 2019.

<sup>21</sup> Brocke, Jan vom, Jörg Becker, and Marco De Marco. "The networked society." *Business & Information Systems Engineering* 58, no. 3 (2016): 159-160.

<sup>22</sup> Riedl, René, Alexander Benlian, Thomas Hess, Dirk Stelzer, and Hermann Sikora. "On the relationship between information management and digitalization." *Business & Information Systems Engineering* 59, no. 6 (2017): 475-482.

<sup>23</sup> Iyawa, Gloria Ejehiohen, Marlien Herselman, and Adele Botha. "Digital health innovation ecosystems: From systematic literature review to conceptual framework." *Procedia Computer Science* 100 (2016): 244-252.

<sup>24</sup> Meske, Christian, Irete Amojó, Akira-Sebastian Poncette, and Felix Balzer. "The potential role of digital nudging in the digital transformation of the healthcare industry." In *International Conference on Human-Computer Interaction*, pp. 323-336. Springer, Cham, 2019.

technologies, such as Artificial Intelligence.<sup>25</sup> The emergence of AI has made significant and positive contributions to the healthcare industry by providing precise data-driven decisions.<sup>26</sup> This is because data from large domains is used for early diagnosis of chronic diseases, which include cardiovascular diseases, cancer and diabetes.<sup>27</sup> It is instructive to note that about 10% of patients' death and 6 to 17% of hospital problems is caused by diagnostic mistakes. It is also important to remember that diagnostic mistakes are not always caused by poor medical performance. Medical experts argued that diagnostic errors are caused by inefficient integration of health information technology, communication breakdown between doctors, patients, and their families, and poor health work system designed to diagnostic processes.<sup>28</sup> The inability to effectively manage health information technology, as a result of increasing data led to the success of AI in the healthcare institutions. This suggests that the potential for disruption in the healthcare industry is enormous.<sup>29</sup> Besides, the study conducted by Aruba revealed that more than 60% hospitals around the world have introduced Internet of Things (IoT) in their organisations.<sup>30</sup> Biomarker testing is a medical tool that uses artificial intelligence. It is used to perform group of tests to identify molecular signs of health so that physicians can recommend the best treatment available to the patients.<sup>31</sup> Natural Language Processing technology is an example of machine learning, which is now being used to generate patients' record such as treatment plans, patients' prescriptions and health problems.<sup>32</sup> Virtual Nurse is another automated system that is driven by digital technology. Patients can avoid long queues, and expensive trip to the healthcare facilities by interacting

<sup>25</sup> Lee, DonHee. "Effects of key value co-creation elements in the healthcare system: focusing on technology applications." *Service Business* 13, no. 2 (2019): 389-417.

<sup>26</sup> Alugubelli, Raghunandan. "Exploratory Study of Artificial Intelligence in Healthcare." *International Journal of Innovations in Engineering Research and Technology* 3, no. 1 (2016): 1-10.

<sup>27</sup> Alugubelli, Raghunandan. "Exploratory Study of Artificial Intelligence in Healthcare." *International Journal of Innovations in Engineering Research and Technology* 3, no. 1 (2016): 1-10.

<sup>28</sup> Alugubelli, Raghunandan. "Exploratory Study of Artificial Intelligence in Healthcare." *International Journal of Innovations in Engineering Research and Technology* 3, no. 1 (2016): 1-10.

<sup>29</sup> Maier, Edith, Ulrich Reimer, and Nilmini Wickramasinghe. "Digital healthcare services." *Electronic Markets* 31, no. 4 (2021): 743-746.

<sup>30</sup> Aruba. "IoT Heading for Mass Adoption by 2019 Driven by Better-Than-Expected Business Results." Accessed September 30, 2017, <https://goo.gl/22UZ8e>

<sup>31</sup> Jack Jr, Clifford R., David S. Knopman, William J. Jagust, Ronald C. Petersen, Michael W. Weiner, Paul S. Aisen, Leslie M. Shaw et al. "Tracking pathophysiological processes in Alzheimer's disease: an updated hypothetical model of dynamic biomarkers." *The lancet neurology* 12, no. 2 (2013): 207-216.

<sup>32</sup> Alugubelli, Raghunandan. "Exploratory Study of Artificial Intelligence in Healthcare." *International Journal of Innovations in Engineering Research and Technology* 3, no. 1 (2016): 1-10.

with digital Virtual Nurse about medications.<sup>33</sup> Robot-Assisted Surgery has been identified to reduce patients' post-operation stay by 21% because of their accuracy and heal faster than human made cuts.<sup>34</sup> Robots are preferred in the surgery room because of their support for non-invasive technology. Sufficient evidence exists on the preference for digital automation in terms of diagnosis than human. Digital health tools are more accurate in detecting illnesses like cancer compare to an experienced physician.<sup>35</sup>

### 3.1. Health workers' performance in implementing digital technology

The benefits of digital health facilities have accelerated its adoption by health management institutions and hospitals, especially during Covid-19 pandemic.<sup>36</sup> Digital technology has become more in demand by hospitals than ever before. The need to ameliorate the challenges of increase in various types of diseases and population have intensified the use of digital health facilities. However, health workers find it difficult to adopt and provide digital health solution due to lack of training on new digital tools, problem of internet connectivity, and poor technical support.<sup>37</sup> This implies that in implementing new technology requires the need to train medical health workers on how to use digital tools for improved performance. Ethiopia and Uganda have been successful in the implementation of digital tools to improve health workers performance to combat diseases and provide care support for patients. Given this, health care workers contributed significantly to the decline in maternal and child morbidity and mortality rate.<sup>38</sup> The use of telemedicine in the US, China, Canada, Australia and Norway has drastically reduced the risk of infection, and patients waiting

<sup>33</sup> Ashrafi, Noushin, Lori Kelleher, and Jean-Pierre Kuilboer. "The impact of business intelligence on healthcare delivery in the USA." *Interdisciplinary Journal of Information, Knowledge, and Management* 9 (2014): 117.

<sup>34</sup> Lee, DonHee, and Seong No Yoon. "Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges." *International Journal of Environmental Research and Public Health* 18, no. 1 (2021): 271.

<sup>35</sup> Luxton, David D. "Artificial intelligence in psychological practice: Current and future applications and implications." *Professional Psychology: Research and Practice* 45, no. 5 (2014): 332.

<sup>36</sup> Maier, Edith, Ulrich Reimer, and Nilmini Wickramasinghe. "Digital healthcare services." *Electronic Markets* 31, no. 4 (2021): 743-746.

<sup>37</sup> Feroz, Anam Shahil, Adeel Khoja, and Sarah Saleem. "Equipping community health workers with digital tools for pandemic response in LMICs." *Archives of Public Health* 79, no. 1 (2021): 1-4.

<sup>38</sup> Feroz, Anam Shahil, Adeel Khoja, and Sarah Saleem. "Equipping community health workers with digital tools for pandemic response in LMICs." *Archives of Public Health* 79, no. 1 (2021): 1-4.

time, with increase online prescription support for patients by physicians. Evidence indicated the use of upSCALE digital platform in Mozambique by health workers to provide basic health care.<sup>39</sup>

### **3.2. Digital technology and health workers' performance**

Discourse on the impact of digital technology on health workers performance is well explored. For example, the research study conducted in Canada by O'Connor & O'Reiley (2018) on the infusion of mobile technology by healthcare practitioners in hospital context. The study established that a significant association exists between mobile health infusions and health practitioner performance. This finding also aligns with the empirical study conducted in Malaysia by Ghaleb Dominic, Fati, Muneer and Ali on the adoption of Big Data technology in healthcare organizations.<sup>40</sup> The authors found that technology adoption significantly influenced healthcare employees and organizational performance. The use of mobile phones to developed community health management information was adopted in Zambia. The study demonstrated that the use of mobile phones for data collection, tracking and management of information improved the performance of community health workers.<sup>41</sup> A qualitative study in rural South Africa among patients and health workers revealed that the use of mobile phones in poor and remote areas promote opportunities and capabilities in accessing health care services.<sup>42</sup> However, the lack of digital facilities and lack of digital literacy are challenges in effective implementation of mobile health services. An empirical study by Adeleke found that 98.8% of health workers acknowledged the impact of IT tools to their professional development.<sup>43</sup> The study by Luthuli (2017) also revealed that the

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<sup>39</sup> M Consortium. "Supporting community health workers in Mozambique to respond to COVID-19." In Adapting the upSCALE digital platform. 2020.

<sup>40</sup> Ghaleb, Ebrahim AA, P. D. D. Dominic, Suliman Mohamed Fati, Amgad Muneer, and Rao Faizan Ali. "The assessment of big data adoption readiness with a technology–organization–environment framework: a perspective towards healthcare employees." *Sustainability* 13, no. 15 (2021): 8379.

<sup>41</sup> Biemba, Godfrey, Boniface Chiluba, Kojo Yeboah-Antwi, Michaels Silavwe, Karsten Lunze, Rodgers K. Mwale, Scott Russpatrick, and Davidson H. Hamer. "A mobile-based community health management information system for community health workers and their supervisors in 2 districts of Zambia." *Global Health: Science and Practice* 5, no. 3 (2017): 486-494.

<sup>42</sup> Watkins, Jocelyn Olivia Todd Anstey, Jane Goudge, Francesc Xavier Gómez-Olivé, and Frances Griffiths. "Mobile phone use among patients and health workers to enhance primary healthcare: A qualitative study in rural South Africa." *Social Science & Medicine* 198 (2018): 139-147.

<sup>43</sup> Adeleke, Ibrahim Taiwo, Adedeji Hakeem Lawal, Razzaq Adetona Adio, and AbdulLateef Adisa

integration of ICT system with record management in the health environment improves the general health management and health workers performance. On the contrary, the investigation of Pal, Dasika, Hasan, Wolf, Reid, Kameswaran and Pandey on the transition from paper-based system to tablet-andmobile-based data collection system indicated that there was no significant difference across the three modes of data collection.<sup>44</sup> The authors revealed that despite positive feelings about the movement from paper-based to digital system, the health care workers retained and prefer paper-based system in the actual practice.<sup>45</sup> The authors further suggest the need for future study on the transformation from paper-based system to digital system within healthcare organizations. The aim of this study is to investigate digital transformation and health workers performance in hospitals in Nigeria and South Africa.

#### 4.1 St. Mary hospital, Marian Hill South Africa

For over 100 years St Mary's Hospital, Marian Hill located in KwaZulu-Natal (KZN) has been providing quality healthcare services for communities residing around the area. The hospital was built by monks who arrived in South Africa in 1882. The 200-bed district hospital serves a population of approximately 3 million. In 2017, the DOH took over St Mary's hospital due to the financial difficulties encountered by the hospital. Fortunately, the DOH intervened when they did as the closure of this hospital would have severely compromised access to healthcare services for the community and hampered efforts to reduce the burden of diseases in the province. The loss of jobs and skills would have also been a problem, as the hospital employees would have been out of employment. Coates IV (2014) asserts that most often, mergers and acquisitions (M&As) come with challenges. Inherently, many M&As deals have employee retention

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Adebisi. "Information technology skills and training needs of health information management professionals in Nigeria: a nationwide study." *Health Information Management Journal* 44, no. 1 (2015): 30-38.

<sup>44</sup> Pal, Joyojeet, Anjuli Dasika, Ahmad Hasan, Jackie Wolf, Nick Reid, Vaishnav Kameswaran, Purva Yardi et al. "Changing data practices for community health workers: Introducing digital data collection in West Bengal, India." In *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development*, pp. 1-12. 2017.

<sup>45</sup> Pal, Joyojeet, Anjuli Dasika, Ahmad Hasan, Jackie Wolf, Nick Reid, Vaishnav Kameswaran, Purva Yardi et al. "Changing data practices for community health workers: Introducing digital data collection in West Bengal, India." In *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development*, pp. 1-12. 2017.

challenges, which results from a negative employee attitude. In reference to St Mary's Hospital, this may include uncertainty about the future of the hospital, job security, problems of integration, employee resistance to change, perceptions of lack of leadership and feelings of confusion due to lack of communication.

#### **4.2. St Joseph hospital, Adazi-Nnukwu, Nigeria**

St Joseph hospital, Adazi-Nnukwu, is located in Aniocha local government area of Anambra State. It was initially built as an outstation clinic under the management of the missionary sisters of the Most Holy Rosary in 1938. The hospital under the care of the sisters were registered with 101 beds in 1939. It soon grew to 188 beds in recent years. The missionary sisters played an important role in the formation of the school of midwifery. The hospital continued to run and remained small in terms of structures, until February 2012 when the administration of Governor Peter Obi decided to invest in the hospital and midwifery school. Hence, major digital transformations took place. St Mary hospital Marian Hill, South Africa and St Joseph hospital Adazi-Nnukwu, Nigeria share the same history and administrative system. Both hospitals were established and run by missionaries before being taken over by the governments. The uncertainty resulting from acquisition and restructuring, which can increase stress levels of employees if not handled effectively. The perspectives of hospital workforces during a redevelopment have been poorly explored. Hospital redevelopment is often considered as a physical action rather than organisational one. Pomare et al. posit that organisational change in hospitals does not require only the physical environment to change, but also the behavioural operations, structural relationships and roles, and the organisational culture may transform at large.<sup>46</sup> According to Lady Cilento Children's Hospital Clinical Review (2015), in a recent example of a new hospital opening in Australia (the Children's Health Queensland hospital), employees attitudes shifted from excitement during early stages of change to frustration as the development progressed. This suggests that the role and support of frontline workers is crucial to implementation of any change (Lourens and Ballard 2016). This study

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<sup>46</sup> Pomare, Chiara, Kate Churruca, Janet C. Long, Louise A. Ellis, and Jeffrey Braithwaite. "Organisational change in hospitals: a qualitative case-study of staff perspectives." *BMC health services research* 19, no. 1 (2019): 1-9.

aimed to investigate the implementation of digital technology and its impact on health workers performance in St. Joseph hospital, Adazi-Nnukwu, and St. Mary hospital, Marian Hill in Nigeria and South Africa respectively. The motivation for this study was due to the recent implementation of digital technology in both hospitals, as a mechanism of change management strategy.

## 5.1 Research methods

This research is framed within the interpretivism philosophical assumption. Interpretivist philosophical worldview allows for the adoption of various means or multiple research approaches to understand a phenomenon or uncover the truth.<sup>47</sup> The adoption of interpretivism ideology permits the use of a mixed-method research approach for this study. Both quantitative and qualitative research approach was found suitable for this study. The case-study research design was found appropriate in investigating hospitals in Nigeria and South Africa. Case study research design has become one of the most widely used in technology management research and information system studies,<sup>48</sup> because it allows to get better understanding and deep knowledge of a complex problem in reality. The population of the study includes physicians, mid-wives, nurses and managers of the hospitals. St. Joseph has 325 staff, while St. Mary has 325 staff, making a total of 540 target population. The sample size was derived by using Krejcie and Morgan's table as illustrated by Sekaran and Bougie,<sup>49</sup> and a total of 301 sample size was determined for survey questionnaire. Purposive sampling technique was adopted in selecting 5 medical staff from each hospital for the purpose of interviews. The 10 selected health workers comprise senior and junior staff who were directly involved in the implementation process. The research questions were derived from extensive literature review, and were critically validated by two experts from the department of Human Resource Management in Durban University of Technology. The research instruments were measured on a six-point Likert scale ranging from "Strongly Agree" to

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<sup>47</sup> Sekaran, Uma, and Roger Bougie. *Research Methods for Business: A skill building approach*. 8<sup>th</sup> ed. West Sussex: Wiley, 2019

<sup>48</sup> Laurenza, Elena, Michele Quintano, Francesco Schiavone, and Demetris Vrontis. "The effect of digital technologies adoption in healthcare industry: a case based analysis." *Business process management journal* (2018).

<sup>49</sup> Sekaran, Uma, and Roger Bougie. *Research Methods for Business: A skill building approach*. 8<sup>th</sup> ed. West Sussex: Wiley, 2019

“Strongly Disagree”. Further, a pilot study of 20 sample size was conducted to test the reliability and validity of the items in the questionnaire, and the result of the Cronbach alpha indicated that both the independent variable (digital technology) and the dependent variable (workers' performance) were well above 0.7 minimum threshold.<sup>50</sup> The principle of accountability and authenticity was adopted to determine the reliability and validity of the research questions for in-depth interviews.

## 5.2 Analysis

The quantitative data was analysed via SPSS version 25, while the qualitative data was analysed through NVivo 12 software. Below shows the result of the factor analysis where the KMO value were above 0.5 accepted minimum value, with significant value of 0.05 Bartlett test of sphericity.

**Table 1: Variables analysis**

Variables	Mean	Std. Dev.	Cronbach $\alpha$	KMO	Bartlett's test
Digital technology	2.46	1.342	0.712	0.721	p < 0.05
Workers performance	2.17	1.302	0.736	0.532	p < 0.05

Source: Authors' compilation

Further, a regression analysis performed by regressing the dependent variable on the independent variable as shown in Table 2 below.

**Table 2: Regression analysis model summary on the influence of digital use on health workers performance in St. Joseph.**

Model	R	R-square	Adjusted R square	Std. error of the estimate	t	F	Sig.
1	0.609	0.370	0.355	0.731	2.760	24.322	0.007

<sup>50</sup> Saunders, Mark, Philip Lewis, and Adrian Thornhill. “Research Methods for Business Students Eight Edition.” *QualitativeMarket Research: An International Journal* (2019).

**Predictors: (Constant), Digital technology**

**Dependent variable: Health workers performance**

As shown in Table 2 above, the outcome of the regression analysis reveals that use of digital technology has an influence on health workers performance (EP) at St Joseph hospital AdaziNnukwu. Furthermore, the p-value = 0.007 indicates statistically significant effect at 5% level of significance. The coefficient of determination which is 0.370 reveals that approximately 37% of the variation observed by the dependent variable (health workers performance) is caused by the independent variable (use of digital technology). The F value and the p-value (24.322,  $p < 0.001$ ) in Table 2 shows that these regression results are significant.

**Table 3: Regression analysis model summary on the influence of digital use on health workers performance in St. Mary**

Model	R	R-square	Adjusted R square	Std. error of the	t	F	Sig.
Estimate							
1	0.747	0.557	0.543	0.587	2.523	39.665	0.014

**Predictors: (Constant), Digital technology**

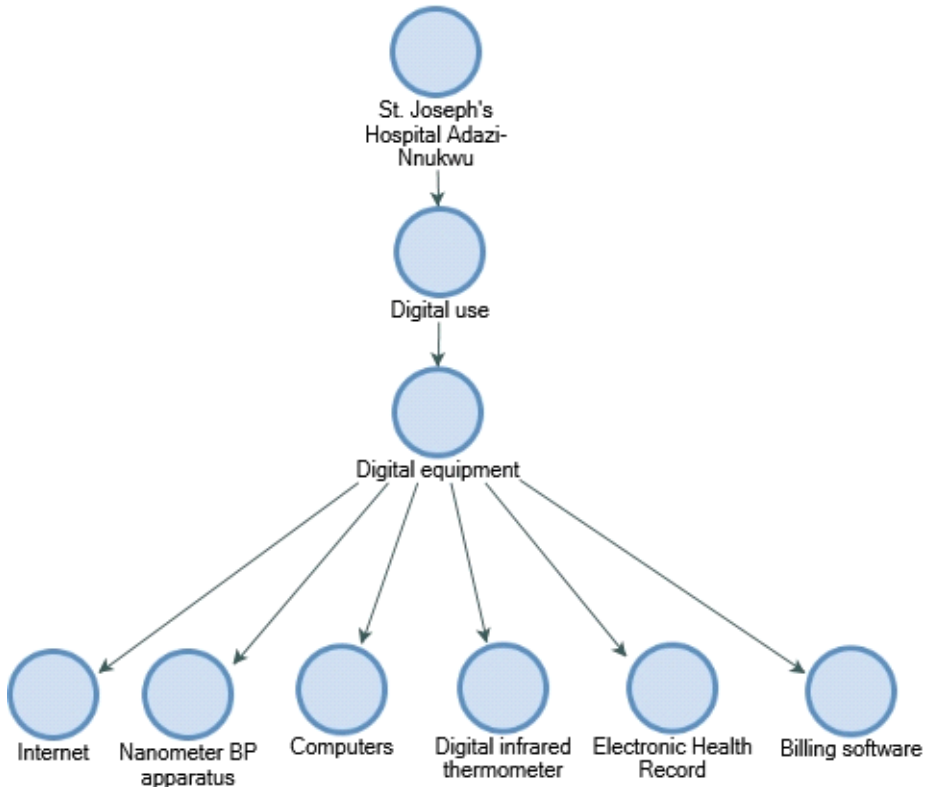
**Dependent variable: Health worker's performance**

This reveals that use of technology has a potential influence on employee performance in St Mary's hospital Marian Hill. Furthermore, the p-value = 0.014 which indicates a statistically significant effect at 5% level of significance. The coefficient of determination which is 0.557 reveals that approximately 55.7% of the variation observed by the dependent variable (health workers performance) is caused by the independent variable (use of digital technology). The F value and the p-value (39.665,  $p < 0.001$ ) in Table 3 shows that the regression result is significant.

### 5.3 Qualitative analysis

The transcribed data received from the structured questions revealed that both St. Joseph's Hospital and St. Mary's Hospital have undergone a process of

organisational change by implementing digital technology as shown in Figure 1 and 2 below. The interview responses that emerged from the in-depth interview sessions with regards to the digital transformation process were coded into different themes and sub-themes as shown below.



**Figure 1: Digital implementation in St. Joseph hospital.**

The composition in Figure 1 above presents the components of digital implementation as it influences health workers performance. The themes that emerged as implemented by the St. Joseph hospital were internet, Nanometre BP apparatus, computers, digital infrared thermometer, electronic health record and billing software. The introduction of digital equipment is the major drivers of change at St Joseph’s Hospital. Some of the participants identified the digital gadgets and shared their previous experiences with the current administrative system, giving credit to the present administrative regarding the new digital implementation by moving from manual process to digital, and how it has improved workers performance. Some of the participants asserted this:

When I came here, there was only one computer in the hospital and that was in the administration department. But right now, there are computers at every department. We are working digitally now with many technologies. Right now, there are many computerised systems that doctors work with, even consulting from their phone. We are trying to facilitate patient care. A lot of patients are very satisfied with the level efficiency in the hospital (participant 2, interview – St Joseph’s).

This comment is buttressed by other participants:

Currently, the organisation has introduced computers to document information, though it not available to all departments. However, it is available in the medical, pharmacy, data, billing and laboratory departments (Participant 3, interview – St Joseph’s).

A lot, everywhere technology has brought about a lot of changes. It is a welcome development, and it is very encouraging. Some of the changes are technology infrastructure, systems, automations and tools (Participant 4, interview – St Joseph’s).

The digital infrastructural facilities were the major practical implementations that influenced changes within the organisation. These changes had a drastic transformation with significant impact on the patients. Some of the participants were in agreement that the digital transformation has improved their finance system and staff performance. Technological innovations in the healthcare system have facilitated easier communication in hospitals.

In the area of finance, I would say the change is useful, at least the management can easily see and track the accounts after the billing process. I prefer the current change because like I said it makes our job more effective and the patients are very satisfied (Participant 4, interview – St Joseph’s).

Yes, I would say beyond measures. The benefit of technology developments can’t be overemphasised. It is difficult for someone to evaluate themselves. But in the last two years a lot of changes have taken place which is unbelievable. We have been able to control the flow of finances (Participant 2, interview – St Joseph’s).

My dear, I can tell you categorically now that there is a lot of improvement, because initially when we were using the manual equipment, especially during billing process, we would write it out with pen before calculating the bill and

sometimes there are errors. But right now, every patient information and billing process is automated. It has decreased patients long waiting times in all departments. The electronic billing system is a game-changer and brings accuracy and speed (Participant 3, interview – St Joseph's).

One of the participants affirmed that the implementation of electronic prescription system has also improved doctors' work efficiency.

Currently the doctors have been introduced to prescribing from their system to the pharmacy and to the billing office, and that has been able to reduce unnecessary queues, cut costs, streamline excessive HR and enhance efficiency and improved customer satisfaction (Participant 4, interview – St Joseph's).

Most of the participants also opined that the implementation of the electronic health record has improves patient data and efficiency.

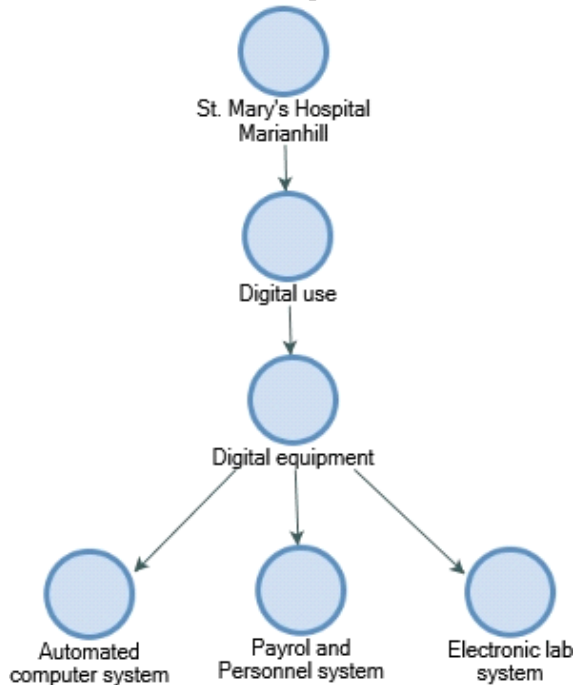
Well, I'm one of the managers here and hence don't treat patients. But for my department I would say the electronic health record (EHR) – this is a software that digitalises patient data and has improved our productivity by 90%. We also have billing software, internet and electronic communication. Now we have shorter waiting periods and patients are happier (Participant 3, interview – St Joseph's).

We are working digitally now with many technologies. Right now, there are many computerised systems that doctors work with, even consulting from there phone. We are trying to facilitate patient care. A lot of patients are very satisfied with the level efficiency in the hospital (Participant 5, interview – St Joseph's).

With respect to enhancing performance as part of a team, all the interview participants concurred that the introduction of digital facilities had had a significant impact on their performance. Technology has revolutionised the way organisations carry out business transactions, hence organisations must embrace an array of technology to develop a competitive advantage in the economic marketplace. Digital facilities increase employees' productivity through the uses of computer programmes and software which allows employees to process more information than the manual methods. Technology has the ability to improve the efficiency of a hospital as an organisation and improve the quality of care delivered to patients. Participants 1 and 5 affirmed this claim below:

I prefer the current change because like I said it makes our job more effective and the patients are very satisfied (Participant 1, interview – St Joseph’s).

I will say that this impacted me positively because it makes my job easier and more efficient. For me technology and training is a driving factor for employee’s efficiency (Participant 5, interview – St Joseph’s)



**Figure 3: Digital implementation in St. Mary hospital**

Three sub-themes emerged under digital equipment which includes, automated computer systems, payroll, personnel systems, and electronic lab systems. These digital facilities were the mostly used at St. Mary’s Hospital.

Participant 4 and 5 indicated below:

Over the years with the previous administration, we used to do things manually, and then with the new era, we have transformed from doing things manually to automated computer systems. Just to mention but a few, we have the metro filing- it deals with filing. And with the capturing of patients’ information we have a system called Rev-Light. Rev-Light is user-friendly and helps us perform our job effectively and efficiently (Participant 4, interview – St Mary’s).

After the change to the current management by the DHA, there were serious transformations in our technology systems to accommodate the new change. Like the introduction of PERSAL which is an HR system, and BAS - a basic accounting system for payments to suppliers (Participant 5, interview – St Mary).

Yes, we have improved in terms of service delivery and waiting times. Before it was taking time to access patient's information manually. It has contributed greatly to my performance. I'm saying this because it is easier to get the required information and tracking patient's information which is not time consuming (Participant 1, interview – St Joseph's).

Furthermore, all the employees were in agreement that the current dispensation is better than the previous era.

This current dispensation is much better because of the digital transformation in the hospital. Previously it was private owned and things were done manually (Participant 3, interview – St Mary's).

It is important to note that the outcome of the qualitative analysis from the two hospitals supports the result of the quantitative analysis, in which, digital technology significantly impact health worker's performance.

According to Laudon and Laudon (2014), information systems and technologies are some of the most important tools available to managers for achieving higher levels of efficiency and productivity in business operations. It is imperative that today's managers should note that technology not only eases work task but promotes flexibility and aids the development of employees. When healthcare workers lack the efficient tools, they get frustrated and so do the patients. Employees must realise that the provision of technology – be it software or hardware has a direct significance on their happiness and well-being of employees in every organisation. Therefore, healthcare practitioners must endeavour to adapt with new technological changes to improve service delivery.

#### **5.4. Discussion of findings**

This study aims to establish how health worker's performance can be enhanced through the implementation of digital technology in the healthcare industry as a measure of organisational change strategy. Two hospitals were

investigated from Nigeria and South Africa as a result of their recent public acquisition, which necessitated a change management strategy through digital transformation. The result of the regression analysis in St. Joseph hospital (Nigeria) indicated that digital technology has 37% variation of health worker's performance, and statistically significance. A significant relationship was also found between digital technology and health worker's performance in St. Mary hospital (South Africa), in which, digital technology was able to explain 55% variation in health worker's performance. These findings support the report of the study conducted in Canada by O'Connor and O'Reiley, in which, the infusion of mobile technology within the hospital significantly influence health practitioners' performance. This finding also aligns with the empirical study conducted in Malaysia by Ghaleb et al. on the adoption of Big Data technology in healthcare organisations. The authors found that technology adoption significantly influenced healthcare employees and organisational performance.<sup>51</sup>

In similar vein, findings from the qualitative analysis via interviews revealed that newly implemented digital facilities have significant and positive impact on health worker's performance. The health workers from the two hospitals affirmed that the movement from paper-based operation to automated system has significantly improved care delivery. Most of the health workers alluded to the fact that the use of digital system has reduced patient waiting time and long queues. Doctors operations have become easier and faster yielding patients' satisfaction. This is consistent with a qualitative study conducted in rural South Africa among patients and health workers, in which, the use of mobile phones in poor and remote areas promote opportunities and capabilities in accessing health care services.<sup>52</sup>

This outcome of this research is embedded in Kotter's (1996) model of change, in which, the author suggests a people-driven approach as a strategy of implementing a change model. It may be assumed that the success of digital transformation in the two hospitals is associated with the concept of need for

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<sup>51</sup> Ghaleb, Ebrahim AA, P. D. D. Dominic, Suliman Mohamed Fati, Amgad Muneer, and Rao Faizan Ali. "The assessment of big data adoption readiness with a technology–organization–environment framework: a perspective towards healthcare employees." *Sustainability* 13, no. 15 (2021): 8379.

<sup>52</sup> Watkins, Jocelyn Olivia Todd Anstey, Jane Goudge, Francesc Xavier Gómez-Olivé, and Frances Griffiths. "Mobile phone use among patients and health workers to enhance primary healthcare: A qualitative study in rural South Africa." *Social Science & Medicine* 198 (2018): 139-147.

change, communication of change model, and empowering the workers to act on the change.<sup>53</sup>

## **6.1 Conclusion**

Implementing digital technology in healthcare is very complex. It involves large amount of data, large number of personnel and lots of patients to manage. Moreover, healthcare processes are very dynamic. The movement from manual system to digital is increasing within the healthcare domain. Medical practitioners are engendered with the impact of digital technologies on care delivery. Therefore, this study demonstrated that healthcare organisations should use digital technologies via the implementation of ICT system and application of digital medical devices such as Electronic Health Record (EHR), Electronic Billing System, Computer system, Electronic Lab system, and Internet, for higher innovative clinical performance.

## **6.2 Theoretical implications**

Most of the previous literature concentrated on the integration of digital technology within the context of the manufacturing industry. A major contribution of this study is the cross-sectional analysis through a mixed-method approach in the implementation of digital technology within healthcare organisations in developing contexts. Our study also contributes to theoretical literature by establishing opportunities that digital technologies provide for healthcare institutions. We support that quality of clinical care should focus on patient-centeredness, efficiency and effectiveness.

## **6.3 Managerial implications**

It is expected that health managers should understand when and how digital technology can provide long-term economic benefits for the organisation, since digitally-driven healthcare organisations are likely to achieve improved medical services.

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<sup>53</sup> Kotter, John P. "Leading change. Boston, MA: Harvard Business School Press. Kouzes, JM, & Posner, BZ (2002)." *The leadership challenge*. San Francisco, CA (1996).

## 6.4 Study limitations

Various studies have identified the challenges of training and resistance in the implementation of digital technologies in organisations. Future study may consider the mediating influence of training, and the impact of resistance to change in the use of digital technology in healthcare organisations.

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