National College of Ireland

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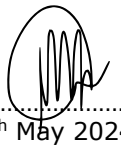
Signature: 

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National College of Ireland

Impact of the Adoption of Business Process Automation and Artificial Intelligence on Employee Performance of Nurses in the Healthcare Industry

A Post-graduate Dissertation

Maria Josefa Semana Cruz

Author

Master of Science in International Business

National College of Ireland

Submitted to the National College of Ireland, May 2024

Abstract

This study aimed to explore the impact of the adoption of Business Process Automation and Artificial Intelligence on the employee performance of nurses in the healthcare industry. It also sought to determine whether the tenure of nurses influences their perceived usefulness of BPA and AI adoption. Lastly, this study intended to find out the relationship between the nurses' perceived extent of training and support and the nurses' perceived usefulness of BPA and AI. A mono-method quantitative, deductive approach was adopted that focused on collecting primary data through a structured questionnaire. The reliability of the instrument was tested using Cronbach's Alpha. The study sample comprised of seventy nurses from five geographic locations, selected through the non-probability, snowball sampling technique. The test for normality of the distribution of data using Kolmogorov-Smirnov and Shapiro-Wilk tests revealed a non-normal data distribution. Therefore, non-parametric tests such as simple linear regression, Kruskal-Wallis, and Spearman rank order correlation tests were conducted. The results showed a significant positive relationship between the adoption of BPA and AI and the employee performance of nurses. Secondly, the tenure of nurses showed no significant influence on their perceive usefulness of BPA and AI. Finally, a positive significant relationship was established between the nurses' perceived extent of training and support and the nurses' perceived usefulness of BPA and AI. Based on this, the study recommends that managers of healthcare organisations definitely consider the adoption of BPA and AI as these tools enhance the nurses' efficiency and patient care and reduce their workload and stress. Consequently, helping the organisation achieve operational excellence through increased patient satisfaction, patient loyalty and hospital revenue. However, manager should not ignore IT-related stress that affects the nurses. Additionally, managers must consistently recognise the importance of providing training and support to ensure that employees can adapt to the digital changes.

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The author would like to express her deepest gratitude to her dissertation supervisor, Miss Gaia Barone, who had been extremely supportive throughout the writing of this dissertation. This project would not have been a success without her invaluable patience, feedback, and time. The National College of Ireland's research faculty members are also appreciated by the author for their assistance and support.

The author is also grateful to her friends for helping her disseminate the online survey for this research and to all the study participants. The author thanks the NCI library team who assisted tirelessly with research resources from the proposal stage of this project.

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List of Abbreviations

AI – Artificial Intelligence

BPA – Business Process Automation

BPM – Business Process Management

CDSS – Clinical Decision Support System

DS – Data Science

DV – Dependent Variable

EHR – Electronic Health Records

EPS – Electronic Prescribing System

GDPR – General Data Protection Regulation

IT – Information Technology

IV – Independent Variable

KPI – Key Performance Indicator

M – Mean

ML – Machine Learning

NLP – Natural Language Process

NCI – National College of Ireland

RPA – Robotic Process Automation

RPM – Remote Patient Monitoring

SD – Standard Deviation

SFA – Sales Force Automation

SPSS – Statistical Package for Social Scientists

TAM – Technology Acceptance Model

Chapter 1: Introduction

The field of Business Process Automation (BPA), with the use of advanced techniques such as Artificial Intelligence (AI), has been rapidly growing in recent years as it aims to automate and optimise corporate operations for increased efficiency and cost savings (Abdelwahab and Helal, 2023). Hence, businesses consider the adoption of BPA and AI as inevitable and a critical factor in the organisation's success. For an organization to remain competitive, it must develop efficient business processes with a focus on digitalisation and automation (Blahušiaková, 2023). AI, as Thormundsson (2023) defines, is the computer or machine's ability to emulate the capabilities of the human mind to learn from prior experiences, make decisions, and resolve problems which Brynjolfsson and McAfee (2019) refer to as superhuman performance. In addition, AI minimises human error, accomplishes multiple tasks faster at the same time and machines can be programmed to work for longer hours (Chondough and Chondough, 2022).

The rapid growth of the adoption of AI in the business market is evidenced by the AI worldwide market size which is forecasted to grow from nearly a billion US dollars in 2021 to almost two trillion US dollars in 2030 (Next Move Strategy Consulting, 2023) as shown in Figure 1-1. This is about twenty times growth in only a decade. Thus, this era is called the Fourth Industrial Revolution also known as the "Industry 4.0" or the "Digital Revolution" (Blahušiaková, 2023) where automation and information technology soar high. The impacts of AI, according to Brynjolfsson and McAfee (2019) will be magnified as various industries such as manufacturing, retailing, transportation, finance, healthcare, and other sectors will transform their business processes to gain advantage and competitive edge from AI. AI, such as machine learning (ML), natural language processing (NLP), and robotic process automation (RPA), etc., is pushing businesses to automate routine tasks of employees at a remarkable speed (Ramachandran, *et al.*, 2022). However, the implementation of automation or any changes in the business processes, although the purpose is to improve efficiency and to save cost for the organisation, would predictably impact the performance of the end-users or the employees.

Therefore, this study seeks to investigate the relationship between BPA and AI and employee performance in the healthcare industry through quantitative analysis. Similar studies have been conducted in the finance, banking, retail, and human resource sectors. However, there appear to be limited studies conducted on the healthcare sector, especially after the COVID-19 pandemic. Thereby, filling a gap in the literature. This study focuses particularly on the nursing workforce, to better understand how these healthcare professionals are affected by the digital changes in their organisational processes and how these variables impact their performance. This study is timely and relevant as the pandemic has accelerated the automation and digitalisation of many organisations (Blahušiaková, 2023) and it would be worthwhile to understand the effects of digitalisation from the nurses' point of view.

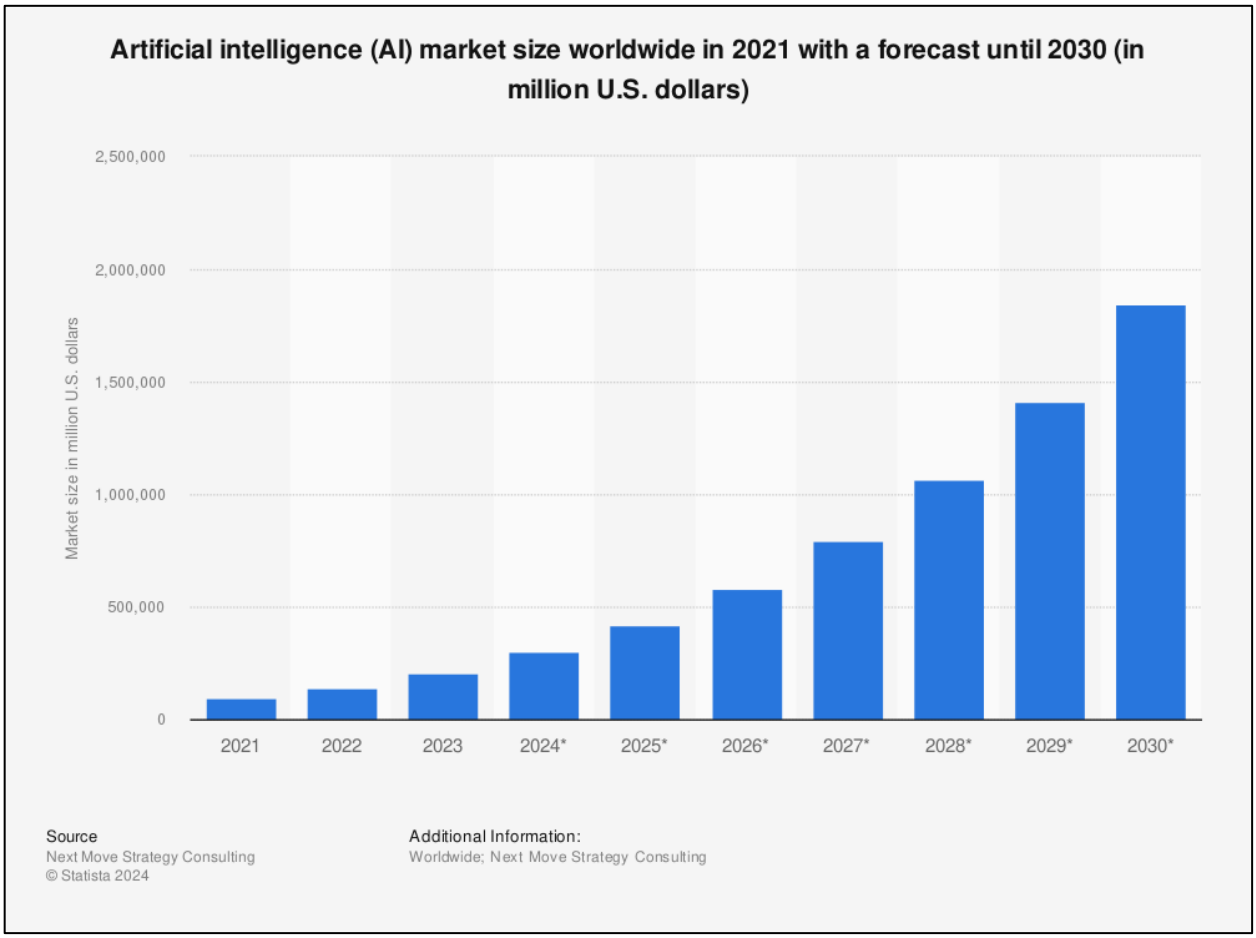


Figure 1-1: AI market size worldwide from 2021 to 2030 (Statista, 2023)

Chapter 2: Review of Literature

While the literature covers a wide variety of theories about employee performance and the adoption of new technologies, this review will focus on seven major themes namely business process management; business process automation; employee performance; the roles of nurses in the digital era of healthcare; technology adoption models; types of AI and automation in healthcare; and the challenges and implications of automation and AI to the healthcare workforce. At the end of this review, the author provided a conceptual framework of theories and ideas that this study focused on.

2.1 Business Process Management (BPM)

Business Process Management (BPM) has two parts – the business processes and the management part of these processes. For this study, it is useful to understand both separately and as one. Business processes, business strategy, and models are usually interlinked and used interchangeably. However, Bask, Tinnilä, and Rajahonka (2010) described each through the different organisational levels. They explained that business strategy involves corporate planning level, business models focus on business unit and architecture level while business processes focus on functional and operational levels of implementation. Business processes are the elements required to execute the business models formulated (Gilsing, *et al*., 2021) and the answer on how to fulfil them operationally (Osterwalder, Pigneur and Tucci, 2005). In addition, Dumas *et al*., (2018) concluded that business processes are assets that are critical to the organisation since it has an impact on employee performance and the organisational culture. In other words, business processes are the lowest level of activities and decisions of an organisation that influence how it conducts its business while being aligned with the overall business strategy.

BPM, according to Ore *et al.,* (2021), is defined as a management tool to examine the end-to-end processes in an organisation to ensure business continuity while moving towards digitalisation ambitions of the business. This suggests that BPM is concerned with the entire organisation's business processes rather than only certain parts of it. Abdelwahab and Helal (2023) also mention that BPM involves the analysis, design,

implementation, and monitoring of business processes to achieve operational excellence by improving process efficiency.

As a result of businesses' main goal to achieve operational excellence, they undertake process change where managers adjust and improve the organisation's business processes (Harmon, 2014). He also identified what drives businesses to process change and these are the constantly changing market and the increasing competitive pressures.

2.2 Business Process Automation (BPA)

Automation of business processes is now becoming substantial to replace manual processes which are usually costly and susceptible to errors (Mohapatra, 2009). However, Porterfield, Engelbert and Coustasse (2014) and Blahušiaková (2023), argued that automation involves high cost hence a barrier for smaller enterprises to automate. Business Process Automation (BPA) is a form of business process improvement that aims to achieve operational excellence and improve efficiency. The use of AI, ML, etc. has been popular in recent years not only because it increases work efficiency but it also resolves bottlenecks and decreases repetitive tasks (Ramachandran *et al.,* 2021). With these advantages, it is understandable that organisations undertake digital changes. In Blahušiaková (2023) study, she investigated the level of automation in Slovakia companies and identified the areas of business where automation and digitalisation of business processes are adopted such as the finance sector, supply chain management, manufacturing, human resource, and healthcare industry. This means that organisations in many industries are treading towards automation as it has a strong link to improving the company's efficiency. It was also evident in both Alobidien *et al.,* (2022) and Lazareva *et al.,* (2022) research studies that there is a positive significant impact of automation and AI on an increased productivity level, performance, and behaviour of employees in the government and retail sectors respectively.

One recent and apparent factor that contributed to the increased level of automation in various sectors was the COVID-19 pandemic. Blahušiaková (2023) stated that the pandemic had a significant effect on the speed of acceleration of automation and digitalisation of many industries including healthcare. It is important to highlight this fact

as this study focuses on the healthcare sector which was seriously affected during the crisis. While the pandemic contributed to the digital revolution in healthcare, Shaheen (2021) highlighted that the two main causes of digital transformation are the lack of healthcare experts and the increasing cost of healthcare worldwide. Given the level of automation and digitalisation that exists today, organisations have little choice but to follow the trend to become competitive and successful.

2.3 Employee Performance

Employees are valuable assets of an organisation as its success or failure depends on employee performance. Hameed and Waheed (2011) conferred that the efficiency and effectiveness of an organisation will be determined by how well the employees perform. In the healthcare sector, Rahiman and Kodikal (2017) highlighted how critical doctors and nurses are in terms of patient treatment and the overall success of the entire organisation.

Pawar (2013) refers to employee performance as employees' level of productivity and achievement. Chowdhury *et al*., (2014) established a positive significant relationship between high employee performance and high company revenue. Although there are various conclusions about employee performance, it ultimately boils down to organisational efficiency and success.

Job performance or employee performance, according to Hoffman-Miller (2022), originated from the theories of scholars Max Webber and Frederick Winslow Taylor from the late nineteenth to early twentieth centuries, where employees who were given specialised tasks were evaluated by their managers based on a standard system of measures. This concept also now known as performance evaluation or appraisal which evolved throughout the years has been a continuous practice in the business world. The primary purpose was to increase the efficiency of employees and subsequently was used as a basis of employee compensation and benefits (Hoffman-Miller, 2022).

There are many factors affecting employee performance. Nevertheless, these were summarised by Diamantidis and Chatzolou (2018) into three core categories i.e. firm or organisational-related factors, job-related factors, and employee-related factors. The

author prepared a tabular list of factors affecting employee performance as shown in Table 2-1 below based on several peer-reviewed journals. However, for the purpose of this study, the author draws attention to four factors: training culture, the level of experience, and the employee's attitude and behaviour.

Table 2-1: List of Factors affecting Employee Performance

	Factors affecting Employee Performance	**References**
Firm-related factors	Leadership style	Aropah, Sarma and Sumertajaya (2020) Hermina and Yosepha (2019) Pawirosumarto, Sarjana and Muchtar (2017)
	Motivation	Hermina and Yosepha (2019) Pawirosumarto, Sarjana and Muchtar (2017)
	Training Culture / Employee Development **	Mahardika and Luturlean (2020) Diamantidis and Chatzoglou (2019) Dermol and Čater (2013) Hameed and Waheed (2011)
	Management Support	Aropah, Sarma and Sumertajaya (2020) Diamantidis and Chatzoglou (2019)
	Organisational Culture / Climate	Aropah, Sarma and Sumertajaya (2020) Diamantidis and Chatzoglou (2019)
Job-related factors	Job Autonomy	Diamantidis and Chatzoglou (2019)
	Job Communication	Diamantidis and Chatzoglou (2019)
	Job Environment	Diamantidis and Chatzoglou (2019)
Employee-related factors	Motivation	Diamantidis and Chatzoglou (2019)
	Level of Experience / Job Tenure **	Chowdhury *et al*., (2014) Ng and Feldman, (2013)
	Level of Education	Chowdhury *et al*., (2014)
	Skill	Diamantidis and Chatzoglou (2019)
	Adaptability	Diamantidis and Chatzoglou (2019)
	Work Discipline (Attitude and Behaviour) **	Hermina and Yosepha (2019) Atatsi, Stoffers, and Kil (2019) Pawirosumarto, Sarjana and Muchtar (2017) Rahiman and Kodikal (2017)
	Commitment	Diamantidis and Chatzoglou (2019)
*** These are the focus of this study.*		

2.3.1 Attitude and Behaviour

Behaviour and attitude are two of the many factors affecting employee performance. These aspects are employee-related which means that these are intrinsic to the nature and personality of the individuals. Alobedien *et al.,* (2022) stated that employee performance could either be referred to as the accomplishment of one's task or the behaviour and attitude of the employee towards work. Behaviour and attitude are aspects of work discipline that have a significant impact on employee performance (Atatsi, Stoffers, and Kil, 2019; Pawirosumarto, Sarjana and Muchtar, 2017). According to Hermina and Yosepha, (2019), an employee with good work discipline shows accountability for the work assigned to him/her, reflects work passion and morale and is personally motivated to achieve organisational goals. Rahiman and Kodikal (2017) in their study of employee performance in the healthcare sector, established as well a significant relationship between the attitude of the employee and employee performance.

2.3.2 Training Culture

Training is a form of employee development and according to Hameed and Waheed (2011), employee development leads to better employee performance. However, Diamantidis and Chatzoglou (2019) argued that training has no direct impact on employee performance, but it has a strong impact on employee flexibility, proactivity and adaptability which are factors directly impacting employee performance.

The main purpose of training is to shape, develop and guide employees to perform their tasks (Dermol and Čater, 2013). This is an opportunity for human resources to learn and adapt to the changing work environment. Training, according to Mahardika and Luturlean (2020), improves the quality of human resources and in their study, they established that training affects the employee performance of car technicians by 65.1% and 34.9% is affected by other factors. Dermol and Čater (2013), however, highlighted that proper support from the supervisors and peers and training customised for the trainees (Saghafian, Laumann and Skogstad, 2021) are required for the training to be successful.

2.3.3 Level of Experience or Job Tenure

Chowdhury *et al*., (2014), from the human capital perspective, asserted that aside from a high level of education, a high level of experience in the field improves the organisation's success significantly. Feldman and Ng (2013), however, discussed two contradicting perspectives on job tenure. The first perspective is that greater tenure increases skills and knowledge thus improving performance. On the other hand, the other perspective about tenure is that employees with longer tenure tend to become bored at work. However different the views are, tenure or the level of experience affects the performance of the employees either negatively or positively.

2.4 Roles of Nurses in the Digital Era of Healthcare

Isidori *et al.,* (2022) concluded that the delivery of healthcare treatments leveraging new technologies has an increasing impact not only on organisational profits but as well as on healthcare people management. This new scenario highlights the need for highly skilled nursing staff who can adapt to constantly and rapidly emerging new situations and challenges as part of the digital healthcare revolution. Digitalisation also escalates the requirement for updating the key performance indicators (KPIs) of nurses. KPIs as defined by the National Council of Professional Development of Nursing and Midwifery (2010) are measurable metrics that indicate crucial success factors of an organisation that must be relevant to the individual area of practice and aligned with the company's overall goals. It is a tool used to measure and monitor employee performance.

The KPIs of a nurse are centered mainly on patient experience, patient care (Gray, McCance and Brown, 2021) and patient safety (Feliciano *et al*., 2020). Nurses must provide acceptable, safe and quality care to patients that would result in patient satisfaction. Patient satisfaction is a crucial and often used metric to assess the quality of healthcare (Prakash, 2010) and a renowned standard to assess the effectiveness of health services being provided (Manzoor *et al*., 2019). Although they argued that patient satisfaction does not guarantee patient loyalty, it is a strong motivator. A study by Richter and Muhlestein (2017) also linked an increase in organisations profitability to positive patient experiences in the healthcare.

Nursing skills and competencies training in this changing environment includes the use and management of new technologies, as well as supporting the use of technology tools for patients and caregivers, and eligibility to receive services delivered digitally. Alobidien *et al.,* (2022) also noted that employees are the biggest factor in the success of digital transformation. Therefore it is important to focus on employees' performance during the digital transformation process.

2.5 Technology Acceptance and Adoption Models

Whereas Davis (1989) focused on the individual's attitude towards the acceptance of new technology i.e. perceived usefulness and perceived ease of use of the user, Saghafian, Laumann and Skogstad (2021) argued that technology adoption models should not only emphasise the individual level but as well as the organisational level because it also has an impact on employee performance.

2.5.1 Technology Adoption – Individual Level

Davis (1989) defined perceived usefulness as the level of an individual's belief that a system can improve his/her performance while perceived ease of use is the level of an individual's belief that using a system requires no effort either physical or mental. Figure 2-1 shows Davis (1989) technology acceptance model (TAM). Although he considered both these factors affecting user attitude and behaviour, his study concluded that perceived usefulness had 50% more influence than perceived ease of use. Hu, *et al*., (2015), in their study of TAM using physicians' acceptance of telemedicine technology, however, concluded that perceived usefulness was found to be significant while perceived ease of use was not. This is the reason why the author of this study focused only on the perceived usefulness rather than on both.

In the study conducted by Raitoharju (2005) taking TAM into healthcare, he concluded that aside from perceived usefulness and perceived ease of use, it is also important to include the usually neglected IT-related (information technology) stress into the model as it has direct and indirect effects on individuals as well as on the organisational level.

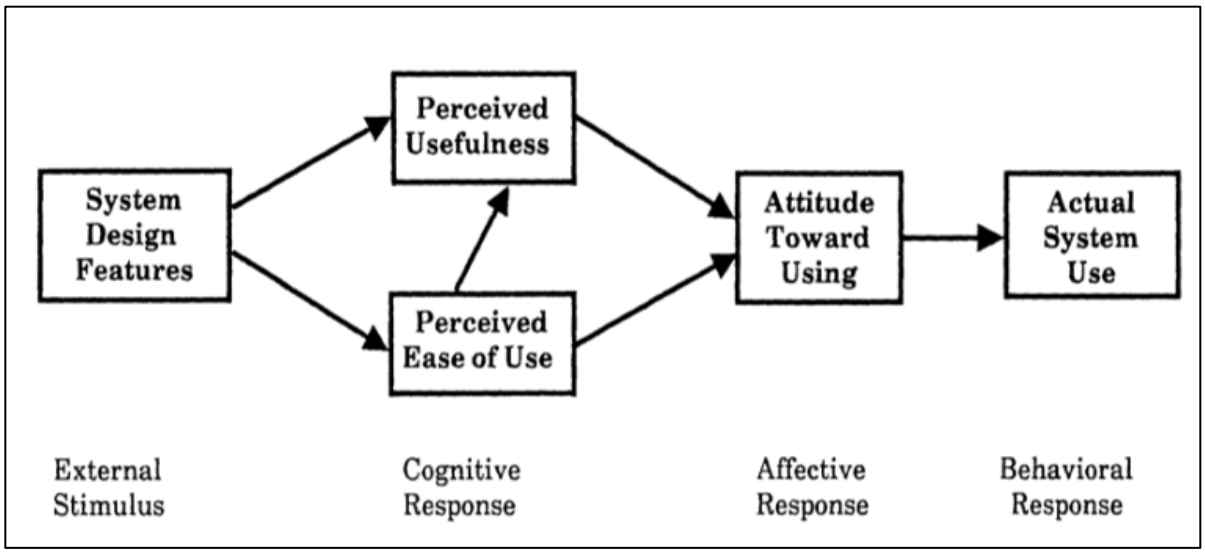


Figure 2-1: Technology Acceptance Model - TAM (Davis, 1989)

On the individual level, direct stress can cause a decrease in job satisfaction while indirect stress can cause work disturbance. On the organisational level, direct stress on employees can cause sick leave and career changes while indirect stress can decrease the overall productivity of the organisation. Table 2-2 below shows the summary of the effects of IT-related stress summary.

Table 2-2 Effects of IT-related Stress (Raitoharju, 2005)

	Direct stress	**Indirect stress**
Individual Level	Decreases job satisfaction	Work disturbances
Organisational Level	Sick leaves, career changes	Decreased productivity

2.5.2 Technology Adoption – Organisational Level

Despite the ambiguity about the different stages of the technology adoption process, Saghafian, Laumann and Skogstad (2021) identified in their study the three main stages of the technology adoption process at the organisational level i.e the pre-change stage, the change process stage and the post-change stage. Figure 2-2 below is the thematic map showing the themes and subthemes in the different stages of technology adoption at the organisational level.

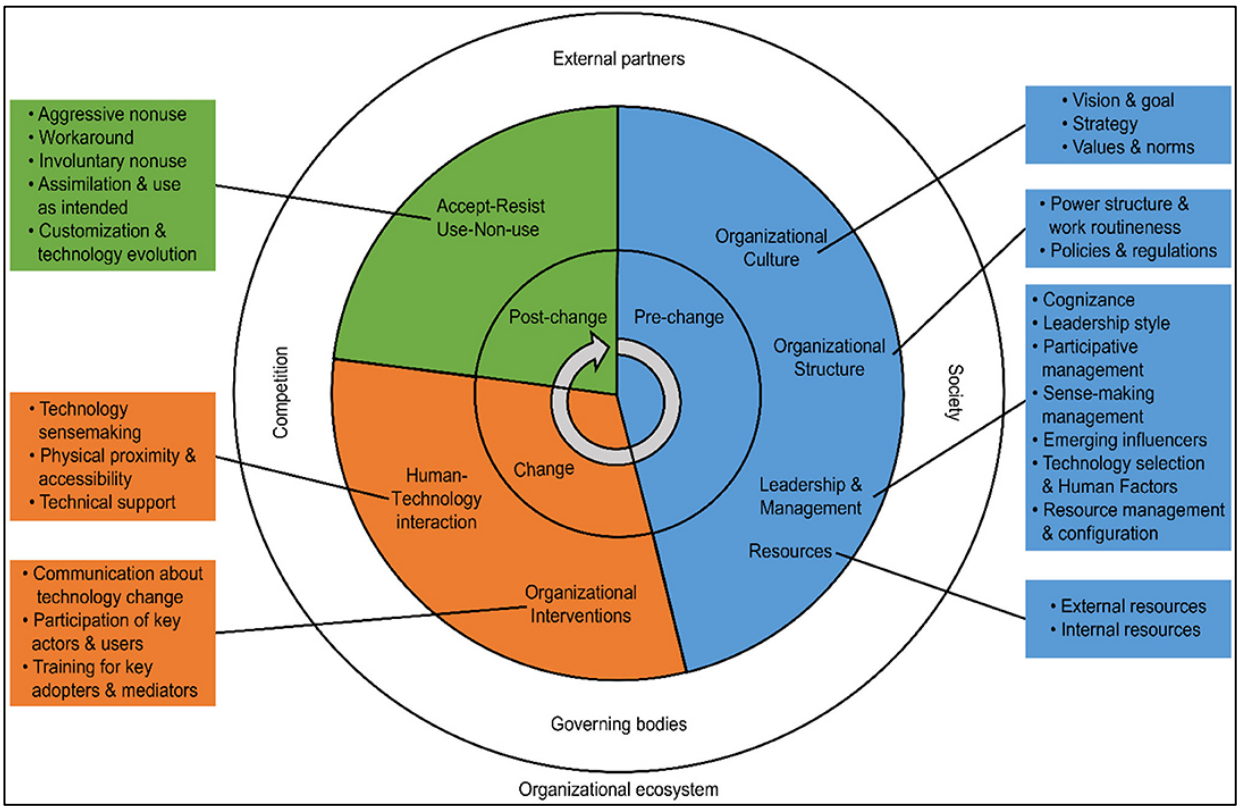


Figure 2-2: Different Stages of Technology Adoption in Organisation (Saghafian, Laumann and Skogstad, 2021)

According to Saghafian, Laumann and Skogstad (2021), the pre-change stage is the state of the organisation before the adoption of new technology that involves the organisation's culture, structure, leadership, and management style. At this stage, the organization must cultivate awareness, interest, evaluation, and commitment to lower the knowledge barrier that inhibits successful implementation of new technology (Fichman and Kemerer, 1997). In other words, at this stage, the management could shape and influence the attitude and behaviour of the employees towards the adoption of the new technology (Saghafian, Laumann and Skogstad (2021).

The second stage is the change process stage which involves organisational intervention such as communication of the technology change, participation of the key users, and training of individuals with the new technology (Saghafian, Laumann and Skogstad, 2021). In the healthcare industry scenario, this implementation stage

is where the nurses come into the picture – when they attend the training, understand the new technology and use it in their daily operations.

The third stage is the post-change or the outcome of the technology adoption where the organisation could assess whether the new technology was accepted successfully or whether resistance within the organization was strong (Saghafian, Laumann and Skogstad, 2021).

2.6 Types of Automation and AI in the Healthcare Industry

AI according to Shaheen (2021) is a critical enabler to simplify processes in healthcare and is used to develop intelligent healthcare systems to substantially improve the quality of life for patients. Davenport and Kalakota (2019) have identified AI technologies that are important to healthcare, and these are machine learning – neural networks and deep learning, natural language processing, rule-based expert systems, physical robots, and robotic process automation. These technologies are now being adopted by healthcare providers where the key categories of applications involve diagnosis and treatment recommendations, patient engagement and adherence, and administrative tasks (Davenport and Kalakota, 2019). Additionally, patient monitoring, clinical decision support, and healthcare intervention are also areas where AI is widely used (Reddy *et al.,* 2019).

2.6.1 Diagnosis and Treatment Recommendation

Although AI has existed for quite some time, the past decade has seen remarkable advances in the medical field such as for diagnosis, therapeutic and prognosis functions. Examples are in the hepatology area to detect tumor-causing hepatocellular carcinoma (Perez and Grande, 2020) and colorectal cancer (Yu and Helwig, 2022); neurodegenerative diseases (Myszczyska *et al.,* 2020) and many others. Google and other technology corporations have partnered with healthcare delivery systems to create predictive models from large data sets, to inform clinicians of the possible occurrence of conditions such as sepsis and heart failure (Davenport and Kalakota, 2019).

2.6.2 Administrative Tasks

AI and automation help healthcare professionals lessen administrative burdens and provide more time and direct care to patients. Reddy *et al*., (2019) provided examples such as the repetitive and routine task of patient data entry and automated review of laboratory data and imaging results. Another example is the implementation of the Electronic Health Records (EHR) system, however complex, is a huge digital transformation step for hospitals, pharmacies, general practitioners, and other healthcare providers away from paper-based medical records (Boonstra *et al.,* 2014). Integrating ML algorithms into EHR systems can assist healthcare professionals and administrators in obtaining accurate and context-relevant patient information (Reddy *et al.,* 2019).

2.6.3 Patient Monitoring

AI-enabled Remote Patient Monitoring (RPM) is transforming healthcare monitoring applications and helps the healthcare professional to monitor their patients due to its ability to learn, predict, and classify patients' behavior and vital signs and more importantly, detect early deterioration in patients' health through wearable devices and contact-based sensors (Shaik *et al.,* 2023). With the increasing number of health apps and the development of smartwatches and other wearable technology to monitor health, these devices will play a significant role in the future of healthcare delivery models from prevention to recovery of every patient (Jeddi and Bohr, 2020).

2.6.4 Clinical Decision Support

Clinical Decision Support Systems or CDSS, are designed to influence healthcare professional decision-making about specific patients at the point in time when these decisions are made to reduce medical mistakes and make healthcare more consistent and efficient (Reddy *et al.,* 2019). In general, CDSS involves three steps: gathering patient data, summarizing the data, and recommending a suitable course of action. Alerts, recollections, order sets, drug dosage calculations, care summary displays, and information retrieval systems at the point of care are all possible

components of CDSS (Ramgopal *et al.,* 2023). AI such as ML approaches, which employ algorithms that make use of statistical techniques to learn useful patterns from data, may be combined with data science (DS). The resulting artificial intelligence-based CDSS (AI-CDSS) may enable prediction performance to identify patients with a higher or lower risk of contracting a disease, experiencing a clinical deterioration, or who may benefit from a certain management approach (Ramgopal *et al.,* 2023).

2.6.5 Healthcare Intervention

AI and automation are both helping health interventions customise to the specific needs of individuals or sub-group of populations like elderlies for example. The biggest utilisation of robots in healthcare is in elderly care. Some of the present gaps in the care of the elderly have been filled by robotic assistants, who can also remind them of routine tasks and guide them through unfamiliar situations (Reddy *et al.,* 2019).

2.6.6 Electronic Drug Prescription

Another automation implemented in the healthcare industry in recent years is the Electronic Prescribing System (EPS). Electronic prescribing, now adopted and widely used worldwide, is the “direct computer-to-computer transmission of electronic prescriptions, (e-prescriptions) from the prescriber’s office to the community pharmacies” (Tobaiqy, *et al*., 2023). In the study conducted by Zadeh and Trembley (2015), the top five main benefits of e-prescription are (1) reduction in medication error rate, (2) saving healthcare cost, (3) improving healthcare quality and patient safety, (4) facilitating coordination of care with other providers and (5) cutting pharmacy cost through reduced redundancy. These findings were similar to the study conducted by Porterfield, Engelbert and Coustasse (2014).

2.7 Challenges and Implication of Automation and AI in Healthcare

Although there are many benefits of automation and AI in healthcare, there are also drawbacks. Shaheen (2021) and Shah and Chircu (2018), both came up with major challenges of AI in the healthcare industry that require necessary further development –

(1) data may reflect inherent biases and disparities; (2) incorrect data in the system which will result to patient damage or can cause other health-care issues; (3) concerns about security, data privacy, and protection; (4) data collection and management and; (5) system efficacy and safety. Furthermore, automation and digitalisation require a high level of cyber security (Blahušiaková, 2023) and involve high costs (Porterfield, Engelbert and Coustasse, 2014).

Aside from the challenges faced by the organisations before, during and post-implementation of automation and AI in the healthcare industry, there are also implications for the healthcare workforce. Concerns about the substantial displacement of the workforce will be a potential result of the adoption of AI and automation in the healthcare sector (Davenport and Kalakota, 2019). However, Shaheen (2021) argued that it would take a significant amount of time before AI replaces humans for a wide range of medical jobs including the nurses.

2.8 Conclusion and Conceptual Framework

Through the review of peer-reviewed scholarly journals, the author found that BPA and AI in healthcare is an emerging field with great potential in the future of healthcare delivery. Digital transformation in the healthcare sector is inevitable and employees are one of the biggest factors in the success of digital transformation. Therefore it is critical to focus on employees' performance throughout the transformation process.

Figure 2-3 shown below provides the visual representation of the author's conceptual framework for this study. The conceptual framework, as defined by Saunder, Lewis and Thornhill (2023), is the outline of theories and ideas of the research project while Caffrey (2023) defines it as the exact description of the author's primary theories.

For this study, the independent variable (IV) identified, which is the variable that is being manipulated to measure its impact (Saunder, Lewis and Thornhill, 2023), is the adoption of BPA and AI, while the dependent variable (DV), defined as the observed outcome (Saunder, Lewis and Thornhill, 2023), is the employee performance of nurses. Other influencing variables are also identified by the author. The moderating variables are the

attitude and behavior of nurses towards the adoption of BPA and AI in their workplace, and the nurses' perceived usefulness of BPA and AI. These variables will examine how individual differences in attitude and behaviour and the perceived usefulness of nurses may influence the relationship between the adoption of BPA and AI and the employee performance of nurses. Moderating variables influence the nature of the relationship between the IV and the DV while the mediating variables are variables in between the IV and DV that transmit the effects between the two. (Saunder, Lewis and Thornhill, 2023). The mediating variables identified are the tenure of the nurses and the training experiences of nurses. These variables may explain the impact of the adoption of BPA and AI on the employee performance of nurses.

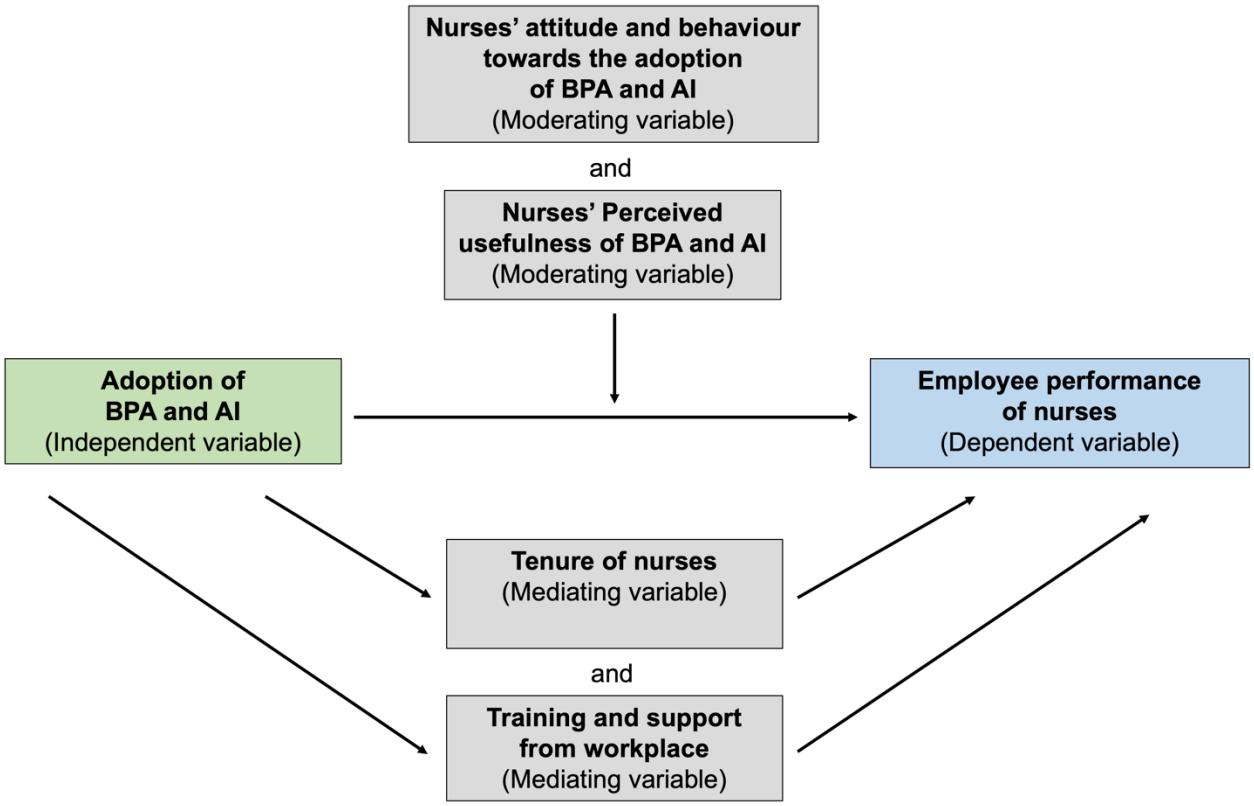


Figure 2-3: Author's Conceptualisation (2024)

Chapter 3: Research Questions and Objectives

Based on the review of the literature and the author's conceptualisation, this section discusses the three main objectives of this study, the research questions, and the corresponding hypotheses.

3.1 Research Objectives and Questions

The author aims to statistically measure the impact of the adoption of BPA and AI on the employee performance of nurses in the healthcare industry. This study has three main objectives. The first objective is to determine whether the adoption of BPA and AI has a significant impact on nurses' employee performance and if so, in which direction would it go – positive or negative? The author seeks to find out what the attitude and behaviour of nurses are in the adoption of BPA and AI in their workplace. In addition, the author wants to determine if BPA and AI contribute to nurses' success i.e. enhance their patient care, improve their efficiency so that they could attend to more patients, ease their workload, and decrease their stress. With this objective, the following is the first research question.

> **Research Question 1:** Does the adoption of BPA and AI impact the employee performance of nurses in the healthcare industry?

The second objective is to determine whether the tenure or length of employment of a nurse affects his/her perceived usefulness of BPA and AI in his/her workplace. The author seeks to find out if nurses who have worked for over 15 years perceive the adoption of BPA and AI in their workplace as less useful. Therefore, the second research question is below.

> **Research Question 2:** Does the tenure of a nurse affect his/her perceived usefulness of the BPA and AI adoption?

Lastly, the third objective is to determine the relationship between the perceived extent of training and support and the nurses' perceived usefulness of BPA and AI. The author aims to evaluate if the training experience of nurses is a factor for them to value the

adoption of BPA and AI in their workplace. Based on this objective, below is the third research question.

> **Research Question 3:** What is the nature of the relationship between the nurses' perceived extent of training and support and the nurses' perceived usefulness of BPA and AI adoption?

3.2 Research Hypotheses

In line with the research objectives stated above, the following hypotheses were formulated to guide the author in finding the answer to the three research questions.

> **Hypothesis 1 (H_1)**: The adoption of BPA and AI has a significant and positive relationship with the employee performance of nurses in the healthcare industry.

> **Hypothesis 2 (H_2):** The longer the tenure of a nurse, the lower the perceived usefulness of the usage of BPA and AI will be.

> **Hypothesis 3 (H_3):** Nurses with less perceived extent of training and support will have a more negative perception of the usage of BPA and AI.

Chapter 4: Research Methodology

This chapter provides the research methodology adopted for this study which includes the research philosophy, research design, research instrument, sampling method, mode of data collection, data analysis techniques used, the potential limitations of the study and the ethical considerations made.

4.1 Research Philosophy

Research philosophy, as Saunders, Lewis and Thornhill (2019) explain, is a set of beliefs and assumptions about developing knowledge in a particular field which could either be ontological or epistemological assumptions. Ontology are questions about the nature of reality while epistemology are questions that relate to knowledge and the validity of new knowledge generated from the research Quinlan, et. al. (2019).

The philosophy adopted for this study is epistemology using a positivist approach. In epistemology philosophy, positivists seek to discover the truth about the world using highly structured, large samples, and observable and measurable facts from which generalisations can be drawn about social reality (Saunders, Lewis and Thornhill, 2019). Moreover, the positivism approach that is often quantitative, according to Park, Konge and Artino (2020), relies on a deductive method that verifies previous hypotheses where functional relationships can be causal i.e. the impact of independent variables causes the result of the outcome to change. The functional relationship is being tested between the independent variables i.e. the adoption of BPA and AI and the dependent variable or outcome is the employee performance of nurses. Considering these factors, the philosophical frameworks fit the nature of this research project.

4.2 Research Design

The research design used in this research was based on a mono-method quantitative, deductive approach that made use of a survey strategy to collect data through an online questionnaire which resulted in the collection of standardized data. Due to time constraints, the time horizon used was the cross-sectional approach, instead of longitudinal, since the primary data collection occurred at a single point of time i.e.

'snapshot' (Saunders, Lewis and Thornhill, 2019). The experimental approach was not considered for this research as well because it would be difficult to set up a highly controlled environment for the sample as they are in different geographic locations.

The survey strategy was used by the author as it was more feasible to facilitate this study of a large population of nurses who are geographically scattered (Quinlan, et. al., 2019). In addition, a large amount of information was easier to be obtained. The deductive approach was selected for this study wherein the author started by developing hypotheses derived from the review of related literature, after which these hypotheses, as listed in Chapter 3, were tested.

The choice of this research design was further substantiated by Alobidyeen et. al., (2022) who conducted a similar research design to study digitalisation and its impact on employee performance in Greater Tafila Municipality which produced a successful data set. A similar research design was used by Chondough and Chondough (2022) who studied the relationship between AI and employee performance in the commercial banks in Nigeria. Hence, this was the approach selected by the author for this study.

4.3 Research Instrument

In line with the research approach, a structured, self-completion online questionnaire was used by the author to collect primary data. With this technique, the author was able to use standardised questions (Saunders, Lewis and Thornhill, 2019). Consequently, this resulted in the collection of standardised and consistent data. The survey questionnaire was composed of closed questions where possible responses were provided, and the respondents simply selected their answers by ticking the box from the multiple choices. Closed questions were used by the author as it is much easier to code and analyse the responses to this type of questions (Quinlan, et. al., 2019; Saunders, Lewis and Thornhill, 2019).

The questions were adopted from the peer-reviewed and published research by Homburg, Wieseke and Kuehnl (2010) which studied the social influence of co-workers and superiors during the implementation of salesforce automation applications and the

adoption of salespeople. Although this study did not focus on employee performance, the questionnaire itself was focused on perceived usefulness, attitude, behaviour and perceived extent of training which are all relevant to this study. In addition, using this previously validated and published questionnaire saved the author's time in formulating and validating the questionnaire.

The survey questionnaire was created through Google Forms where the link to the survey was sent to the target sample. There are in total of 18 multiple-choice questions that were divided into three sections and designed to understand the impact of the adoption of BPA and AI on the employee performance of nurses. The actual survey questionnaire sent to the respondents is shown in Appendix 1. Which has three sections.

In the first section, an introduction at the beginning of the survey was made available for the participants that provided an overview of the purpose and objectives of the research. It also briefly explained and provided examples of automation and AI in the healthcare industry so that the participants would better understand the survey questions. In addition, it also indicated that the responses of the participants will be treated with complete anonymity and confidentiality.

The second section was the participants' consent to participate in this study and confirmation that their current role is a staff nurse (questions 1 and 2). This is important as the study focuses on the nurses only.

The third section is composed of five subsections. The first one is from questions 3 to 5 where the respondents were asked about their gender, tenure of employment as a nurse, and their current work location. These items defined the study sample characteristics and demographics. The second subsection is where the respondents were asked about their personal attitudes and behaviour towards the adoption of BPA and AI in their hospital/clinic (questions 6 and 7). These items measured the BPA and AI adoption of nurses. The third subsection, from questions 8 to 10, measured the nurses' perceived usefulness of BPA and AI while the fourth subsection, from questions 11 to 14, measured the employee performance of nurses using BPA and AI. Finally, the fifth subsection which

is from questions 15 to 18, measured the respondents' perceived extent of training and support provided by their hospital/clinic cocerning the adoption of BPA and AI.

The author made use of the Likert Scale of 6 options with a value of 6 denoting "Strongly agree" and "Strongly disagree" which is represented by 1. These were used from questions 8 to 18 to measure the positive or negative attitude of the respondent towards each question. Likert scale, developed by Rensis Likert, is a widely used scale to measure the direction and force of attitude (Quinlan, 2011).

4.4 Research Population and Sample

Non-probability sampling, particularly the snowball technique was used by the author to identify the sample for this study since the research methodology required a large number of participants in a limited period. Non-probability sampling, as Quinlan *et al*., (2019) explain, is a technique in which the sample is selected based on the author's personal judgement and convenience and is selected to represent a population, however, cannot be considered as the representative of the population.

Hence, for this research, the sample selected were friends and acquaintances of the author who are nurses by profession. The target sample size for this study is one hundred (100) nursing professionals employed in various geographic locations such as Ireland, Philippines, United Kingdom (UK), United Arab Emirates (UAE), and United States of America (USA). The sample size decision was based on the study by Egbunike, Enemuo-Uzozie, and Anekwe (2020) who used eighty (80) staff from different banks in Anambra, Nigeria to understand the interrelationship between job automation, employee turnover and organisational performance. Based on this, the author of this study was convinced that the target sample size of 100 would be enough to understand the phenomenon being investigated.

The locations of nurses were selected only because the author personally knows nurses from these countries. To reach the target number of samples, the author engaged in the snowball technique. This is a non-probability sampling approach where the additional respondents were provided and identified by the initially identified respondents (Quinlan,

et al., 2019) such as their colleagues from the same hospital or their friends who are nurses from the same country.

4.5 Mode of Data Collection

Although time-consuming and labour-intensive to collect and analyse, the author opted to collect primary data instead of secondary data for three main reasons. One reason is that the author could easily gather relevant results as the survey questionnaire was tailored specifically based on the research questions and objectives. Another reason is that primary data can provide new, unique, and original results that could not be available from secondary sources. Lastly, secondary data sources i.e. data that are already available (Quinlan, *et al*, 2019), may not be relevant at the current time of this study especially since one variable being measured in this study is the impact of AI and automation which have been developing rapidly in recent years.

Primary data were collected via an online survey questionnaire on Google Forms because it is free to use, and it is easy to create a survey questionnaire without any coding experience. The link to the survey was distributed to the identified participants through the use of WhatsApp, Facebook Messenger, and Instagram Messenger. These social media were used by the author to easily reach the participants who are in different geographical locations and time zones. Furthermore, since it is an online survey, participants could easily access and complete the survey from any device, whether a mobile phone or a computer, anytime, anywhere with an internet connection.

In the creation of the online survey questionnaire on Google Forms, a few restrictions and response settings were implemented by the author. Firstly, every question was made mandatory to answer so that participants could not submit the survey by leaving a question unanswered; hence there will be no missing data. Secondly, the survey was restricted to be completed only once by each participant and response editing after being submitted is disabled. Thirdly, a copy of the participant's responses was automatically sent to their email for their reference after completing the survey for their reference. In addition, although a valid email was required and collected, the names of the participants were not collected to protect their privacy and to maintain anonymity.

The online survey was made live on 30th January 2024 and closed on 20th February 2024 which was 21 days or 3 weeks in total. The author sent a thank you email on 09th March 2024 to all the respondents who completed the survey as shown in Appendix 2. In the end, seventy responses out of the target sample size of one hundred were obtained, resulting in a 70% response rate.

4.6 Data Analysis

4.6.1 Statistical Software – IBM SPSS

To begin the data analysis, the author exported the responses from Google Forms into a .csv file which was then converted into an Excel format .xlsx. Afterwards, the author began coding the responses in numeric format according to the author's codebook as explained in chapter 4.6.2 below. The finalised Excel file was then exported to IBM Statistical Package for Social Scientists or SPSS, the statistical software used by the author to analyse the quantitative data gathered. The author also used the SPSS Survival Manual (Pallant, 2016) as a step-by-step guide to process the data analysis. The types of data that were gathered from the survey were categorical data such as nominal and ordinal and these were analysed through both descriptive and inferential statistics. Ordinal data has a ranking order whereas nominal data is categorised without intrinsic order and for identification purposes only (Quinlan, *et al*., 2019).

4.6.2 Author's Codebook

Table 4-1 below shows the codebook developed by the author for this study which is defined by Pallant (2016) as the summary of instruction that the author used to convert the responses from the survey into an SPSS-readable format. The first column in the codebook refers to the question number in the online survey questionnaire. The second column describes the variable which identifies each question in the online survey questionnaire while the third column refers to the abbreviated name of the variables in SPSS. The fourth column is the coding instruction which details how each response was coded and interpreted in SPSS. Lastly, the fifth column identifies the level of measurement of each variable.

As part of the data preparation, the author reverse-coded the variable "stress" (Q14) in SPSS as the question was negatively worded (Pallant, 2016). In their study, Homburg, Wieseke and Kuehnl (2010), the authors of the survey questions that served as the basis for this study, also reverse-coded this variable.

Table 4-1: Author's Codebook

Question Number	Variable Description	SPSS Variable Name	Coding Instruction	Measure-ment Level
N/A	Identification number	id	A number is assigned to each participant	Scale
Q3	Gender	gender	**1** = Male, **2** = Female	Nominal
Q4	How long have you been working as a nurse since the start of your career?	tenure	**1** = 0-11 months, **2** = 1-2 years, **3** = 3-5 years, **4** = 6-10 years, **5** = 11-15 years, **6** = Over 15 years	Ordinal
Q5	My current work location is	loc	**1** = Ireland, **2** = Philippines, **3** = UAE, **4** = UK, **5** = USA	Nominal
Q6	My personal attitude concerning AI and automation in my hospital/clinic is that its usage is	att	**1** = Unfavourable, **7** = Favourable	Ordinal
Q7	How would you best describe your behaviour in relation to the adoption of AI and automation in your hospital/clinic?	bhvr	**1** = I do not use the tools since I am afraid of making a mistake during my operation, **2** = I do not use the tools since I cannot benefit from its usage, **3** = I use the tools rather seldom, **4** = I use the tools most often in my operations, **5** = I use the tools as often as possible	Ordinal

Q8	The usage of AI and automation in my hospital/clinic enhances long-term patient satisfaction.	psat	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q9	The usage of AI and automation in my hospital/clinic enhances long-term patient loyalty.	ploy	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q10	The usage of AI and automation increases the profit of my hospital/clinic.	hprofit	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q11	The usage of AI and automation in my hospital/clinic makes me more efficient thus I can attend to more patients.	effncy	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q12	The usage of AI and automation in my hospital/clinic eases my workload.	wrkld	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q13	The usage of AI and automation in my hospital/clinic enhances my patient care.	pcare	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q14	The usage of AI and automation in my hospital/clinic increases the stress in my work.	stress (reverse coded = rcstress)	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal

Q15	During the implementation stage of AI and automation in my hospital/clinic, I was provided with detailed training.	dtraining	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q16	During the implementation stage of AI and automation in my hospital/clinic, I was regularly provided with advice and tips for its usage.	usetips	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q17	During the implementation stage of AI and automation in my hospital/clinic, I was provided with sufficient information by my company.	suffinfo	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Q18	During the implementation stage of AI and automation in my hospital/clinic, there has been the possibility of receiving adequate support in case of doubt.	adqtsupp	**1** = Strongly disagree, **2** = Disagree, **3** = Slightly disagree, **4** = Sightly agree, **5** = Agree, **6** = Strongly agree	Ordinal
Calculat-ed variables	Total perceived usefulness of BPA and AI calculated by adding psat, ploy, and hprofit (range between 6 to 18)	totalpercv use	High scores indicate a greater perceived usefulness	Scale
	Total perceived extent of training and support calculated by adding dtraining, usetips, suffinfo, and adqtsupp (range between 4 to 24)	totalpercv trng	High scores indicate a greater perceived extent of training and support	Scale

	Total employee performance of nurses calculated by adding effcncy, wrkld, pcare, and stress (range between 8 to 24)	totalep	High scores indicate a greater employee performance of nurses	Scale
	Total BPA and AI adoption of nurses calculated by adding att and bhvr (range between 4 to 12)	totaladoption	High scores indicate a greater adoption of nurses to BPA and AI	Scale

4.6.3 Descriptive Statistics

Descriptive statistics, according to Pallant (2016) is used to describe the characteristics of the sample, check the variables for any violation of the assumptions and to address specific research questions. For this study, the frequency and percentage analysis were used to summarise and describe the characteristics of the study sample such as their gender, tenure, and location. The same analysis was likewise used to describe the descriptive information of each variable in terms of the nurses' perceived usefulness of BPA and AI as well as the nurses' perceived extent of training and support with the adoption of BPA and AI in their workplace. Furthermore, the author also made use of histograms to assess the distribution of the responses specifically for the attitude and behaviour of nurses with the adoption of BPA and AI in their workplace.

Additionally, the author conducted Kolmogorov-Smirnov and Shapiro-Wilk tests to statistically test the normality of the distribution of the variables as this is an important assumption required to select the right statistics for this study. The calculated significance (Sig.) should be greater than 0.05 for the data to be considered normally distributed (Saunders, Lewis and Thornhill, 2019). The result from these two tests, as further discussed in chapter 5.5, revealed that the data are not normally distributed, hence the non-parametric statistic tests were chosen by the author.

4.6.4 Inferential Statistics

If descriptive statistics is used to describe, inferential statistics is used to predict and draw conclusions about the population (Quinlan, *et al*., 2019). For this study, inferential statistics was used to measure the reliability of the research instrument and to test the three hypotheses identified in Chapter 3.2.

The internal consistency and reliability of the research instrument were evaluated using Cronbach's alpha reliability coefficient for the scale used. The score must be above 0.70 to be considered reliable (Pallant, 2016). Reliability in research instruments, according to Saunder, Lewis and Thornhill (2023), means the consistency of the questionnaire to generate consistent results under different circumstances at various times. Validity, on the other hand, refers to the questionnaire of the author being a valid instrument for measuring the phenomena being studied (Quinlan, *et al*., 2019). For this study, since the author used a previously validated and published questionnaire, validation is no longer required.

In terms of the hypotheses testing, the author conducted three different tests. For the first hypothesis, the simple linear regression technique, sometimes referred to as ordinary least square (OLS) regression was conducted to understand the impact of the BPA and AI adoption on employee performance of nurses. The same approach was used by Egbunike, Enemuo-Uzozie, and Anekwe (2020) in their study that explored the interrelationship between job automation, employee turnover and organizational performance. Similarly, OLS regression was used by Homburg, Wieseke and Kuehnl (2010). Simple linear regression is a statistical test that seeks to understand the relationship between one IV and one DV, whereas multiple regression investigates the relationship of multiple variables at the same time (Saunder, Lewis and Thornhill, 2023). In this study, there is only one IV which is the BPA and AI adoption and one DV which is the employee performance of nurses; hence, the simple linear regression was suitable. To check the assumptions of the linear regression, the normal probability plot of the regression standardised residual and the scatterplot of standardised residuals were conducted as recommended by

Pallant (2016). To evaluate the model, an adjusted R square value was reported to show how much variance in employee performance is explained by the model. The statistical significance was evaluated using the F-statistic and the t-statistic and their corresponding *p* value which should be <.05 to be considered significant. This was the same analysis conducted by Egbunike, Enemuo-Uzozie, and Anekwe (2020).

Research question two or hypothesis two intended to explore the differences between the six tenure groups' perceptions of BPA and AI usefulness. Hence, the non-parametric Kruskal-Wallis test was conducted. Pallant (2016) stated that this test is used to compare the mean scores of a continuous variable for three or more groups. Kruskal-Wallis test was used by De Baetselier, *et al*. (2024) in their study to assess the differences between four educational levels in the inclusion of pharmaceutical care in the curricula of nurses. The Sig. (*p*) value was used to interpret the result which should be less than or equal to .05 to reach the significance level (Pallant, 2016). The Mann-Whitney U test is also used to compare groups in a study. However, it is used to compare only two different groups (Pallant, 2016). This is the reason why Kruskal-Wallis test was used in this present study instead of Mann-Whitney U test. The mean ranks and the box plot as suggested by Pallant (2016) were also analysed to compare the median scores of the different groups to provide further analysis and arrive at a conclusion.

For research question three, the author wanted to understand the nature of the relationship between the two continuous variables i.e. perceived extent of training and support and the perceived usefulness of BPA and AI. To statistically measure the relationship and to test the hypothesis, the non-parametric Spearman's rank order correlation (rho) was conducted. It is a technique used to explore the strength of relationship between two continuous variables (Pallant, 2016). The same technique was used by Bojnec, *et al*. (2019) in their study of Romanian consumer preferences that investigated the strength and direction of the relationship between the frequency of consumption of organic food and their willingness to pay. Their study explored the relationship of two variables which is similar to the third objective of this present study i.e. to explore the relationship between the perceived extent of training and support

and the perceived usefulness of BPA and AI. Hence, the author of this present study used the same statistical analysis. In addition, the scatterplot was initially analysed to check the shape and direction of the distribution of the two variables and to remove the outliers as recommended by Pallant (2016).

4.7 Limitations

The potential limitation of this study is that, although it is focused on one sector only which is healthcare, the study sample is from different geographical locations and the different views of the nurses and their perception of BPA and AI and its impact on their performance would depend on how the level digitalisation a particular location or workplace is. Their perception may also vary based on their workplace's current stage of adoption of BPA and AI.

Quinlan, *et al*., (2019), highlighted that it is critical to use the probability sampling method when using inferential statistics to minimise bias and to guarantee that the sample represents the population of the study. This is another methodology limitation of this study as the author employed a non-probability sampling method due to limitations on the number of participants available and lack of time. In addition, since the sampling for this study was done through a non-probability sampling method, the sample may not be representative of the whole nursing population.

4.8 Ethical Considerations

While conducting this study, several ethical considerations were carefully considered. Firstly, the author has completed and submitted the NCI Human Participants Ethical Review Form. Additionally, the author handled the data gathered following the General Data Protection Regulation (GDPR) (European Commission, 2016).

The sample selected for this study were all consenting adults, more than 18 years of age, working professionals, and were not part of any vulnerable or high-risk groups. A vulnerable population is defined by Quinlan, *et al* (2019) as a group of people who are somewhat vulnerable due to their age, social standing, and general condition of well-being. Referring to Appendix 1 at the beginning of the survey questionnaire, the objective

and purpose of this study were clearly stated as well as how the findings will be used. For the purpose of transparency and to comply with GDPR Article 12, should the participant request any information concerning the study, the author's email address was also provided.

Another ethical consideration was ensuring the participants' voluntary participation in the study. The participants were invited to participate without any form of coercion or pressure from the author or anyone to answer the survey. Full consent of the participants was obtained by the author, particularly in Section 2 of the survey questionnaire where they voluntarily ticked the *"I wish to participate in this research"* box. The participants had the right to discontinue at any point if they did not wish to participate or complete the survey.

The confidentiality and anonymity of the participants were likewise given paramount importance while conducting this study to protect the data privacy of the participants and following GDPR Article 5. The data collected in this study was only used for the purpose stated by the author. Although the author opted to collect the email addresses of the participants, the author removed this identifying information and replaced it with a unique participant ID during the data analysis. In addition, all the data collected were securely stored in a password-protected folder which was only accessible by the author. Furthermore, the author ensured that the survey questionnaire only contained questions related to the phenomena being investigated. The participants were not assessed on components that are irrelevant to this study.

In terms of writing the survey questionnaire, the author professionally formulated the questions by avoiding the use of any discriminatory, or unacceptable language that might offend the participants. Finally, to avoid plagiarism, the author properly cited and acknowledged the works of other authors that were used in any part of this study using the Harvard-style referencing system.

4.9 Section Conclusion

This study is grounded in the positivist philosophy of epistemology. Primary data for this study were gathered via an online survey questionnaire as part of the mono-method

quantitative, deductive approach. The questions were adopted from peer-reviewed published research by Homburg, Wieseke and Kuehnl (2010). The study sample size for this research is seventy nursing professionals, selected through the non-probability sampling method, particularly the snowball technique. The data was analysed using both descriptive and inferential statistics using IBM SPSS. The descriptive statistics used include histograms, frequencies and percentages while the inferential statistics used include the simple linear regression, the non-parametric Kruskal-Wallis test, and Spearman rank order correlation.

Chapter 5: Analysis and Findings

This chapter provides the results from the statistical analyses and findings on the data gathered including the characteristics of the study sample, missing data, reliability of the research instrument, descriptive information of the variables, testing for normality of the distribution and the hypotheses testing.

5.1 Characteristics of the Study Sample

Table 5-1 below shows the summary of the characteristics and demographic profile of the sample of this study. It is evident that 77.1% of the study sample is female and the remaining percentage of 22.9% (16) is male, giving a total of 70 respondents. The respondents' high level of experience is shown by the fact that almost half of the respondents or 45.7% of the study sample had been working as a nurse for more than 15 years, 24.3% worked between 11-15 years, 20% worked between 6-10 years, 7.1% worked between 3-5 years, 1.4% worked between 1-2 years and another 1.4% worked between 0-11 months. This indicates that they have experienced the transition of the healthcare sector to the digital era to some degree over the last 15 years. Being a qualified nurse also implies that they hold a bachelor's degree as a minimum and that they have the fundamental knowledge and capacity to answer the questionnaire. Lastly, in terms of the geographic location of the respondents, a huge percentage of 31.4% were from the UAE, 30% were from the UK, 17.1% from Ireland, 11.4% from the Philippines and the remaining 10% from the USA.

Table 5-1: The Characteristics of the Study Sample

	Characteristics	Frequency	Percent	Valid Percent
Gender	Male	16	22.9	22.9
	Female	54	77.1	77.1
	Total	70	100	100
Tenure	0-11 months	1	1.4	1.4
	1-2 years	1	1.4	1.4
	3-5 years	5	7.1	7.1
	6-10 years	14	20	20
	11-15 years	17	24.3	24.3
	Over 15 years	32	45.7	45.7

	Total	70	100	100
Location	Ireland	12	17.1	17.1
	Philippines	8	11.4	11.4
	United Arab Emirates	22	31.4	31.4
	United Kingdom	21	30	30
	United States of America	7	10	10
	Total	70	100	100

5.2 Reliability of the Research Instrument

The internal consistency test called Cronbach's Alpha, revealed an alpha coefficient value of 0.878 as shown in Table 5-2 below for 13 questions in the survey questionnaire which are items Q6 to Q18. Any value above 0.70 is acceptable, however, anything more than 0.80 is preferable (Pallant, 2016). Thus, this result indicates that the instrument used was considered highly reliable.

Table 5-2: Reliability Statistics

Cronbach's Alpha	Number of Items
0.878	13

5.3 Missing Data

Since the author had made every question in the online survey a mandatory question, there was a total of seventy valid cases for this study which corresponds to the total number of respondents and there were no missing data points recorded, as shown in Table 5-3 below. This, therefore, negates the need for further coding in SPSS to account for non-responses.

Table 5-3: Case Processing Summary

Cases	Number	Percentage
Valid	70	100.0
Excluded	0	.0
Total	70	100.0

5.4 Descriptives of the Variables

The following is the descriptive information of the thirteen (13) variables from the survey questionnaire items Q8 to Q18 that were analysed through histograms, frequencies, and percentages. These variables were subdivided into four categories namely the nurses' adoption of BPA and AI, nurses' perceived usefulness of BPA and AI, employee performance of nurses, and nurses' perceived extent of training and support from their workplace.

5.4.1 Nurses' Adoption of BPA and AI – Their Attitude and Behaviour

The adoption of BPA and AI of nurses is measured by two variables: the attitude and behaviour of nurses. Figure 5-1 below describes the nurses' attitudes toward the adoption of BPA and AI. The author asked the respondents what their personal attitude towards the usage of BPA and AI in their workplace is and to provide a score between 1 to 7 with 1 being unfavourable and 7 being favourable. Referring to the histogram below, the distribution of the responses is evidently not a normal distribution which is defined by Pallant (2016) as a symmetrical bell-shaped curve with a peak in the middle and smaller frequencies towards both the left and right side of the graph. The results show that the greatest frequency of the scores is on the high-end or right-hand side of the graph. This type of distribution indicates that the majority of the nurses are in favour of BPA and AI usage in their workplace and that the resistance to the use of these tools is not significant.

Out of the 70 respondents, although there were 4 nurses (5.71%) who were not in favour of the usage of BPA and AI and answered "1", 2.86% answered "2" and another 2.86% answered "3", the results still suggest that the largest percentage of nurses are in favour of using BPA and AI in their workplace where 28.57% answered "7", 22.86% answered "6", 27.14% answered "5" and 10% answered "4".

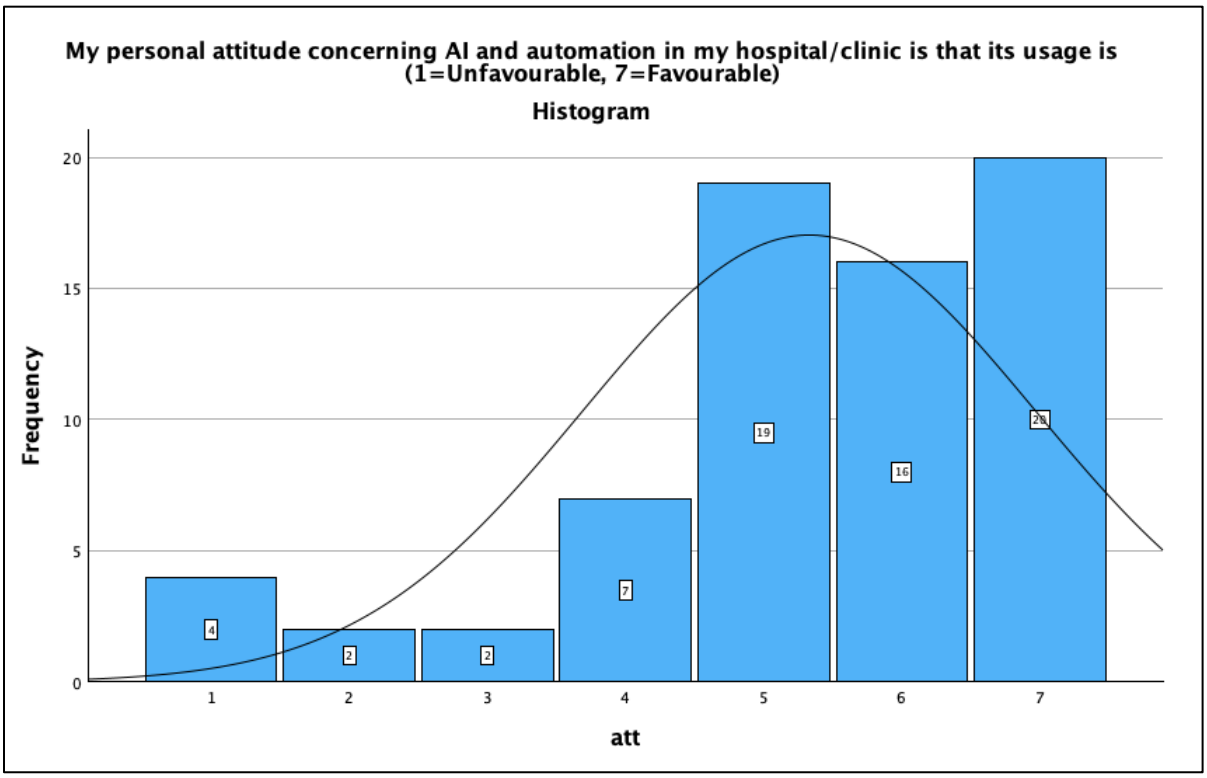


Figure 5-1: Histogram of Nurses' Attitude Towards Adoption of BPA and AI

Figure 5-2 below defines the nurses' behaviour towards the adoption of BPA and AI in their workplace with five different options. The author asked the respondents to describe their behaviour in relation to the adoption of BPA and AI in their workplace. Similarly to the variable attitude, the peak of the distribution of the responses is clustered on the right-hand side of the graph which implies that the nurses use the tools (BPA and AI) rather than not. In particular, almost half of the respondents (44.3%) use the tools as often as possible, 22 respondents (31.4%) use the tools most often in their operations, and 12 respondents (17.1%) use the tools rather seldom. These responses may imply that most nurses can adapt to the digital changes in their workplace hence they use the tools. There are a few of the respondents (5 nurses) who do not use the tools. Specifically, 3 of them (4.3% of the sample) do not use the tools because they are afraid of committing a mistake during their usage. This may be because the tools are in the initial phase of launching hence the nurses would need more time to practice. It could also mean that they may lack

training or need more training, therefore the confidence to use the tools is weak. The other 2 respondents (2.9% of the sample) do not use the tools because they perceive them as not beneficial to use. These are the nurses who are resistant to digital changes in their hospital or clinic and prefer to use the manual techniques that they were used to.

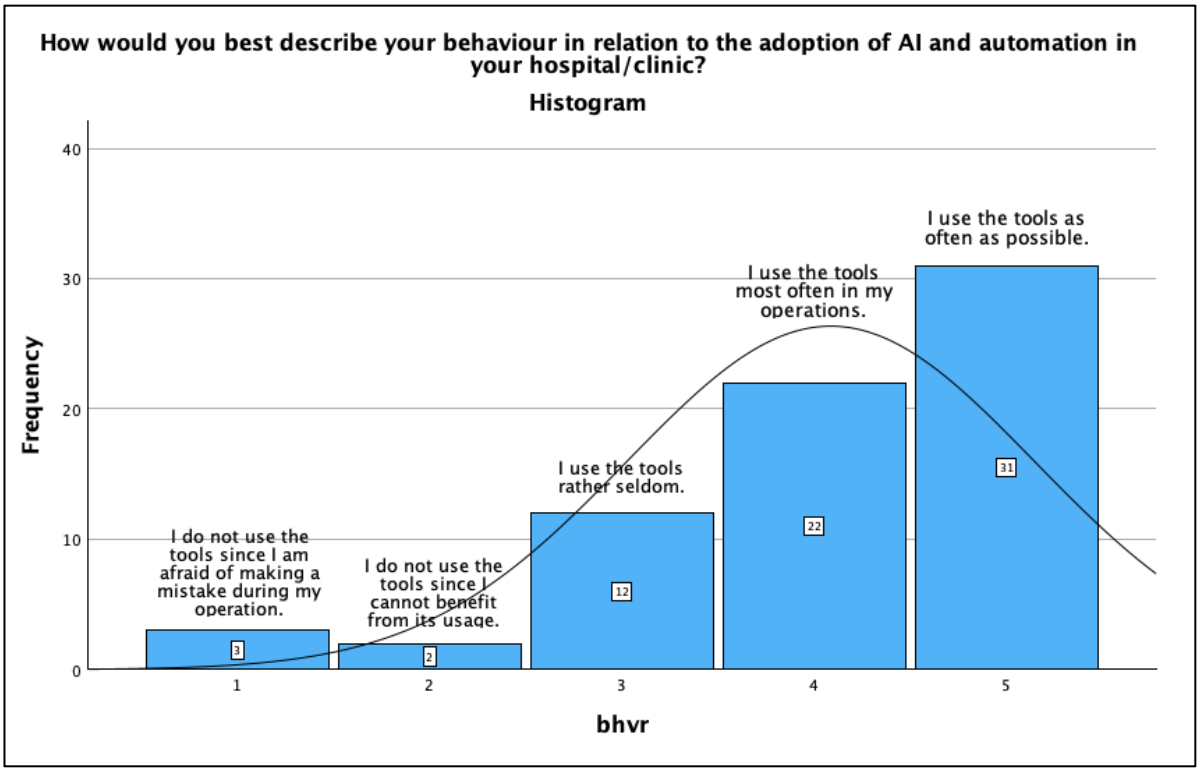


Figure 5-2: Nurses' Behaviour towards the Adoption of BPA and AI

5.4.2 Nurses' Perceived Usefulness of BPA and AI

There were three variables measured to understand the nurses' perceived usefulness of BPA and AI. The frequencies and percentages are summarised in Table 5-4 below. There were six options provided to the respondents for each question from Q8 to Q10 with 1 being "Strongly disagree", 2 being "Disagree", 3 being "Slightly disagree", 4 being "Slightly agree", 5 being "Agree", and 6 being "Strongly agree".

Table 5-4: Nurses' Perceived Usefulness of BPA and AI

Question Number	Variables	Strongly disagree		Disagree		Slightly disagree		Slightly agree		Agree		Strongly agree	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Q8	The usage of AI and automation in my hospital/ clinic enhances long-term patient satisfaction.	0	0.0%	2	2.9%	3	4.3%	11	15.7%	41	58.6%	13	18.6%
Q9	The usage of AI and automation in my hospital/ clinic enhances long-term patient loyalty.	0	0.0%	2	2.9%	6	8.6%	14	20.0%	39	55.7%	9	12.9%
Q10	The usage of AI and automation in my hospital/ clinic increases the profit of my hospital/clinic.	0	0.0%	1	1.4%	4	5.7%	11	15.7%	39	55.7%	15	21.4%

Freq = Frequency; % = Percentage

The first variable measured is long-term patient satisfaction. The author asked the respondents whether the usage of BPA and AI enhances long-term patient satisfaction. 18.6% “strongly agreed”, 58.6% respondents “agreed”, and 15.7% “slightly agreed” that the usage of BPA and AI enhances patient satisfaction in their workplace. On the other hand, the percentage of respondents who disagreed was quite low – only 2.9% said they “disagreed” and 4.3% said they “slightly disagreed”. No one strongly disagreed with the statement. This therefore implies that most nurses believe that the usage of BPA and AI at their workplace enhances the long-term patients’ satisfaction.

The second variable is long-term patient loyalty. The author asked the respondents whether the usage of BPA and AI enhances long-term patient loyalty. The results showed that 12.9% “strongly agreed”, 55.7% of respondents “agreed” and 20% “slightly agreed” that the usage of BPA and AI enhances the long-term patient loyalty. In contrast, the percentage of respondents who disagreed was on the low end – only 2.9% said they ”disagreed” and 8.6% said they “slightly disagreed”. No one said they “strongly disagreed” with the statement. This suggests that the nurses perceive BPA and AI as significantly helpful in terms of ensuring clients’ repeat business in their hospital/clinic.

The last variable is the profit of the hospital or clinic. The author wanted to understand whether the nurses agree that the usage of BPA and AI increases the profit in their workplace. The results show that 21.4% “strongly agreed”, 55.7% “agreed”, and 15.7% “slightly agreed” that the usage of BPA and AI increases the profit of their hospital or clinic. A small percentage of 5.7% said they “slightly disagreed” and 1.4% “disagreed” with the statement. No respondents expressed a strong disagreement with the statement. This means that the nurses believe that BPA and AI has a favourable impact on the revenue of their workplace.

5.4.3 Employee Performance of Nurses

There were four variables measured to understand the employee performance of nurses with the adoption of BPA and AI. The frequencies and percentages are summarised in Table 5-5 below. There were six options provided to the respondents for each question from Q8 to Q10 with 1 being “Strongly disagree”, 2 being “Disagree”, 3 being “Slightly disagree”, 4 being “Slightly agree”, 5 being “Agree”, and 6 being “Strongly agree”.

The first variable is nurses’ efficiency. The author asked the respondents whether they believe that the usage of BPA and AI makes them more efficient in their job thus they can attend to more patients. The results showed that the biggest percentage of the respondents (54.3%) “agreed” while 20% expressed “strong agreement” and another 20% “slightly agreed” that the usage of BPA and AI makes them more efficient in their job. On the other hand, only 2.9% “slightly disagreed” and another 2.9% “disagreed” with the statement. There was no strong disagreement expressed. This result indicates that the usage of BPA and AI helps nurses perform their jobs more efficiently.

The next variable measured is nurses’ workload. The author asked the respondents if the usage of BPA and AI in their workplace eases their workload. Based on the results, 21.4% said that they “strongly agreed”, while more than half of the sample (55.7%) “agreed” and 20% said that they “slightly agreed” that the usage of BPA and AI eases their workload. Conversely, only 1.4% “slightly disagreed” and another 1.4% “disagreed” with the statement. No strong disagreement was recorded. This finding infers that the nurses’ workload is reduced and that the usage of BPA and AI lightens the workload of nurses in their daily operations.

The third variable measured is nurses’ patient care. The author asked the respondents whether they think that the usage of BPA and AI enhances their patient care. According to the findings, 15.7% “strongly agreed”, 60% “agreed” and 18.6% “slightly agreed” that the usage of BPA and AI enhances their patient care. On the other hand, the percentage of respondents who disagreed was quite low – only 4.3% said they “slightly disagreed” and 1.4% said that they “disagreed”. No one expressed

strong disagreement with the statement. This result means that the nurses, who give high priority to patient care as one of their KPIs, believe that the usage of BPA and AI in their workplace further improves their patient care.

The last variable measured is stress. The author asked the respondents whether the usage of BPA and AI in their workplace increases their stress at work. The results showed varied answers from the respondents. The biggest percentage of the respondents (31.4%) said that they “slightly disagreed” with the statement, followed by 24.3% who “disagreed” while only 2.9% showed “strong disagreement” with the statement. However, 22.9% “agreed”, 15.7% said they “slightly agreed” and 2.9% “strongly agreed” that the usage of BPA and AI adds stress to their work. In summary, 58.6% believe that the usage of BPA and AI decreases stress at work while 41.4% believe that the usage of these tools adds stress. The nurses who belong to 41.4% could be those who find difficulty in adjusting to the new systems at work hence giving them more stress.

Table 5-5: Employee Performance of Nurses

Question Number	Variables	Strongly disagree		Disagree		Slightly disagree		Slightly agree		Agree		Strongly agree	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Q11	The usage of AI and automation in my hospital / clinic makes me more efficient thus I can attend to more patients.	0	0.0%	2	2.9%	2	2.9%	14	20.0%	38	54.3%	14	20.0%
Q12	The usage of AI and automation in my hospital / clinic eases my workload.	0	0.0%	1	1.4%	1	1.4%	14	20.0%	39	55.7%	15	21.4%
Q13	The usage of AI and automation in my hospital / clinic enhances my patient care.	0	0.0%	1	1.4%	3	4.3%	13	18.6%	42	60.0%	11	15.7%
Q14	The usage of AI and automation in my hospital / clinic increases the stress in my work.	2	2.9%	17	24.3%	22	31.4%	11	15.7%	16	22.9%	2	2.9%

Freq = Frequency; % = Percentage

5.4.4 Nurses' Perceived Extent of Training and Support

Four variables were measured to understand the nurses' perceived extent of training and support during the BPA and AI implementation stage at their workplace. Frequencies and percentages were likewise used to interpret the data which is summarised in Table 5-6 below. There were also six options provided to the respondents for each question from Q15 to Q18 with 1 being "Strongly disagree", 2 being "Disagree", 3 being "Slightly disagree", 4 being "Slightly agree", 5 being "Agree", and 6 being "Strongly agree".

The first variable is the provision of detailed training. The author asked the respondents whether they were provided with detailed training during the implementation stage of BPA and AI. The biggest percentage of 48.6% "agreed" with the statement followed by 22.9% who "slightly agreed" and 18.6% who "strongly agreed". This means that their workplaces appreciate the vitality of training hence detailed training was provided. On the other hand, 4.3% "slightly disagreed", 2.9% "disagreed" and another 2.9% "strongly disagreed" with the statement. These are the nurses who experienced a lack of training from their hospital or clinic.

The second variable is the provision of regular advice and tips for the usage of BPA and AI. The author asked the respondents whether they were provided with regular advice and tips during the implementation stage of BPA and AI. 44.3% "agreed", 25.7% "slightly agreed and 20% expressed "strong agreement" with the statement. Aside from the detailed training they receive, they were provided with regular advice and tips for its usage. In contrast, 4.3% "slightly disagreed", 2.9% "disagreed" and another 2.9% "strongly disagreed" with the statement.

The third variable is the provision of sufficient information. The author asked the respondents whether they were provided with sufficient information during the implementation stage of BPA and AI. 55.7% "agreed" with the statement, 17.1% "slightly agreed" and 15.7% "strongly agreed". While 7.1% "disagreed", 2.9% "slightly disagreed" and 1.4% "strongly disagreed". This outcome implies that the hospital or

clinic of the large portion of nurses provides a satisfactory level of information as required by the nurses to operate the new systems.

The fourth variable is the provision of adequate support in case of doubts. The author asked the respondents whether they were provided with adequate support in case of doubts during the implementation stage of BPA and AI. The results showed that 58.6% said they “agreed”, 18.6% said they “strongly agreed” and 15.7% said they “slightly agreed”. Conversely, the percentage of respondents who disagreed was quite low – only 2.9% said they “disagreed”, another 2.9% said they “slightly disagreed” and 1.4% expressed “strong disagreement”.

Table 5-6: Nurses' Perceived Extent of Training and Support

Question Number	Variables	Strongly disagree		Disagree		Slightly disagree		Slightly agree		Agree		Strongly agree	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Q15	During the implementation stage of AI and automation in my hospital/clinic, I was provided with detailed training.	2	2.9%	2	2.9%	3	4.3%	16	22.9%	34	48.6%	13	18.6%
Q16	During the implementation stage of AI and automation in my hospital/clinic, I was regularly provided with advice and tips for its usage.	2	2.9%	2	2.9%	3	4.3%	18	25.7%	31	44.3%	14	20.0%
Q17	During the implementation stage of AI and automation in my hospital/clinic, I was provided with sufficient information by my company.	1	1.4%	5	7.1%	2	2.9%	12	17.1%	39	55.7%	11	15.7%
Q18	During the implementation stage of AI and automation in my hospital/clinic, there has been the possibility of receiving adequate support in case of doubt.	1	1.4%	2	2.9%	2	2.9%	11	15.7%	41	58.6%	13	18.6%

Freq = Frequency; % = Percentage

5.5 Testing of Normality of Distribution

Test for normality of distribution using the Kolmogorov-Smirnov (*D*) and Shapiro-Wilk (*W*) tests both revealed that the data of the variables tested as shown in Table 5-7 below are not normally distributed because the results all show statistical significance ($p < 0.05$). Hence, the null hypothesis, i.e. the data are not normally distributed, is accepted. Consequently, the non-parametric tests are the suitable approach for hypotheses testing since the data violated the assumption of normal distribution.

The first variable is the total perceived extent of training and support with D =.188, df = 70, p <.001; W = .856, df =70, p <.001. The second variable is the total perceived usefulness of BPA and AI with D = .207, df = 70, p <.001; W = .885, df = 70, p <.001. Next is the total employee performance of nurses using BPA and AI with D = .142, df = 70, p = .001; W = .953, df = 70, p = .010. Lastly, is the total BPA and AI adoption of nurses with D =.143, df = 70, p = .001; W = .902, df = 70, p <.001.

Table 5-7: Test of Normality Results

Variables	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total perceived extent of training and support	.188	70	<.001	.856	70	<.001
Total perceived usefulness of BPA and AI	.207	70	<.001	.885	70	<.001
Total employee performance of nurses using BPA and AI	.142	70	.001	.953	70	.010
Total BPA and AI adoption of nurses	.143	70	.001	.902	70	<.001

5.6 Hypotheses Testing

Hypothesis 1 (H_1): The adoption of BPA and AI has a significant and positive relationship with the employee performance of nurses in the healthcare industry.

The simple linear regression technique was conducted to understand the relationship between the IV i.e. BPA and AI adoption of nurses and the DV i.e. employee performance of nurses. However, before proceeding, the author must ensure that the assumption of

linear regressions is not violated by checking the normal probability plot of the regression standardised residuals and the scatterplot of standardised residuals to identify outliers. The normal probability plot referred to as Figure 5-3 below shows little but no major deviations from normality. According to Pallant (2016), the data points should lie along a straight diagonal line which can be observed in the below graph. Hence, the assumption that the probability plot of the regression standardised residuals is normal is not violated.

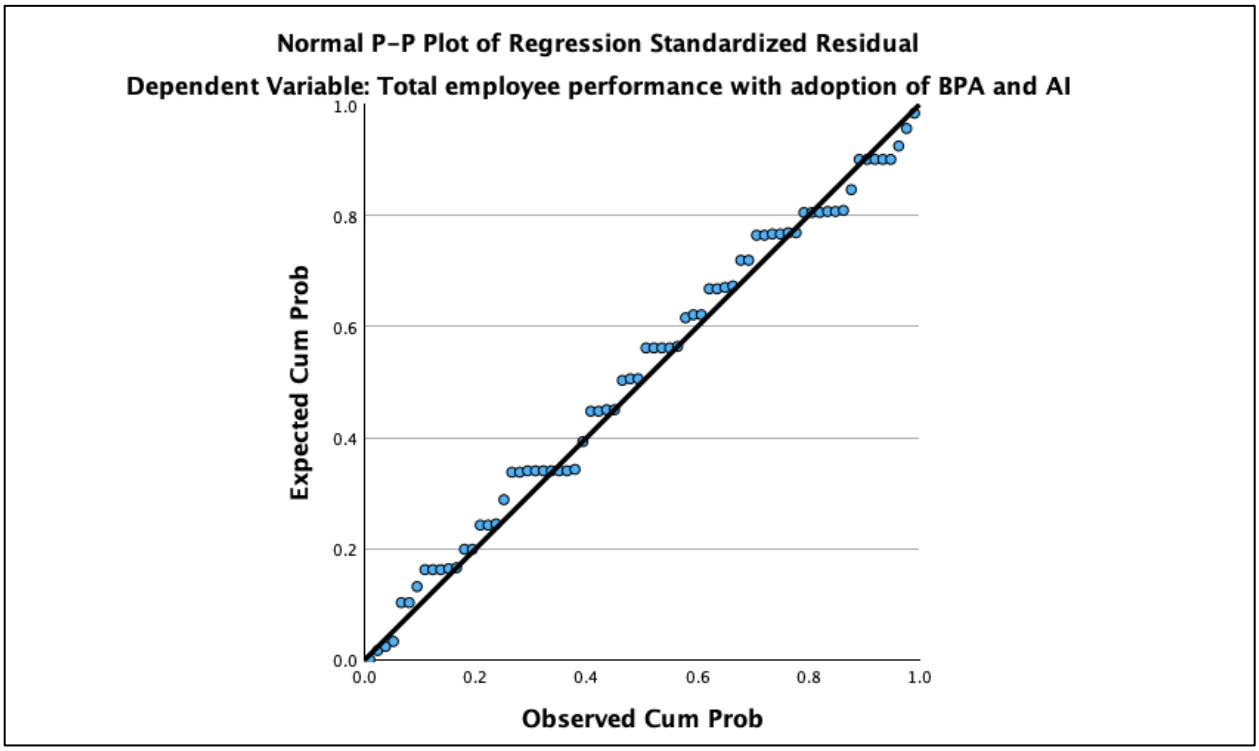


Figure 5-3: Normal Probability Plot of the Regression Standardised Residual

To identify outliers, the scatterplot of standardised residuals was checked as shown in Figure 5-4 below. The residuals should be distributed on a rectangular shape with scores concentrated along the 0 point and no data points should be more than 3.3 or less than -3.3 (Pallant, 2016). It is observed that case 57 is above 2 but not more than 3.3 while case 41 is less than -3.3; hence considered an outlier. Pallant (2016) stated that it is common to find outliers and finding a few is not an issue for large samples. However, the sample size for this study is not that large (n = 70) so the outlier can affect the result of the analysis; hence the author excluded case 41 from the analysis.

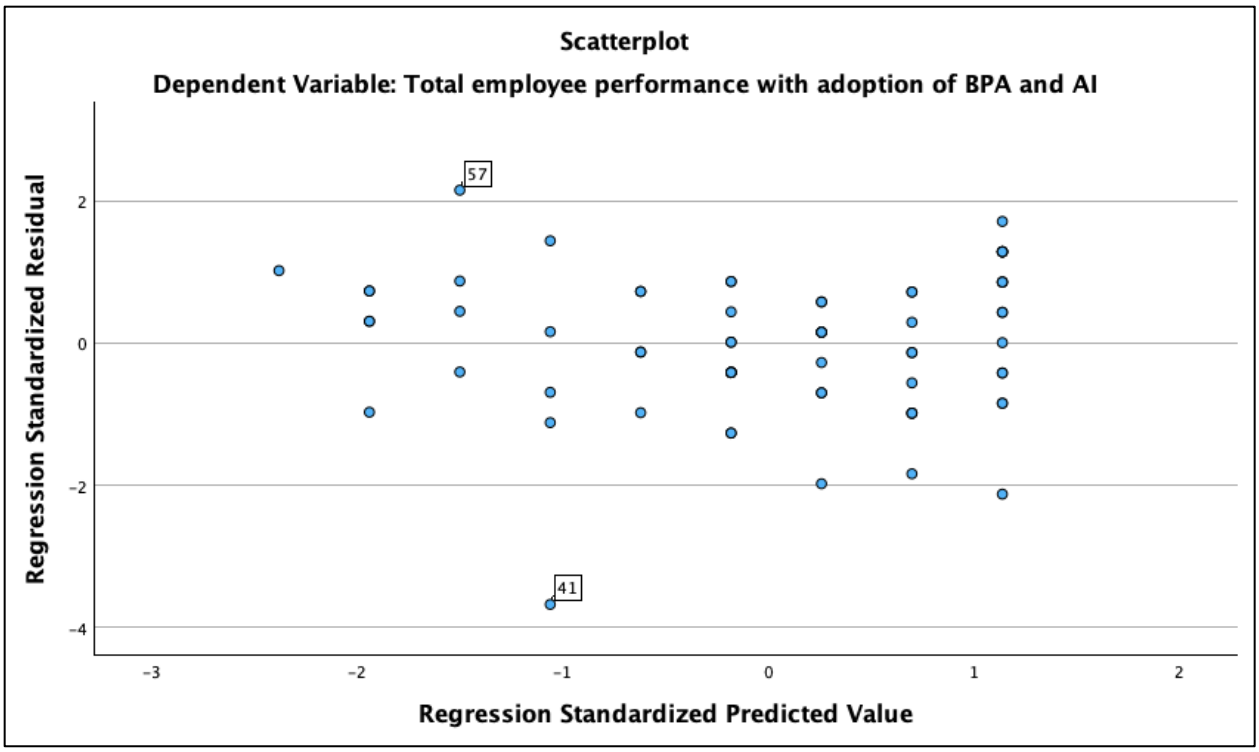


Figure 5-4: Scatterplot of Standardised Residuals

As shown in Table 5-8 below, the simple linear regression test showed an adjusted R squared value of .297. This means that the proportion of variance in the dependent variable (employee performance of nurses) explained by the independent variable (adoption of BPA and AI) is 29.7%. The F statistic revealed a value of 29.674, p <.001, where p is at the significance level; therefore, the hypothesis that all regression coefficients are zero is rejected. The t statistic of the adoption of BPA and AI of nurses is 5.447, p <.001, where p is again at the significance level; thus, the null hypothesis is rejected, and the alternate (H_1) is accepted. Therefore, the adoption of BPA and AI has a significant and positive impact on the employee performance of nurses.

Table 5-8: Linear Regression Result Showing Effect of the Adoption of BPA and AI on Nurses' Employee Performance

Adjusted R-Squared	.297
F-Statistic	29.674
Sig. (F-Statistic)	<.001
t-statistic	5.447
Sig. (t-Statistic)	<.001

Hypothesis 2 (H_2): The longer the tenure of a nurse, the lower the perceived usefulness of the usage of BPA and AI will be.

The Kruskal-Wallis test was conducted to explore the impact of nurses' tenure on their perceived usefulness, shown in Table 5-9 below. The categorical independent variable is the tenure of the nurses which has six categories: 0-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years, and over 15 years. The continuous dependent variable is the nurses' total perceived usefulness of BPA and AI. The result of the Kruskal-Wallis test revealed no significant difference in perceived usefulness score across the six tenure groups X^2 (5, n = 70) = 9.118, p = .104 which is greater than the significance level of .05.

Table 5-9: Kruskal-Wallis Test of the Six Tenure Groups

Total N	70
Test Statistic	9.118[a]
Degree Of Freedom	5
Asymptotic Sig. (2-sided test)	.104

An inspection of the mean ranks for the tenure groups as illustrated in Table 5-10 below suggests that the median score difference across the six tenure groups is quite small. Four groups have the highest median score of 15.00 i.e. 0-11 months (n = 1), 1-2 years (n = 1), 3-5 years (n = 5) and over 15 years (n = 32). While group 6-10 years (n = 14), has a median score of 14.50 and group 11-15 years (n = 17) has the lowest median score of 14.00.

Table 5-10: Median of Nurses' Total Perceived Usefulness by Tenure

Tenure	N	Median
0-11 months	1	15.00
1-2 years	1	15.00
3-5 years	5	15.00
6-10 years	14	14.50
11-15 years	17	14.00
Over 15 years	32	15.00
Total	70	15.00

In addition, the boxplot as shown in Figure 5-5 below was also investigated for visual analysis and it shows the same median score for the first three groups i.e. 0-11 months, 1-2 years and 3-5 years and fluctuations are observed from tenure groups 6-10 years, 11-15 years to over 15 years.

This, therefore, concludes that the results from the Kruskal-Wallis test, mean ranks inspection and boxplot illustration all indicate that the tenure of the nurses has no impact on how they perceive the usefulness of BPA and AI in their workplace. Therefore, H_2 is not accepted.

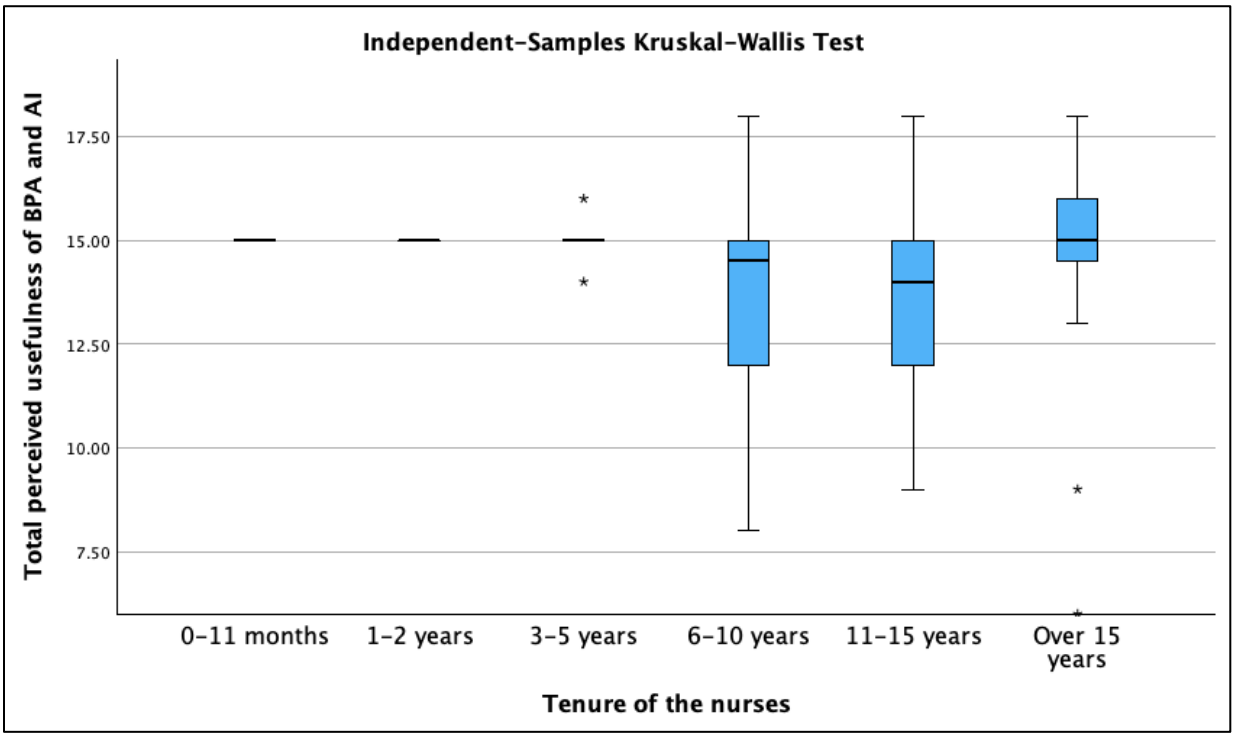


Figure 5-5: Boxplot of the Nurses' Total Perceived Usefulness by Tenure

Hypothesis 3 (H_3): Nurses with less perceived extent of training and support will have a more negative perception of BPA and AI usefulness.

Before calculating the Spearman rank order correlation, the scatterplot test was initially conducted to explore the relationship between the two continuous variables i.e. the nurses' total perceived extent of training and support and the nurses' total perceived usefulness as illustrated in Figure 5-6 below. Based on the scatterplot, the data points

formed a line pointing upwards from left to right which indicates that the two variables are positively related. In other words, when the total perceived extent of training and support of the nurses increased, so did the nurses' perceived usefulness of BPA and AI. The relationship between the two variables is also linear as evidenced by the straight line. There were, however, two extreme outliers observed in the scatterplot i.e. cases 22 and 70 which are labeled, and these were excluded from the analysis as Pallant (2016) recommended.

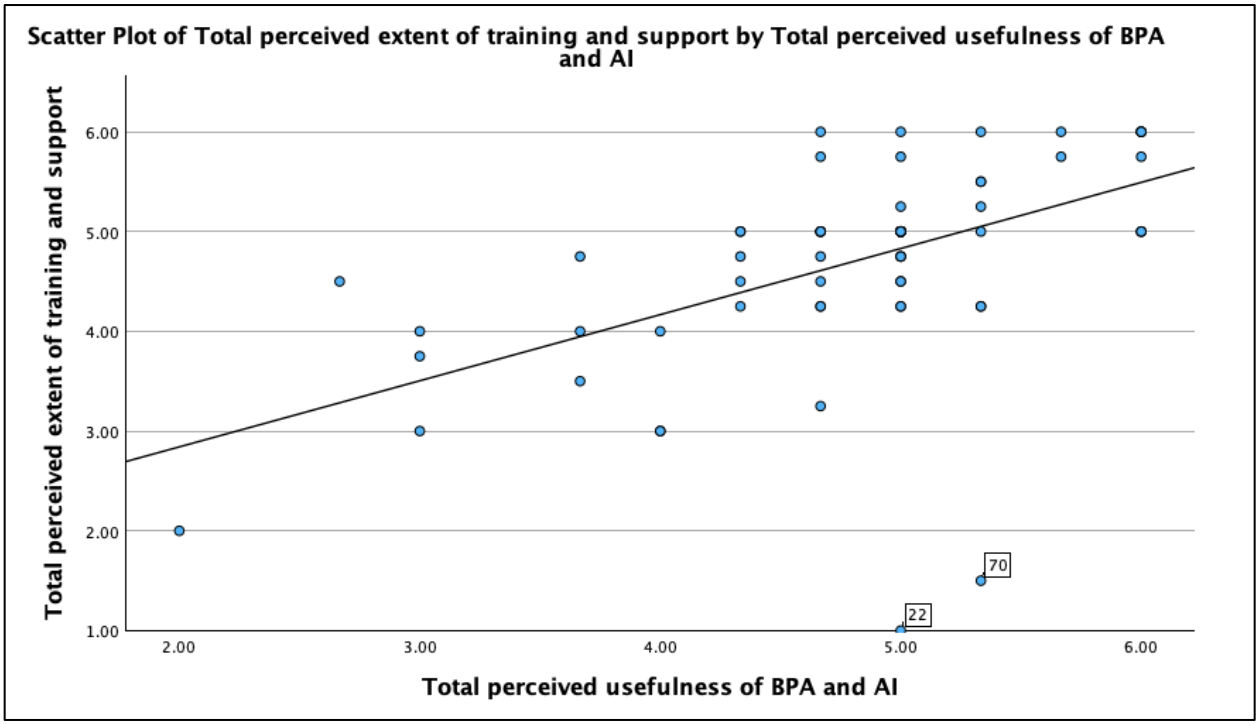


Figure 5-6: Scatterplot of Total Perceived Extent of Training and Support and Total Perceived Usefulness of BPA and AI

Since the scatterplot is not enough to conclude the relationship between these two variables, the non-parametric Spearman rank order correlation (rho) was conducted to arrive at the statistical conclusion. The result, as shown in Table 5-11 below, reveals a significant and positive correlation between the two variables, with *rho* = .666, *n* = 68, *p* < .001. This result concurs with the scatterplot analysis. Therefore, a high level of perceived extent of training and support of nurses is associated with a high level of nurses' perceived usefulness of BPA and AI. This also means that H_3 is correct and is accepted.

Table 5-11: Relationship between Total Perceived Extent of Training and Support and Total Perceived Usefulness of BPA and AI

Correlations				
			Total perceived usefulness of BPA and AI	Total perceived extent of training and support
Spearman's rho	Total perceived usefulness of BPA and AI	Correlation Coefficient	1.000	.666**
		Sig. (2-tailed)	.	<.001
		N	68	68
	Total perceived extent of training and support	Correlation Coefficient	.666**	1.000
		Sig. (2-tailed)	<.001	.
		N	68	68
**. Correlation is significant at the 0.01 level (2-tailed).				

Chapter 6: Discussion

The three main objectives of this study are to determine the impact of the adoption of BPA and AI on the employee performance of nurses, to determine whether the tenure of nurses influences their perceived usefulness of BPA and AI, and to determine the relationship between the nurses' perceived usefulness of BPA and AI and their perceived extent of training and support. This study provides knowledge and contribution not only to the healthcare literature but also to the human resources and business literature as it focuses on employee performance. It should be noted, however, as with any study, that this study has a few limitations. The first is that the study sample is from different geographical locations and the different perception of the nurses about BPA and AI and its impact on their performance would depend on their workplace's current stage and level of adoption of BPA and AI. Another methodology limitation of this study is that the sample may not be representative of the whole nursing population since a non-probability sampling method called the snowball technique, has been used due to limitations on the number of participants available and lack of time.

6.1 Discussion of the Results

Hypothesis 1

The first hypothesis of this study showed a significant positive relationship between the adoption of BPA and AI and the employee performance of nurses (p <.001). This outcome concurs with a previous study by Alobidyeen et. al., (2022) that showed that digitalisation has a positive and significant correlation with employee performance in Greater Tafila Municipality in Jordan, and another study by Chondough and Chondough (2022) that established a positive and significant correlation between AI and employee performance in the Commercial Banks in Nigeria. Although these two studies did not directly focus on BPA and the healthcare industry, they both studied the impact of the adoption of new technologies on employee performance which are both similar in concept to the present study.

The nurses' adoption of BPA and AI was measured by their attitude and behaviour. The results showed that, in terms of the nurses' attitude, a large percentage of nurses (78.57%) answered 5, 6 and 7 when they were asked to rate how favourable they find the adoption of BPA and AI, with 7 being the highest score. It means that the nurses are in favour of the adoption of these tools. This is because automation and AI simplify the processes in healthcare according to Shaheen (2021), which are widely used in diagnosis and treatment recommendations, patient engagement and adherence, and administrative tasks, according to Davenport and Kalakota (2019). As a result, the nurses perceive these tools as beneficial to their daily operations. As regards to the behaviour of nurses, the majority of the sample (44.3%) uses the tools as often as possible. This means that the nurses can adapt to these digital changes and use the tools.

The employee performance of nurses was measured through four variables – efficiency, workload, patient care and stress. Efficiency, as defined by Wynn (2023), is "the ability to use the organisation's resources in the best possible way, without wastage". The findings show that the majority of the nurses (54.3%) agree that because of the usage of BPA and AI, they are able to attend to more patients thus being more efficient at their job. In terms of the workload, the findings conclude that a large percentage of the sample (55.7%) agreed that their workload is reduced with the usage of BPA and AI. This result supports the findings of Ramachandran *et al.,* (2021) that the manual repetitive tasks are decreased because of automation and AI, easing the workload of the nurses. When it comes to patient care, 60% of the sample agree that the adoption of BPA and AI improves their patient care. This is an important finding as one of the major KPIs of nurses is to provide quality patient care to their clients as stated by Gray, McCance and Brown (2021). Patient care has a huge impact on patient experience and patient satisfaction which are both significant metrics in assessing the performance of a nurse and the success of the organisation as a whole. Lastly is stress variable. It is noted that despite the numerous advantages of these new technologies on employee performance, many nurses still feel stressed (41.5% of the sample). These are the nurses who answered "slightly agree", "agree" and "strongly agree" with the statement that "the usage of BPA and AI increases stress at work". This could be attributed to IT-related stress that Raitoharju (2005) concluded in his study which is also an important factor to consider during the adoption

of new technology in healthcare but is most often neglected by organisations. Raitoharju added that stress can affect the employee's job satisfaction and can create work disturbances. However, a bigger percentage of the sample (58.5%) believe that the usage of BPA and AI actually decreases their stress levels.

Hypothesis 2

The second hypothesis revealed that there is no significant difference (p = .104) in the perceived usefulness score across the six tenure groups of nurses from 0-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years and over 15 years. This outcome means that the employment tenure of nurses, whether they only started their career or have been in the industry for several years or more than 15 years, has no impact or influence on how they perceive the usefulness of BPA and AI. This, therefore rejected the alternate hypothesis (H_2) stating that the longer the tenure of a nurse, the lower the perceived usefulness of the usage of BPA and AI will be. However, this result, opposes the findings by Juris Bennett, Walston, and Al-Harbi (2015) concluding that healthcare employees in Middle Eastern hospitals with longer tenure have lower perceived usefulness of a tool called health information technology. It is noted that this previous study was conducted eight years ago in 2015 and automation and AI were not as widely used as they are today. Hence, the awareness of the benefits of automation and AI was lower. According to Statista (2023), the AI market share rapidly increased in the past years and will continue to increase in the next two decades. This could be the main reason why the result of this present study is different from that of the previous one. People are now becoming more aware of the benefits of automation and AI in the business world.

Examining the variables of the nurses' perceived usefulness of BPA and AI, it is found that all three variables – long-term patient satisfaction, long-term patient loyalty and hospital revenue, generated positive results in this present study. 58.6% of the sample agreed that the usage of BPA and AI enhances long-term patient satisfaction. This could be an indication that, with the help of BPA and AI, the nurses are able to meet or exceed the expectations of their patients. The core of any business is to ensure that the customers' needs are met at a minimum. Similarly, for healthcare, patient satisfaction

plays a crucial role in assessing the quality of healthcare services provided (Prakash, 2010). Long-term patient loyalty also achieved a high score in this study. 55.7% of the respondents agrees that the usage of BPA and AI enhances long-term patient loyalty. It means that the usage of BPA and AI is beneficial in increasing the likelihood of a patient returning to their care consistently in the future. Although customer satisfaction and loyalty are always linked to each other, Manzoor *et al.,* (2019) argued that satisfaction, although a strong motivator, does not always guarantee loyalty. Hence, orgaisations need to work on establishing good relationships with the clients to achieve the long-term goal of loyalty. In terms of hospital revenue, 55.7% of the sample agrees that the usage of BPA and AI increases hospital revenue. This positive result may justify the positive results of the previous two variables – patient satisfaction and patient loyalty. When patient experiences are positive, the profit of the hospital increases (Richter and Muhlestein, 2017).

Hypothesis 3

The result of the last hypothesis established a positive relationship between the perceived usefulness of BPA and AI and the perceived extent of training and support at the significance level ($p < .001$). It means that when the nurses' perceived extent of training and support is high, the nurses' perceived usefulness of BPA and AI is also high. Both variables move in the same direction. A similar result was obtained by Juris Bennett, Walston, and Al-Harbi (2015) concluding that the higher levels of training in healthcare employees had a significant positive relationship with perceived benefits of health information technology. These findings highlight the significance of providing effective training to employees especially when adopting new technologies.

For this present study, the perceived extent of training and support is measured by the hospital's provision of detailed training, provision of regular advice and tips for the usage of BPA and AI, provision of sufficient information, and provision of adequate support in case of doubts. The first variable focuses on the training while the other three pertain to the support the nurses received from their organisation during the adoption of BPA and AI. All four variables generated positive results. Approximately half of the respondents (48.6%) agrees that their hospital provides them with detailed training. Training is a crucial

organisational intervention in the second stage of TAM at the organisational level, which is the change process stage, to ensure that employees can adapt to the changing work environment (Saghafian, Laumann and Skogstad, 2021). This is important to achieve successful implementation of new technologies. According to Juris Bennett, Walston, and Al-Harbi (2015), a customised, specific training maximises the impactful perception of new technologies. Aside from training, another success factor that is essential during the implementation stage is the support from the organisation as highlighted by Dermol and Čater (2013). According to Homburg, Wieseke and Kuehnl (2010), support from the management and colleagues during digital changes, has a direct influence on the behaviour of the employees towards the usage of the new tools and how they adapt to the new technology. The provision of regular advice and tips for the usage of BPA and AI gained a positive result in this present study, as 44.3% of the sample agrees that they were provided with regular advice and tips. This kind of support from the management could potentially speed up the learning process and increase the confidence level to use the tools. The next variable is the provision of sufficient information which also had a positive result in this present study where 55.7% of the sample agrees that their organisation provides them sufficient information about the tools. User knowledge is another essential component to the successful implementation of a new system. To improve user knowledge, organisations can become creative in providing different learning styles which could be in the form of user manuals, guides, videos, etc. which could be made available for the nurses to learn the technology. The better the employees understand the system, how it operates and the benefits of its usage, the better its adoption will be. The last variable is the provision of adequate support in case of doubts which also attained a positive outcome in this present study. Majority of the respondents (58.6%) agree they were provided with adequte support in case of doubts. This result may mean that when the nurses require support during their operations (for example, they have questions and clarifications about handling, troubleshooting, etc.), their hospital or clinic provides the required support. Employees who are new to any technology may have lower confidence levels during operation and knowing that adequate support is available could alleviate the stress of employees when learning an unfamiliar technology.

6.2 Managerial Implications

The key finding of this study in terms of managerial relevance is that managers of contemporary healthcare organisations should definitely consider the adoption of BPA and AI. In fact, these tools enhance employee performance and help the company to achieve operational excellence. However, although these new technologies offer numerous advantages to employee performance, managers are advised not to overlook IT-related stress as this could affect the employees' performance negatively. Additionally, managers must also recognize the importance of providing detailed training as it is a crucial intervention to ensure that employees can adapt to the changing work environment. Finally, managers must also be aware that providing support to employees during the implementation stage of new systems can increase their perceived usefulness of the tools.

Chapter 7: Conclusion

The adoption of BPA and AI is becoming inevitable and is now the future of conducting businesses, particularly in healthcare. This study makes three contributions to employee performance research in the healthcare industry, especially after the COVID-19 pandemic.

First, the results of the statistical analyses carried out confirmed that the adoption of BPA and AI has a significant positive impact on the employee performance of nurses. The tools evidently enhance the nurses' overall performance at their job, particularly their efficiency level and patient care and reduce their workload and stress. Thus helping organisations achieve operational excellence by enhancing long-term patient satisfaction and long-term patient loyalty and boosting hospital revenue. Second, the employment tenure of nurses revealed no impact or influence on the nurses' perceived usefulness of BPA and AI. Whether they only started their career or have been in the industry for several years or more than 15 years, there is no statistically significant difference in the scores across the six tenure groups. This result may be different from past studies because of the rapid increase in automation and AI adoption in the last decade and the awareness of these technologies and the benefits they bring to the business are now higher. Third, the results provide evidence that the perceived usefulness of BPA and AI and the perceived extent of training and support have a significant positive relationship in this study. It means that when the nurses' perceived extent of training and support is high, the nurses' perceived usefulness of BPA and AI is also high. The provision of customised and specific training and the provision of support from the organisation to employees, during digital transformation are both paramount to ensuring that the employees are able to adapt to the changes.

It is concluded that managers of contemporary healthcare organisations should consider the adoption of BPA and AI because of the benefits they bring to the employees and the organisation as a whole. Managers must not overlook IT-related stress as this could affect the employees' performance negatively. Finally, managers must also recognize the

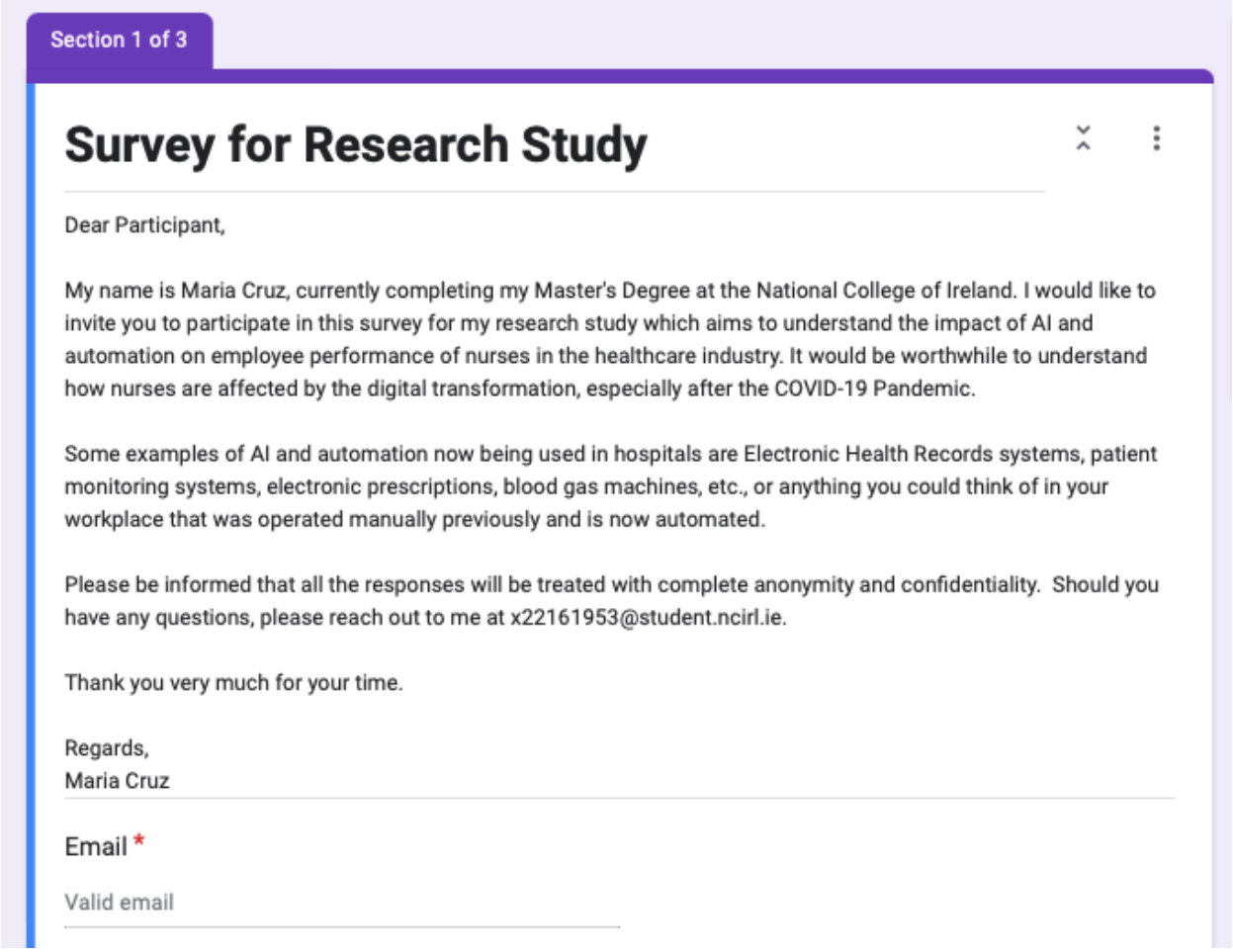
importance of providing training and support during the implementation stage of new systems to ensure that employees can adapt to the changing work environment.

This study opens up new possibilities for future research into the impacts and effects of digital changes, automation, and AI on employee performance in other industries. Doing similar future research in other sectors will provide more understanding of the similarities and differences with the outcome of this study especially with the rapidly growing adoption of automation and AI nowadays. It will be interesting to use a different research method such as the qualitative technique as this could provide more personal and new insights from employees that survey questionnaires are not able to capture.

The author recommends conducting future research on the relationship between the adoption of automation and AI and employee dismissal in the healthcare industry as this is now a concern and an obvious implication to employees in many other sectors. However, Shaheen (2021) argued that this is not the same case in the healthcare industry and that it would take a significant amount of time before AI replaces humans for a wide range of medical jobs. Therefore, it would be interesting to find out the outcome.

Appendices

Appendix 1: Survey Questionnaires from Google Forms



Section 1 of 3

Survey for Research Study

Dear Participant,

My name is Maria Cruz, currently completing my Master's Degree at the National College of Ireland. I would like to invite you to participate in this survey for my research study which aims to understand the impact of AI and automation on employee performance of nurses in the healthcare industry. It would be worthwhile to understand how nurses are affected by the digital transformation, especially after the COVID-19 Pandemic.

Some examples of AI and automation now being used in hospitals are Electronic Health Records systems, patient monitoring systems, electronic prescriptions, blood gas machines, etc., or anything you could think of in your workplace that was operated manually previously and is now automated.

Please be informed that all the responses will be treated with complete anonymity and confidentiality. Should you have any questions, please reach out to me at x22161953@student.ncirl.ie.

Thank you very much for your time.

Regards,
Maria Cruz

Email *

Valid email

Section 2 of 3

Participant Consent and Confirmation of Current Role

Description (optional)

1. Participant consent. *

- ○ I wish to participate in the research.

2. What is your current role in your hospital/clinic? *

- ○ Staff nurse

After section 2 Continue to next section

Section 3 of 3

Start of Survey

Description (optional)

3. Gender *

- ○ Male
- ○ Female

4. How long have you been working as a nurse since the start of your career? *

- 0-11 months
- 1-2 years
- 3-5 years
- 6-10 years
- 11-15 years
- Over 15 years

5. My current work location is *

- Ireland
- Philippines
- United Arab Emirates
- United Kingdom
- Unites States of America

6. My personal attitude concerning AI and automation in my hospital/clinic is that its usage is *

(1-Unfavourable, 7-Favourable).

- 1
- 2
- 3
- 4
- 5
- 6
- 7

7. How would you best describe your behaviour in relation to the adoption of AI and automation in your hospital/clinic? *

- I use the tools as often as possible.
- I use the tools most often in my operations.
- I use the tools rather seldom.
- I do not use the tools since I cannot benefit from its usage.
- I do not use the tools since I am afraid of making a mistake during my operation.

8. The usage of AI and automation in my hospital/clinic enhances long-term patient satisfaction. *

- ○ Strongly agree
- ○ Agree
- ○ Slightly agree
- ○ Slightly disagree
- ○ Disagree
- ○ Strongly disagree

9. The usage of AI and automation in my hospital/clinic enhances long-term patient loyalty. *

- ○ Strongly agree
- ○ Agree
- ○ Slightly agree
- ○ Slightly disagree
- ○ Disagree
- ○ Strongly disagree

10. The usage of AI and automation increases the profit of my hospital/clinic. *

- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

11. The usage of AI and automation in my hospital/clinic makes me more efficient thus I can attend to more patients. *

- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

12. The usage of AI and automation in my hospital/clinic eases my workload. *

- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

13. The usage of AI and automation in my hospital/clinic enhances my patient care. *

- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

14. The usage of AI and automation in my hospital/clinic increases the stress in my work. *

- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

15. During the implementation stage of AI and automation in my hospital/clinic, I was provided with detailed training. *

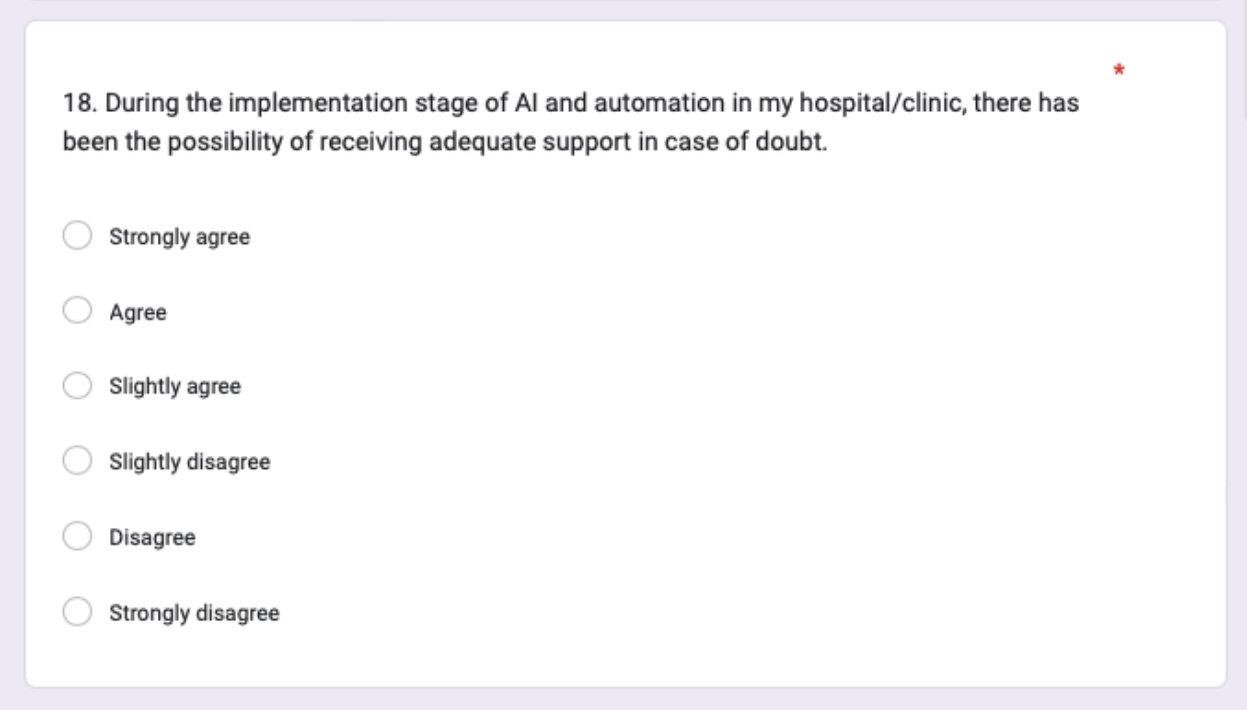
- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

16. During the implementation stage of AI and automation in my hospital/clinic, I was regularly provided with advice and tips for its usage. *

- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

17. During the implementation stage of AI and automation in my hospital/clinic, I was provided with sufficient information by my company. *

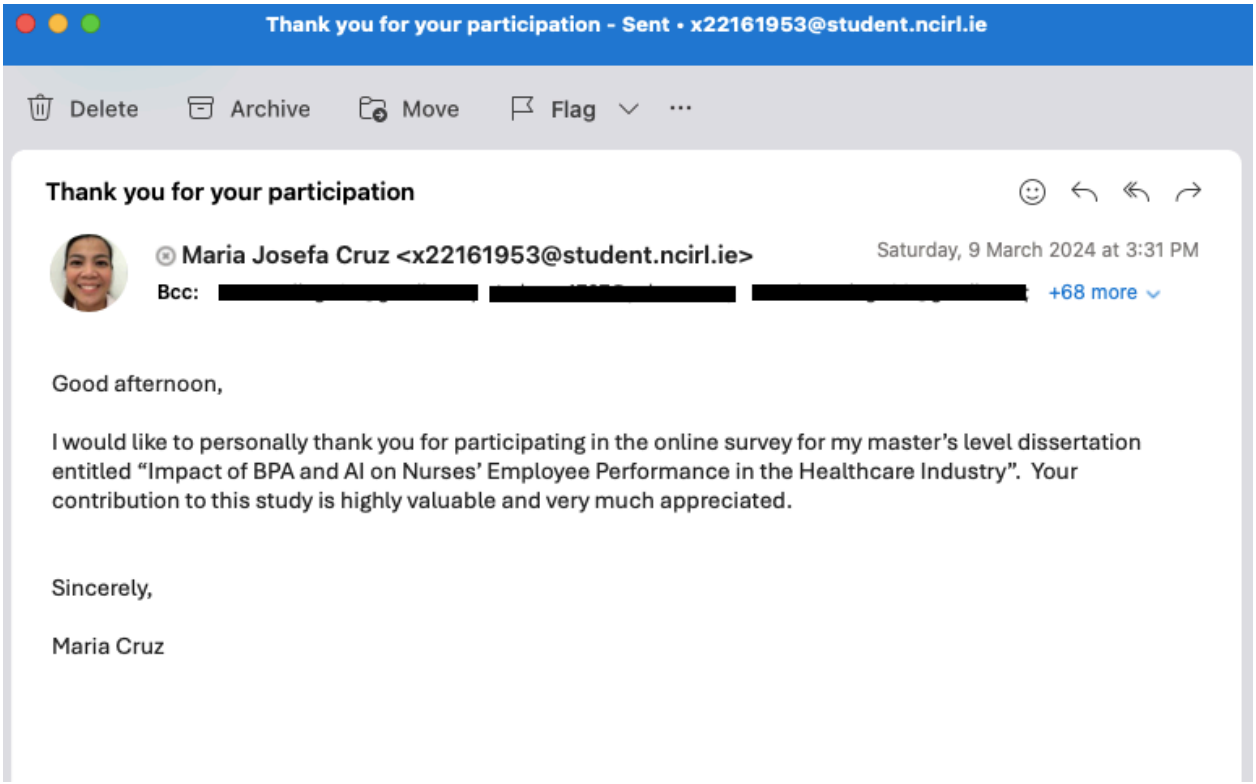
- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree



18. During the implementation stage of AI and automation in my hospital/clinic, there has been the possibility of receiving adequate support in case of doubt. *

- Strongly agree
- Agree
- Slightly agree
- Slightly disagree
- Disagree
- Strongly disagree

Appendix 2: Thank You E-mail to the Study Participants



Thank you for your participation - Sent • x22161953@student.ncirl.ie

Delete Archive Move Flag ···

Thank you for your participation

Maria Josefa Cruz <x22161953@student.ncirl.ie> Saturday, 9 March 2024 at 3:31 PM

Bcc: [redacted] +68 more

Good afternoon,

I would like to personally thank you for participating in the online survey for my master's level dissertation entitled "Impact of BPA and AI on Nurses' Employee Performance in the Healthcare Industry". Your contribution to this study is highly valuable and very much appreciated.

Sincerely,

Maria Cruz

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