Implementing New Technology in a Medical Facility

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Abstract

Technology in the healthcare industry continues to evolve which creates a learning curve amongst medical staff during implementation of new technology. The problem addressed is the identification of issues that learning curves may have on the implementation of new technology and identify guiding principles that consider the learning curves of employees which impacts medical staff and patients in various areas. The purpose of this qualitative study was to develop a standard or platform that accounted for and minimized the issues associated with the learning curves of employees. The conceptual framework for this study depicted the challenges, such as, finding the correct technology, analyzing the process, challenges with new technology, implementation processes, issues of implementation, and liability responsibility. The methodologies and design utilized in this research were qualitative research and triangulation with the use of semi-structured interviews and research articles. Seventeen participants from various medical facilities were asked thirteen questions during a one-hour recorded interview. Findings indicated there is a learning curve in medical facilities as it focused on the effects of moderating the effects of a learning curve, addressing issues to enhance efficiencies, and the importance of training and education to minimize liability. This study has shown the implications as an essential impact on the medical community and the importance of minimizing the learning curve to reduce liability. Recommendations for future practice would consist of obtaining feedback from staff, more repetitious training, and documentation of errors. Recommendations for future research would consist of studying specific medical groups, obtaining feedback from personnel, gather in depth knowledge about the software and its users, ethnography study of personnel to understand intricacies, and the exodus of premature departures due to new technology in the industry.

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Chapter 1: Introduction

The technology field is consistently evolving, and the medical field is frequently conducting research on improving patient healthcare (Harvey et al., 2018). The healthcare industry has encountered various challenges with remaining up to date with the latest software, such as policies, accreditation guidelines, testing, training, education, and financial issues. However, there are guidelines that must be followed and criteria for executing modern technology from manual to electronic filing and transitioning from old to new equipment. The workflow processes are geared to increase the productivity and improvement of patient care in the medical facility. These processes may have a learning curve for employees and patients; therefore, it is imperative for management and leadership to assure that everyone is trained and educated on the processes before implementation. Stakeholders must consider the financial investment before executing new software while considering costs of software, equipment, training, and education for both the employees and patients.

Research has shown there are several stages before the 'Go Live' date for introduction of a program or new technology (Chou, Bry, & Comer, 2017; Daly, 2016; Johnson & Ehrenfeld, 2017; Larrison, et al., 2018). In the healthcare industry, stakeholders must assure that new processes and workflows are understood by every employee and that they are able to convey the information to other staff as well as patients. These processes must be tested in a staged environment to guarantee improved patient care, results, and efficiency upon receipt. Research has provided a step-by-step process for introducing new technology into a medical facility and determining the pros and cons for its implementation. This research will identify the various procedures for establishing technology in healthcare facilities and provide best practice recommendations for implementation.

Statement of the Problem

The problem to be addressed is the identification of issues that learning curves may have on the implementation of new technology with navigation of the system and identify guiding principles that consider the learning curves of employees. Medical staff and patients experience a learning curve when they lack knowledge of procedures, workflow processes, resources, and new technology that will aid in improving patient healthcare (Ansari et al., 2016; Sturman, Tan & Turner, 2017). It is imperative to educate and create a development process for stakeholders through training and education to mitigate the possible adverse effects of learning curves in an organization (Gofton et al., 2016). Usually, there are multiple learning curves within an organization which means there can be a positive or negative outcome; therefore, stakeholders should understand optimization when introducing new technology to ensure development with minuscule risk to the patient (Gofton et al., 2016). Companies have created or implemented plans that will curtail intergenerational conflict by either hiring consultants, apply policies that contain goals which are designed to attract and retain different generations, and effectuate intergenerational mentoring (Williams, 2016). However, the process for implementing or introducing new software in the medical industry and whether the same process will work for another medical facility is unknown. This transition in the workplace will impact the patients because medical staff must be able to navigate in the system by inputting or retrieving patient results in a timely manner for improved healthcare with the intent of obtaining medical information even during a time of crisis to save lives. Further research would consist of the best way to train employees on new technology either through documentation via PowerPoint, simulation, or utilization of consultants (Macer & Wilson, 2017).

Purpose of the Study

The purpose of this qualitative case study was to recognize the concerns when implementing new technology and develop a standard or platform that accounted for and minimized the issues associated with the learning curves of employees. The instruments that were used to conduct this research and collect data were interviews of 17 medical employees from various healthcare facilities. Information that was obtained from managers who were implementing or had implemented new technology in their facility gave guidance and awareness on strategies to better train employees when implementing new workflow processes in each facility located in the Knoxville, Tennessee area. This study was conducted in a medical facility with the intent to expand globally in the future and compare the implementation process. This study ascertained the information needed to execute new technology, the implementation process, the limitations, the accuracy of implementation, and whether the results for implementation were successful.

The outline for this study was to determine the implementation process for new technology at a medical facility that accounts for different learning curves of employees. Golnari and his colleagues (2016) wrote about errors that were accruing amongst technologists due to lack of training and education. Management began to bring in consultants that would administer educational courses to employees to discuss the errors in which they were occurring daily (Golnari et al., 2016). The medical facility added definitions and reference sheets that would give employees information concerning the various errors and equip them with information about the software and workstations in which they utilized daily (Golnari et al., 2016). Employees can become more engaged in learning the information through e-learning which means the information will always be accessible and would help employees become

computer savvy, motivated, flexible, independent, and competent in learning (Hosseini, 2013). This process by Golnari was not perfect and incurred issues from staff resisting change, but researchers believe there are future opportunities for improvement (Golnari et al., 2016).

Conceptual Framework

The qualitative conceptual framework in Figure 1 below depicts the issues in which learning curves have on the implementation of new technology. This study revealed the problems and opportunities in a medical facility during the implementation process. This approach displayed the complex areas due to the learning curve in the facility amongst employees and communicating this new information to patients. The compound areas are interconnected with the following perspectives: precise technology, analyzing the process, challenges with new technology, implementation process, and liability responsibility. Knowledge of these perspectives is essential to the safety of patients when considering implementing new technology. New technology may be introduced to a medical facility because it is the latest product on the market; therefore, stakeholders may feel obligated to implement new technology without considering the learning curve for the facility (Griffin, 2016). This study delineated the processes for implementation, intricacies of execution, and liabilities as it pertains to the learning curve amongst employees.
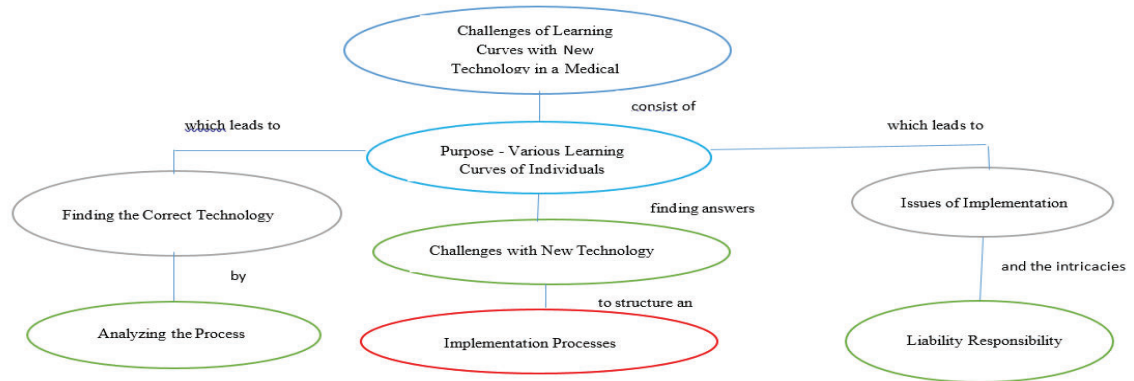
Figure 1. Learning Curve Framework

Learning Curves in a medical facility can be challenging when introducing new technology. The health industry is continuously faced with evolving technology in which stakeholders must ensure employees have received training and education to use the product accurately and efficiently. Learning curves are inevitable because of new technology and devices that are introduced into the medical industry for patient improvement (Jackson, 2015). Learning curves can be experienced on every level in a facility, from administrative to professional careers, which indicates that employees can experience issues with inputting information into new technology and the physicians may experience issues with retrieving results on patients for proper care (Jackson, 2015). There is a learning curve that will affect every person, such as stakeholders, employees, and patients, in a medical facility when new technology is implemented.

The medical industry is continuously challenged with embracing new technology and steered to believe various technologies will improve patient care. The medical facility must guarantee that the technology in which they are introducing to the facility is the correct technology. However, stakeholders must ensure that the new technology is safe to use for all parties involved. If the technology is not intuitive, then stakeholders will need to ensure that

employees and physicians have been trained and educated on the product (Batt-Rawden, Björk, & Waaler, 2017). Research of new technology is ensuring that it is effectively approved and established by the facility (Batt-Rawden, Björk, & Waaler, 2017).

Once the facility has agreed upon the new technology, then the process must be analyzed for introducing the product within the facility. The stakeholders must investigate the learning curve with the product amongst employees and the means to curtail errors. The analyzation process would consist of constructing a plan that will review resources, impact on staff, assuring goals and objectives are met, setting criteria for training and supervision, and assuring regulatory standards are met (Furci & Furci, 2014). This stage is important because it forecasts any issues and ensures a quality product is safe before introducing it to the medical staff (Furci & Fruci, 2014).

The challenges when implementing technology can be very intricate if stakeholders have not had the proper training or if they lack cognitive skills. Once a product has been chosen, and the processes have been analyzed, then the stakeholders must consider the intricacies, for instance, learning curves amongst staff, training, education, finance, consultants, and a 'Go-Live' date. Sometimes challenges can detour or delay the process for various reasons, for instance, the medical facility may have anticipated the learning curve to be less of an issue; however, it can present a problem for employees. Learning curves amongst staff can present safety issues for patients if the employees are not knowledgeable with the effective use of the product (Govindarajulu et al., 2017). Stakeholders can avoid some challenges if they confront and address any issues before implementation.

The process of implementing new technology can be tedious. Learning curves amongst the staff must be considered during implementation. The stakeholders must assure employees

have received training and will be continuously educated on version updates, access to a contact person or consultant for questions, simulation or mock trial before the 'Go Live' date, meeting with staff members to inform them of the product, and answering questions that will lead to successful use during patient care. This stage of the process is to ensure data is accessible to employees, planning, communication, integration of software, and testing which is essential before final implementation of new technology (Friedman, 2017).

Medical facilities may have various issues during the implementation process, such as malfunctioning software or miscommunication. However, one significant concern in which the facility should consider is the learning curve. This issue spreads across all age groups within the facility; however, there is no set timeframe for employees to overcome their learning curve (Matsen, 2014). Management will need to ensure that staffing is trained and educated with access to technical support to assure that there is assistance when issues are prevalent. This issue is not quarantined to a specific age group, but it affects every age group. Some employees may not embrace change and would preferably utilize technology that is familiarly promoting 'work around processes' to compensate for the lack of implementing new technological procedures. It is the responsibility of management to ensure these issues are under control by communicating processes with employees.

Medical facilities can be held liable for errors when patient care has not improved. The lack of training and education with staff can be detrimental to patients, as well as the medical facility. Learning curves can present an issue when employees do not possess the knowledge to use a product efficiently. The lack of efficiency can lead to patient harm or death. The hospital is held liable for any issues that may occur when utilizing a new product (Bal & Brenner, 2014).

It is imperative that the medical facility review all liabilities before full implementation of any product to avoid negative consequences or ramifications.

Nature of the Study

Qualitative methodology was chosen for this research to study the epistemology of a medical facility. This methodology captured the experiences of individuals, as well as, the impact on the facility which could later be compared to a quantitative study to display percentages of a success rate with the implementation of new technology (Butina, Campbell & Miller, 2015). The researcher gathered inductive information which will allow for flexibility. Quantitative methodology was not chosen because the research was not centered on finding 'how many' or 'how much' facilities are utilizing various forms of new technology or measuring the success rate of implementation. However, this qualitative research extended the horizon to mixed methodology research where the results from both the qualitative and quantitative research could be combined into one study.

The research designs that were utilized in this study are exploratory and descriptive research. This design was chosen because the implementation process and learning curve may vary amongst facilities; therefore, a conclusive design would not be as effective for this study. Due to the nature of this study, data was gathered during an interview process that was specific to this research that depicted procedures, intricacies, and liability (Jones & Smith, 2002). By interviewing individuals who had experienced a learning curve with the implementation of new technology, the researcher discovered this methodology was most efficient to gather evidence throughout the entire process.

Research Questions

The following research questions for this qualitative study were designed to collect information that could improve execution processes when introducing new technology and eventually expanding this process globally to ensure improved healthcare around the world.

Q1. How can medical facilities account for and moderate the effects of the learning curve of employees when implementing new technologies?

Q2. What strategies can be employed to proactively address the potential issues with the introduction of new technology to increase acceptance and utilization for enhanced efficiencies?

Q3. How does management implement training and education to avoid liability?

Significance of the Study

This qualitative case study was vital because it gave exposure to the intensity of learning curves and principles to implement technology that will aid in reducing liability to the medical industry. There are hidden learning curves which are not directly known to patients when staff is not fully aware of new devices. This area of uncertainty can be detrimental when a facility does not implement training and education to avoid encounters that will increase liability. This research was significant because it gave awareness not only to the issues of a learning curve but, it gave medical facilities options on counteracting the matter before it became a significant problem.

This case study allowed the researcher to obtain prolific amounts of advice, counsel, or both that produced ease amongst the stakeholders with revolutionary technology. Positive feedback will give other medical facilities the incentive to embrace, educate, retain knowledge, and compose processes that will be beneficial for all parties involved. It is imperative for the

health industry to remain abreast of new technology; however, training and education are critical to the success of employing new technology.

Definitions of Key Terms

National Health Service (NHS). The NHS is an organization which ensured healthcare was offered to all individuals regardless of their status (Naguleswaran, Tribedi, Fenn, & Patel, 2015; Newman, 2018).

Healthcare Technology Management (HTM). The HTM team is involved in ensuring medical staff has received the proper training before implementation of new technology (Logan, 2014).

Implementation. Implementation is the introduction of new devices, technologies, and techniques to medical staff and patients (Strong et al., 2014).

The Joint Commission (TJC). The TJC is an organization in which hospitals seek accreditation for improved patient care, risk management, and reduction of errors on a continuous basis (Wrzesniewski, 2017).

Learning Curve. Learning Curve is repetitive use of a product to improve knowledge, technique, capability, timing, and experience for performance improvement and stability (Ansari et al., 2016; Khan et al., 2014).

Summary

Learning curves of employees in a medical facility are an essential challenge when implementing new technology. Generally, change becomes the enemy in any industry because employees are unaware of expectations and do not possess the knowledge to utilize new technology efficiently. Learning curves need to be identified in a medical facility to ensure it adheres to regulatory standards and evade liabilities. The facility will need to understand the

learning curve amongst employees and implement effective training and simulation programs that will provide accessible information to employees for success. All medical facilities may not have the same scientific knowledge; therefore, the facility has to ensure the correct technology has been chosen for their specialty or according to its patients' care and needs. Stakeholders will have to analyze the process to forecast cost, proper planning, regulations, and training procedures for employees. During these procedures, stakeholders must consider the challenges that will present issues before the implementation process. Obstacles can consist of a learning curve, meeting guidelines, testing, contracts, and finances. These challenges can abort the process of implementation. The implementation process is vital because employees are introduced to the product, prepared for training, exposed to risks that may occur, alternative methods, and medical liability. It is pertinent for medical facilities to understand the learning curve amongst its employees and convey predominate principles for successful implementation.

Chapter 2: Literature Review

Research has shown technology is evolving in the health industry (Arni & Laddha, 2017).   The health industry has not been able to introduce the new technology fast enough for stakeholders, staff, and patients. Before introducing new technology into the workplace management must ensure the technology meets the guidelines for their facility, ensure it has been tested and approved by stakeholders, train all employees, and ensure patients are trained and educated (Harvey et al., 2018). However, the introductory phase is not easily embraced because of various reasons, such as, comfort, awareness, learning curve, time for training and education, and confidence in the product (Arni & Laddha, 2017). It is imperative for management to assure everyone is knowledgeable about the technology before moving forward with a 'Go Live' date (Friedman, 2017).

It is important that the facility chooses the correct technology to ensure it is not too challenging for stakeholders to comprehend, cost effective, safe for all users and patients, retrieves expected results and reports, and continuing education for technology upgrades. Choosing the wrong technology can be detrimental if it does not meet the need of the facility and individuals involved. The stakeholders must assess and evaluate the overall needs of the facilities, communicate with employees, and obtain views on improving processes in the workplace. Employees views should be considered and taken seriously before choosing new technology to ensure the new software or technology has the capabilities that are needed, if attainable.

Once the technology has been chosen it should be analyzed and presented to stakeholders to construct a plan and introduce the new software to users. Analytical views concerning the capabilities of the software should be discussed as well as the pros and cons. Viewpoints should

be expounded upon to ensure the software is affordable, competent to users, assesses the learning curve, evaluates improvement processes for workloads and patients, and assesses the long-term usage of the technology. Perceived issues should be communicated during this process from all involved participants to guarantee all voices and concerns have been heard on the current issues and an explanation of the new technology improving current issues. This information can be gathered utilizing surveys which will give stakeholders an approximate view of learning curve issues and unknown variables.

There are challenges with new technology when an old product will be integrated or replaced with a new product. These challenges can vary from employee resistance, cost, learning curves, non-technological savvy employees, government mandates, timing for implementation, training and education, and the incorrect product for the facility. Challenges will vary amongst medical facilities; however, there is a lesson learned in each process regardless of the variances. Assessing the bottlenecks and issues to decrease errors before implementation and production is a key element. If the facility's employees ages range from 18 to 70, then stakeholders may want to consider any issues that may evolve where some employees may not comprehend the new technology as fast as others (Williams, 2016). Another challenge might occur when the government has mandated all medical facilities to transfer all paper files to electronic files within a specific time causing additional strain to the facility due to lack of finances or the incapability's to train and educate employees within the given deadline.

The implementation process is very important, and communication is a key component to successful implementation. New software and technology should be tested with either a group of employees or via simulation. Participants should have access to rigorous training and consultants to ensure comprehension of the product and all its features. During this process staff

will be susceptible to errors but resolutions for inaccuracies and miscalculations will be prevalent for corrections. Errors which have occurred during this process should be observed and reviewed to see if the fault lies with the user or the technology. During this phase it is very important that everyone communicates any issue and processes going forward to reduce the learning curve before live production.

There are unknown issues with implementation that may arise which did not arise during the testing or simulation process. A learning curve during the implementation process can be an issue because users are not fully aware of the capabilities of the system and its features. Some employees may not be technologically savvy; therefore, the learning process for those individuals will be slower than others. Workloads during this time will present an issue for employees if they are trying to learn a new product while working with patients during busy days. Issues can arise during implementation, but stakeholders should have a consultant or help site in which an employee may contact for any issues or questions. Also, employees may not embrace change which will make the process of implementation more intricate because those users have not learned the effectiveness of the product. The issues amongst medical facilities will vary depending on the users, finances, software, cooperativeness, and needs.

The importance of learning the capabilities and features of the new product is essential to curbing the learning curve and reducing liability. It is the responsibility of the facility to ensure all employees are numerously trained on new products before contact with patients. Users should inform patients of the new technology before use to make them aware of new processes and improvements. The hospital is held liable for any errors that may occur during this process; therefore, it is important for staff to be trained and educated on the new product. Lack of

educational growth while technology continues to evolve in the industry can be deemed as detrimental to the patient, negative feedback for the facility, and lack of trust in the industry.

Each of the areas mentioned above depends on the other for successful implementation. In other words, the facility must research new technology to ensure it is appropriate for the organization and its needs. Second, examining the process of introducing new technology to stakeholders and the reasons for change is necessary. Third, the implementation team will discuss the challenges concerning new technology, such as, acceptance of change, learning curve amongst stakeholders, financial obligations, various testing and assisted simulation coaching, and informing all participants who will be affected by the new technology. Fourth, the implementation process will consist of the testing phase to ensure stakeholders understand the product and possess the knowledge for workaround processes in case unknown occurrences arise; communication is essential throughout the process. Finally, the organization must consider liability and responsibility. It is imperative for the medical facility to understand the weight of any errors and responsibility which may be derived from a learning curve because the facility will be held liable for actions.

Conceptual Framework

A learning curve has a significant impact on the implementation of new technology (Wenes, 2015). This conceptual framework as depicted in Figure 1, lists each component from the introductory process of new technology to the liabilities and responsibilities of new technology and the specific challenges presented by employee learning curves within the facility. Research has shown consistency in challenges presented by a learning curve amongst employees, staff, and stakeholders before and after implementation (Baig, Gholamhosseini & Connolly, 2015; Burnham et al., 2018; Jamtvedt et al., 2015).

Finding the correct technology for a medical facility is essential. Stakeholders should observe and listen to the concerns of employees and patients to understand needed enhancements for improved patient care. It is important for stakeholders to comprehend the needs and search for the technology that is feasible and useful for the comprehension of individuals. While considering innovation the stakeholders must contemplate the organizational structure and the milestones for implementation to ensure success (Cresswell, Bates & Sheikh, 2016). Stakeholders must ensure there is support both financially and educationally for employees to feel comfortable with new technology. A new innovation will introduce a learning curve to the organization and that characteristic must be adhered to determine the depthless of the learning curve (Cresswell, Bates & Sheikh, 2016).

The next component is to analyze the process of implementation. Stakeholders must examine, scrutinize, and evaluate the process of introducing new technology with a framework that will interchange data information across departments (Cresswell, Bates & Sheikh, 2016). Monitoring medical results and receiving feedback for quality assurance purposes is pertinent to avoid mistakes and erroneous results that would be deemed detrimental to the patient (Cresswell, Bates & Sheikh, 2016). During this stage the stakeholders can assess the learning curve of employees according to current processes. In other words, if the medical facility is introducing new software, then the facility needs to assess its infrastructure from transitioning from an archaic mode to an electronic mode (Cresswell, Bates & Sheikh, 2016).

The introduction to innovative technology can present challenges that will prevent or hinder the process of implementation. Challenges can range from nonconsensual disagreements on the new product, mandated government regulations, financial issues, learning curve of employees, lack of information on the product, timing for training and education, and resistance

to change (Heath, 2018; Mandeville et al., 2019; McCaman, 2016). Challenges with a learning

curve can intervene with set milestones and cause modification in the project. For instance, the

forecasted time for training and educating employees may be extended due to resistance or

incomprehensible learning of the product. However, if the product has been mandated by the

government or it has been introduced and implemented for improving patient care, then

stakeholders must take the necessary steps to ensure all individuals have access to knowledge to

reduce the learning curve and patient risks.

The implementation process is very tedious because it consists of training and

simulations to ensure employees have hands on experience with the new product. Employees

who have utilized the technology numerous times will become more familiar with its capabilities

and functionalities (Cresswell, Bates, & Sheikh, 2016; Rudin, Bates, & Calum, 2016).

Stakeholders have to consider patients in the process of implementation because the product will

affect each individual; however, employees comprehend the product in order to pass the

information onto the patient (Collier, 2017; Knepper et al., 2016). It is during this stage where

the learning curve will become more prevalent as employees began to use the product to improve

patient care.

Even though stakeholders may have properly planned to introduce the product, there may

be issues to confront. Some issues with implementation may be known or unknown. For

instance, stakeholders may not be prepared for troubleshooting when an issue or default becomes

prevalent in the new product. The organization may realize during the time of implementation

that they may need to upgrade or rewire to be effective and successful. An unknown issue like

this one can present a financial constraint for the organization (Knepper et al., 2016). Other

issues with implementation may be reliability of the product, security, efficiency, privacy,

quality of data, and a large learning curve (Baig, Gholamhosseini, & Connolly, 2015). Each of these aforementioned issues can reduce the quality of healthcare and increase the liability to the hospital. It is important for stakeholders to assess and confront the known issues with implementation and brainstorm with a committee to become proactive for possible implementation issues that will affect the overall product in the facility (Wu & Orlando, 2015).

The final component to this framework is liability responsibility which is very significant to the organization when there is an increased learning curve. For instance, the medical facility will be held liable for incompetency, erroneous errors, learning curves, and lack of knowledge amongst employees (Aydin et al., 2017; Griffin, 2016). A serious liability can be a security breach which is unacceptable for the facility. The facility must have protective measures in place to ensure secured controls with patient results, such as, encrypting private information, increased cyber security, and strict firewalls to avoid compromising data, computer viruses, and hackers (Kruse et al., 2017). Therefore, the medical facility can have multiple liabilities along with a learning curve which will present complex issues if proactive resolutions are not put in place. The learning curve can be just as serious as any other liability because it affects the lives of patients. It is pertinent for stakeholders to ensure patients feel protected and safe within the facility when new innovation is being introduced and used to guarantee quality patient care.

This framework relates to this study because it shows the challenges in which medical facilities must conquer. It is important to understand the serious nature of integrating or importing new technology without observing the learning curve amongst the users because it can lead to fatalities or permanent to severe harm to a patient. This study was able to expound on detailed experiences from facilities, possible setbacks, variances in processes for implementation, liabilities, identifying challenges, and minimizing harm in a medical facility.

The following components (as shown in Figure 1) are essential to understanding the challenges and reducing the learning curve in a medical facility: precise technology, analyzing the process, challenges with new technology, implementation process, and liability responsibility.

Learning Curves

Assessing the learning curve of employees before implementation as technology continues to evolve for improvement in medical, surgical, and administrative procedures is pertinent to avoid legal responsibility and to ensure employees are knowledgeable and experienced before application (Savoldelli, Chamorey, & Bettega, 2018). Learning is an essential and key mechanism for continuous productivity in healthcare. A learning curve is an integration of new processes/procedures conducted by medical staff (Gofton et al., 2016; Govindarajulu et al., 2017). It is the responsibility of the medical staff to ensure safety for its patients while embracing the learning curve with new technology (Gofton et al., 2016). The effect of learning curves has been recognized in the medical field when new technology is going to be introduced in the workplace (Jaffe et al., 2017; Reider, 2018). New technology should be analyzed beforehand to establish educational resources, length of time, simulation training, and a level of confidence to ensure safety to decrease the learning curve in the facility (Epaminondas, et al., 2018; Govindarajulu et al., 2017; Koedinger, Yudelson & Pavlik, 2016). Research has shown the learning curve has been observed through testing in medical facilities with new technology (Monnerat Lott et al., 2018; Sturman, Tan & Turner, 2017). Medical staff continues to work in teams to confront the learning curve as a positive aspect to improve patient care with minimal risk (Forbes, Mohamed & Raman, 2016).

The factors which may influence and impact a learning curve in the health industry are attitude, knowledge strengthening through training exercises, self-assurance, outcome of medical

procedures, medical device safety, and previous acquired skills related to experience (Abboudi et al., 2014; Gandaglia et al., 2016; Govindarajulu et al., 2017; Mazzon et al., 2017; Wiener et al., 2015). Understanding learning curves in the health industry is critical because learning development will increase productivity, increase performance, and reduce costs in the industry (Savoldelli, Chamorey, & Bettega, 2018). Oftentimes, it is believed that iteration will help improve the process and experience for the employee when utilizing a new product; however, this may not be valid depending on specific circumstances (Yeolekar & Yeolekar, 2015). A physician or surgeon may be utilizing a new technological product and may have a scanty experience with performance on the first patient; however, the physician or surgeon will have acquired more knowledge and proficiency after repetitious use while gaining more experience during performance when utilizing the same technology on the twenty-fifth patient which reduces risk to subsequent patients (Yeolekar & Yeolekar, 2015).

There can be a steep learning curve within the medical facility, depending on the intricacy of the technology. This complexity should be assessed to determine if staff will conduct repetitious and tedious trainings or utilize an educational tool for assistance in learning (Savoldelli, Chamorey, & Bettega, 2018; Yeolekar & Yeolekar, 2015). A medical facility can decrease the learning curve by assuring physicians, employees, and stakeholders have access to numerous videos, trainings, simulations, observations, and fellowships (Andolfi & Umanskiy, 2017; Yeolekar & Yeolekar, 2015). It is pertinent to derail the learning curve in medical facilities because it can have a critical impact on patient care, medical procedures, and safety (Govindarajulu et al., 2017).

A learning curve can be affected by the novice employee or physician as well as the experienced employee or physician. In other words, the medical facility should have trainings,

videos, and simulations in place so the novice physician can obtain knowledge and experience with the new technology (Andolfi & Umanskiy, 2017; Govindarajulu et al., 2017). The learning curve can be affected by the employees who retire or resign from the workplace; therefore, taking the knowledge and experience out the door. This exodus increases the learning curve in the facility making it vulnerable to mistakes and errors (Govindarajulu et al., 2017). It is imperative for medical facilities to warrant hands-on training, reviews, consultations, simulations, and etc. are consistently visited amongst staff to guarantee experience and knowledge with the product (Govindarajulu et al., 2017).

Simulation has proven to decrease the learning curve because it allows medical staff to practice with the new technology for numerous hours (Forbes, Mohamed & Raman, 2016). The environment during simulation allows staff freedom to constitute and modify misunderstandings, miscalculations, blunders, and inaccuracies to improve precision and accuracy before conducting a live procedure (Forbes, Mohamed & Raman, 2016). The effectiveness of simulations was tested between two groups: a medical staff employing simulations and a medical staff not utilizing simulators (Forbes, Mohamed & Raman, 2016). Though both groups were required to complete the same number of hours and cases for valuable training, it was proven, that the group utilizing simulators was more effective in decreasing the learning curve because of continuous hands-on experience and experimental procedures (Forbes, Mohamed & Raman, 2016). The group which did not utilize the simulator was not as skilled and efficient as the group with the simulators because they lacked the physical experience and training which caused the learning to curve and patient risk to increase (Forbes, Mohamed & Raman, 2016).

A medical facility will be held liable for any harm caused to a patient when utilizing new technology (Griffin, 2016). There have been cases where a facility has been urged to embrace

new technology in which improper preparation for utilization was deemed unsafe (Griffin, 2016).

The staff's errors increased due to the significant increase in the learning curve which was larger

than the initial technology or product (Griffin, 2016). If the technology is to improve patient

care and the staff has not been appropriately trained, the incompetency will be viewed as a

defective due to an elevated learning curve (Griffin, 2016). In essence, when choosing new

technology, it is the responsibility of the facility to train all staff and minimize the learning curve

to improve patient care while avoiding liability.

        Finding the correct technology. Researchers believe that when staff wants to make

modifications to technology that they should be required to submit a formal review of the

product and the effects it will have on patient care and the organization (Furci & Furci, 2014).

This information will allow the hospital or medical facility to assess and evaluate the technology

for its success rates and safety (Furci & Furci, 2014). There are several things that should be

considered before implementing new technology, such as, analyzing the needs of the

organization and assuring the goals and objectives are met with the new technology, assessing

the impact of finances, operations, conflicts, economic and political issues, and the learning

curve for medical staff, forecast a financial amount that would be invested into the technology

and whether resources can be maintained after implementation, training, education, feedback on

the use of technology, success rates, and other concerns (Furci & Furci, 2014). Research has

shown that computers can be utilized to train and provide problem solving techniques to medical

staff and new employees based on previous concepts and procedures if the correct information is

uploaded into the system. This information can provide solution to problems and illnesses that

will provide suggestions to medical staff for improvement of patient care (Coccoli & Maresca,

2018).

There has been dissatisfaction amongst physicians, employees, and stakeholders concerning the innovation of new technology (Rudin, Bates & Calum, 2016). Individuals involved and affected by the new innovative technology in healthcare are disgruntled because of lack of communication concerning the product between the technologist and the user, the assumption of one-size-fits-all, costs of the product, delayed innovation in specific areas due to demands, rewards for branding instead of quality, privacy rights of patients, efficiency, and integration challenges (Baig, Gholamhosseini & Connolly, 2015; Jaffe, et al, 2017; Rudin, Bates & Calum, 2016; Tkach & DiGirolamo, 2017). Developers are concerned with creating a product that can be utilized in the industry; however, the developer does not consider the user, patients, and clinicians which gives the developer a lack of understanding concerning the needs of the affected individuals (Rudin, Bates & Calum, 2016). The users of innovative technology vary in age and knowledge (Matsen, 2014; Rudin, Bates & Calum, 2016; Williams, 2016). Technological features are customizable but may not meet the needs of every medical facility based on the population, size of the facility, inpatient, outpatient, patient care, and clinical events (Rudin, Bates & Calum, 2016). If the developer does not consider the population, then the knowledge and skillset of diverse users may be underestimated; therefore, an incline in cost, training time, and functionality will deem to be important values until the affected individuals understand the use of the product (Rudin, Bates & Calum, 2016).

The rapid evolution of technology in the healthcare system and its frustrations amongst stakeholders, staff, and physicians are tremendously increasing (Thompson, 2016). Professor Nicholson, director of the Sloan Program in Health Administration, and Arnaub Chatterjee, former healthcare advisor for the Obama Administration conducted a case study by presenting a course in healthcare information technology that would capture the behavior of twenty six

second year students studying for their Masters in Health Administration (MHA) on the conversion of information technology in healthcare (Thompson, 2016). This study was designed to enhance the knowledge of students during the phases of implementation, evaluation, experiencing frustrations, employee acceptance, and management of information technology in the healthcare industry (Thompson, 2016). The students were exposed to various case studies, perceptions from faculty, experts in the industry, and other experiences from Weill Cornell Medical College and Cornell Tech (Thompson, 2016). Healthcare is evolving in various areas; therefore, students were exposed to new technology in telehealth, software for electronic medical records, genetic and molecular profiling, insurance claims, and clinical practices (Thompson, 2016). The rigorous course introduced to students enabled each to obtain the ability to gather knowledge and experience that would help them to understand the importance of choosing the correct technology, intricacies of implementation, rejection of change, and a proactive business plan to confront the issues when identified in an environment (Thompson, 2016).

Communication is key to understanding the correct and most appropriate technology for the medical facility and its users (Charbonneau-Gowdy, 2015; Kopanitsa, 2017). The users of new technology should be taken into consideration when contemplating technology advancement within the facility. If proper communication is not mandated, then the introductory process becomes obscured and efficient processes become questionable (Franz, & Murphy, 2015). Inefficiencies can delay timing, increase cost for training, patient risks, and frustrations amongst users, and devalue the important use of the product (Pitts, 2015). It is imperative that all stakeholders understand and gain access to the new technology and the effects it will have on each entity, as well as the entire facility.

Analyzing the process. The National Health Service has aligned a seven step improvement process model which identifies the issue and the severity of the problem, assures all data has been taken into consideration and that it is valid, processes the data and how it was collected to assure accuracy, understands the trends and analyzes the data to assure it is what is expected and needed, assesses the information and presents it in a plan for action, and the correct action should be implemented to assure all needs are met for continuous improvement (Muhammad Ahsan ul & Muhammad Salman, 2015). However, there has not been a plan to aid in the learning curve when introducing new technology. The strategic plan for implementation should consist of monitoring and reviewing the plan for any updates, appointing an accountable team leader, understanding the measures for efficiency, outcome, quality, and projection of costs. Research shows careful implementation of a strategic plan will increase and improve patient care while expanding every sector of the medical industry, such as, emergency clinics, long term care facilities, outpatient clinics, and other practices (Fry & Baum, 2016). Technology is extremely high and the costs for implementation will be spread amongst those who benefit from the medical technology. This is an issue for the medical industry because their main goal is to reduce or maintain cost (Baig, Gholamhosseini & Connolly, 2015; Hayden, 2014). This article gives instruction on how to implement new technology in the medical facility by testing the product and utilizing comprehensive safety guidelines that will manage errors in early testing to avoid any type of impact after implementation (Garcia, Nyström, Fiorino & Thwaites, 2015).

Learning curves and their effects are inevitable whenever any new technology is introduced to a facility or an individual (Jackson, 2015). Medical facilities must embrace the learning curves of its stakeholders and employees when implementing new technology (Jackson, 2015). It is an intimidating challenge to learn and implement new technology and the negative

or positive aspects before introducing it to the entire facility (Jackson, 2015). Stakeholders must

be mindful of the various levels in which they introduce new technology, in other words,

implementation of new technology will affect every level of staff (Jackson, 2015). For example,

if a physician is utilizing a new device, then the learning curve is increased amongst the

physician, financing, clerical, nursing, compensation, and benefits staff (Jackson, 2015). The

learning curve affects each staff member and patient in some form. For instance, the new device

must be learned by the physician, the nursing staff must acquire knowledge and communicate

definitive information to the patient, the clerical staff must be able to find the device in the

system for correct billing, and whether the technology is covered by the insurance company.

Analyzing the process before implementation is imperative because of the individuals involved.

Therefore, dedication to assuring the steepness of the learning curve becomes knowledgeable

and should be communicated through training processes to ensure quality improvement despite

the learning curve (Jackson, 2015).

Challenges with New Technology. There are many issues with implementation of

new technology in the industry, such as, interoperability, reimbursement costs, usability, and

regulatory issues (Hollmark et al., 2015). Some other implementation issues that management

encounters are social acceptance, service systems, research and technological development, and

framework conditions. The solutions to meeting these issues must be solved to move forward to

increase and improve patient healthcare. Procurement and reimbursement were found to be the

highest challenges when implementing new technology (Hollmark et al., 2015).

Problems often occur when there is poor testing or dissemination amongst clinicians;

however, most of these issues are oblivious to these errors. Implementing a new device in the

health industry was found to be costly and inefficient which can increase costs for patients and

misinform the economic overall cost. Unfortunately, the protective laws allow companies to continue implementing technology without enough testing which can cause loss of life to patients. On the other hand, if there were regulatory standards that would label companies who have implemented such untested devices in a negative manner it may change the concept of testing and training before marketing and implementation (Choby & Clark, 2013).

It is imperative that stakeholders understand the consequences of errors in reporting because of invalid values. This study provided surveys and questions to groups to ascertain information that would highlight their experiences with specific software and the errors in which they occurred (Golnari et al., 2016). On the other hand, the percentage of errors were taken into consideration while performing a quality assurance assessment and the effects it had on the organization and the patients. Technology errors can cause harm and fatalities to patients; therefore, processes must be in place to assure that the implementation of new technology will improve outcomes (Golnari et al., 2016). The project managers believe the opposition for implementation came from leadership because they were involved in the entire process. However, the percentages show both project managers and general managers resist Enterprise Resource Planning when implementing new technology (Celjo, Hanić, & Kazalac, 2011).

Another challenge with the implementation of new technology is the interaction between the patient, physician, and the new technology (Franz & Murphy, 2015). The dialogue between the physician and patient can become impeded due to the physician assuring he/she is on the correct screen, looking at the correct value, technological difficulties, reduces critical thinking, and disrupts patient care (Franz & Murphy, 2015). Computers compensate for human weaknesses or errors which does not dissipate the issue, it just shifts the blame (Franz & Murphy, 2015). The user of new technology must be able to detect when the new technology

has not calculated or resulted in yielding the correct information; this is not only a challenge, but it is a liability (Franz & Murphy, 2015). On the other hand, physicians will need proper training with new software to ensure there are no hinderances and collaboration with the patient is a consistent flow (Franz & Murphy, 2015).

Challenges with implementation of new technology can range from the use of old equipment, such as, old desktops, slow internet, wireless devices, manual data entry, outdated interfaces, untrained on new software, cost of software, unfamiliar with technology (Birkhead, 2017; Thomas, 2017). It is pertinent to remove various old components to warrant the use of new components and interfaces with new software (Musa & Toycan, 2018; Thomas, 2017).

Implementation processes. The technology industry may consistently present a new technological product to the industry, but every product that is presented to the industry may not be integrated into the industry in which it was created to improve (Arni, Laddha, 2017). These innovative products must be thoroughly tested for accuracy before implementing or introducing it to the patients. For instance, manual reporting is susceptible to high percentages of human error when communicating information to medical staff. However, if patient's medical information is placed within an electronic system where it is accessible to medical staff, then there could be an increase in reception of patient results, medical history, and faster accurate service (Evert et al., 2016; Gibney et al., 2016). Communication can be improved with modern technology because the physician is able to obtain results faster and more efficiently as the medical technologist inputs the information into the computer system (Borycki et al., 2017). The health industry must also be aware of technology errors that may occur, such as, conflicts between technologies, government, or any legislative procedures (Borycki et al., 2017). These procedures must be corrected to assure the correct results are being received; otherwise, the

information is incorrect and the industry, as well as patients will endure harsh experiences because of these errors.

It is important to assure that implementation consists of customer data integration, standardization and acceleration of business processes, and unification of information on human resources (Celjo, Hanić, & Kazalac, 2011). The team leader who represents the company during implementation must keep up team morale by attending all meetings and meeting the milestones that are necessary for success (Chreiman et al., 2015). Cognitive computing techniques is another positive aspect of implementing modern technology because it allows the computer to analyze inserted information on a humane reasoning level which may be very intricate when dealing with various tasks (Coccoli, & Maresca, 2018). Researchers believe teaching or programming computer systems to think like humans will vice versa teach humans new concepts and procedures which allow better reasoning (Coccoli, & Maresca, 2018). Computing technology is not readily embraced in all industries; however, researchers believe this will help improve healthcare performance systems that will propose solutions to physicians and staff utilizing big data (Coccoli, & Maresca, 2018).

An industry or facility cannot just purchase a product and expect employees to learn it at a fast pace and begin to use it immediately. A company that does not take the time to train and educate their employees will have to deal with frustration, lack of embracing the software, reporting errors, lack of productivity, and financial cost. Friedman wrote on seven ways in which an organization should implement new technology (Friedman, 2017). The management team or leadership should communicate the information about the new technology and what it entails to the employees (Friedman, 2017). Employees may be able to embrace change easier when there is an open line of communication throughout the process. Second, find a champion

which is someone that is on the implementation team and in the selection process of choosing the most applicable software / technology for the organization (Friedman, 2017). The champion is someone that can articulate the information from meetings to employees and answer questions because he/she has been a part of the process (Friedman, 2017). Third, create a skeletal framework that will give employees a realistic timeframe for implementation, a budget that is conducive for the organization and explains the impact financially it will have on the company in various areas, such as, training, consultant fees, revenues, and expenditures (Friedman, 2017). Fourth, decide if the product will be implemented by staff or a consultant which will answer questions concerning the technology and its integration (Friedman, 2017). Fifth, analyze the data and setup your team that will review the data before the migration process to assure that only accurate information will be integrated into the new system (Friedman, 2017). Sixth, conduct testing before the implementation process to assure there are not any critical points that will prevent the system from delays and assure all employees are comfortable and the system is working efficiently (Friedman, 2017). Lastly, a 'Go Live' should be set to ensure there is a date to work towards that is realistic from the time of training; however, this date should be designated upfront as part of the initial milestones (Friedman, 2017).

The Affordable Care Act (ACA) mandated hospitals to implement new software for new electronic health records system to improve patient data (Thomas, 2017). The new electronic health record is designed for scheduling, billing, maintaining data for diagnosing and treating patients, as well as documenting information for reporting to agencies (Thomas, 2017). The process the hospital used (Thomas, 2017) was as follows: chose an inexpensive software that was not intricate to ensure there would be a low learning curve, a representative from the company installed the software, uploaded information into the computer system for both faculty

and students while receiving instructions on the flexibilities and capabilities of use, trained

faculty and students, created a testing zone for all participants to practice utilizing the new

software, such as, printing patient labels, accepting specimens, entering patient values, and

distributing information to various departments. This simulation process was conducted to bring

awareness to the lessons learned and challenges during implementation. A quality assurance

assessment (Thomas, 2017) was performed after the simulation course which consisted of the

following: verifying results which were reviewed by managers to ensure accuracy, tracking

pending information, compilation of mandated reports, an analysis of each participants' scripted

experiences, scenarios, feasibility of features concerning the new technology, and an overview of

departmental perceptions. Stakeholders collaborated on the overview of the simulation course

and the feedback received from all participants and departments (Thomas, 2017). Suggestions

from participants and departments were adhered to and the system was modified within its

capabilities to regulate workflow, accuracy, and reduction of a learning curve (Thomas, 2017).

Once the suggestions and the enhancements were installed and completed in the new system,

then another simulation was scheduled to ensure bottlenecks were no longer an obstacle for

departments and participants; however, consultants found that timing was an essential tool when

training participants, without excessive workloads, on new technology to ensure accuracy and

absorbed knowledge without stress (Thomas, 2017).

      Issues of Implementation. Implementing a new product is not easy in the workplace

much less in any industry. Change is not easily embraced by staff, management, and sometimes

patients. Medical facilities are consistently faced with learning curve challenges when

introducing new technology (Gofton et al., 2016). The assumption of 'learning by doing' to

overcome challenges of the learning curve is an assumption that has been adapted and believed

to reduce errors when medical staff has utilized new technology repeatedly (Gofton et al., 2016).

Physicians have spoken of steep learning curves when utilizing new technology to perform

procedures on their patients (Matsen, 2014). Duwelius mentioned the numerous technological

challenges physicians consistently confront regardless of the numerous classes in which they

have enrolled to conduct research and the amount of time spent in laboratories (Matsen, 2014).

However, there is no time limit given for medical staff to have aborted the learning curve phase

because it depends on the complexity of the technology and sometimes the experience of the

physician (Matsen, 2014).

New technology presents a learning curve for individuals who are not up to date with

working with technology and have been utilizing the same system, such as, manual systems for

fifteen plus years. A study was conducted across fifteen nursing homes over an approximate

period of twelve months which allowed the vendors to capture the implementation experience

over all the nursing homes simultaneously (Avgar, Tambe, & Hitt, 2018). Each nursing home

utilized the same version of the new electronic medical record technology system. The facilities

utilized employee surveys and measured support requests to gather information concerning the

learning curve; however, support after the implementation process varied across institutions

(Avgar, Tambe, & Hitt, 2018). Two of the main issues post implementation were how to utilize

the features in the software and dysfunctional software (Avgar, Tambe, & Hitt, 2018). Research

has shown that when management is faced with the decision to ensure changes are in the project

plan, there is then a great possibility in which there will be conflict in the plan (Celjo, Hanić, &

Kazalac, 2011). Failure rates with implementation can rise if the plan is not submitted correctly

and costs for the software can present a problem. Enterprise Resource Planning is an

organization that helps increase the speed of implementing processes within the organization and

track them under one database (Celjo, Hanić, & Kazalac, 2011). If there are several software's

in the facility, then Enterprise Resource Planning will replace those systems with a united system

that has modules that will cater to the processes of the business to assure implementation (Celjo,

Hanić, & Kazalac, 2011).

In another study, the research looked at the implementation of a Computerized

Physician Order Entry which is a mandatory software system that was implemented in a medical

facility to reduce medical errors (Charles, Willis & Coustasse, 2014). This system was designed

to meet various aspects of medical orders, such as, x-rays, laboratory tests, pharmacy

prescriptions, and physician referrals (Charles, Willis & Coustasse, 2014). However, the

medical facility had to consider barriers that would prevent a feasible implementation process,

such as, cost and older physicians who may not want to convert to new technology (Charles,

Willis & Coustasse, 2014; Levac et al., 2015). Older physicians were used to utilizing paper

charts and communicating with their patients via eye contact (Charles, Willis & Coustasse,

2014). However, the implementation of this new software was mandatory to reduce medical

errors and improve patient care (Charles, Willis & Coustasse, 2014). This system would

interpret physicians orders and maintain medical history of patients that would be accessed at a

faster rate versus depending on the patient to remember various tests that were taken in the past,

retrieving medical history from a file room, and illegible handwritten notes; therefore, it was

important for staff to learn the software (Charles, Willis & Coustasse, 2014). The greatest

barrier during the implementation process was the hesitation of older physicians to adopt and

learn the software after practicing medicine successfully their entire medical career (Charles,

Willis & Coustasse, 2014). This study did not go into detail concerning the implementation

process or the learning curve during implementation of the older physicians. The study

mentioned learning curves as the number two concern during the implementation process as it distinctly specified this limitation; therefore, this drastic change would take the older physicians time to learn this software because it became a government mandate.

Research was conducted with several companies on the productiveness of replacing and/or integrating from their old system to a new system to improve electronic health records (Kellar et al., 2017). The components of one technological software were incompatible with the new technological software; therefore, the integration process was faced with many issues (Kellar et al., 2017). Stakeholders should consult and communicate with technicians and staff to ensure integration compatibility. This research was conducted utilizing surveys, interview questions, and group discussions with twenty nine companies to capture their views on the integration process of new technology, bottlenecks, security of information, technical capabilities, available support, and regulatory challenges (Kellar et al., 2017). There were issues with lack of collaboration amongst sites, sponsors, vendors, development organizations, and vendors in the research and health markets (Kellar et al., 2017). The lack of collaboration displayed a breakdown in processes and increased insecurities on privacy and data security (Baig, Gholamhosseini & Connolly, 2015; Kellar et al., 2017; Ramsey et al., 2016). Companies were asked to document their processes for following mandated regulations for governing data integrity in the workplace (Kellar et al., 2017; Musa & Toycan, 2018). The survey results displayed encryption of data during the entire process by utilizing software that will not compromise patient information, using fortified data that was compliant with industry guidelines, complying with benchmarks for industry and health security, login credentials for access and traceable within the secured cloud, limiting access for specific users, periodic system maintenance, periodic back up for both onsite and offsite, deidentifying patient information in

the areas of signature or redact information that was deemed not necessary, protecting of patients' rights, consistent training in place for improved clinical practices, and reviewing / testing the security of technology and its processes (Kellar et al., 2017; Ramsey, Lord, Torrey, Marsch, & Lardiere, 2016). The challenges with the above-mentioned compliances will be considered detrimental to the health industry if precautions and periodic technological maintenance checks are not scheduled to ensure safety for patient information (Huysamen, de Kock, & Bam, 2018). On the other hand, facilities must be aware of version upgrades when dealing with technological software. Obtaining information can become difficult, frustrating, and time consuming if an upgrade has not been tested before it has been released into the production zone (Kellar et al., 2017). If physicians are not able to access information in a timely manner, then the life of a patient can be compromised due to version upgrades (Kellar et al., 2017). Any new version or upgrade that happens during the midnight hour should be communicated by staff in a timely manner to ensure there are no incapability's during work hours (Charbonneau-Gowdy, 2015; Kellar et al., 2017).

Timing is costly and very important when implementing technology. The implementation team should have a project plan that constructs each process with specific dates to ensure deadlines are being met. Debates between management, the implementation team, and the product owner can continue for a short period of time or extend for very long periods of time which can mean many years (Celjo, Hanić, & Kazalac, 2011). The price of technology may cause an organization not to embrace a product because it is unaffordable. A company may want to embrace change and want to purchase new technology that will help propel the company into a new dimension of improvement; however, if the company is unable financially to purchase the product, then they might have to settle for a lesser product or decide not to purchase the product

(Celjo, Hanić, & Kazalac, 2011). The Enterprise Resource Planning group has found the issues

with implementation of modern technology are lack of organization acceptance / participation,

acceptance problems with modern technology, manager involvement, difficulties with

implementation / training, and financial dilemmas with purchasing software and suppliers (Celjo,

Hanić, & Kazalac, 2011).

Cost will have to be considered as well as integration so that all will have access to the

same information for healthcare improvement (Hara et al., 2017). Time zones for

implementation and testing can be an issue because every stakeholder or team leader will need to

work together to assure all information is crossing through the system (Hara et al., 2017).

Companies may experience different issues in which they may have to troubleshoot depending

upon their economic system and modern wiring.

Liability responsibility. The facility has the obligation to assure the learning curve is

not a hindrance in patient care (Bal & Brenner, 2014). Technology will continue to evolve to

improve patient care and give physicians quicker access to results; therefore, as technology

increases, liability will continue to increase because of the learning curve (Bal & Brenner, 2014).

This means the facility must implement processes to assure staff is able to utilize the new

technology with little to no errors (Richards, 2016). The physician / staff must inform the

patients of the new technology and the length of time in which he / she has been utilizing the

technology (Matsen Ko, 2014). Training is essential for physicians and staff to assure the

learning curve is addressed to maintain continuous improvement in patient care (Richards, 2016).

The hospital is not excused from errors or liability suits when implementing or utilizing new

technology (Bal & Brenner, 2014). A learning curve with utilizing technology cannot be viewed

as an obstacle with any medical facility; however, it is the responsibility of the facility to ensure

proficiency with new technology amongst all staff (Bal & Brenner, 2014). It is essential for medical facilities to meet the demand of the learning curve with essential training on the new technology (Richards, 2016).

Healthcare Technology Management is responsible for assuring staff has met training guidelines before utilizing it on patients (Vockley, 2015). The length of time for training is based on the intricacy of learning the software which means timing can vary from a couple of hours to a couple of days (Vockley, 2015). Huntington Memorial Hospital permits its staff to participate on every aspect of the implementation process, such as, administration and simulation which allows the staff to attain knowledge and ask questions while utilizing new technology (Vockley, 2015). The Joint Commission holds hospitals responsible for the learning curves in their facilities (Vockley, 2015). The Joint Commission has been in existence for sixty-three years (Wilson, 2014). They are known for accrediting thousands of healthcare organizations with the "Gold Seal of Approval" (Wilson, 2014). A healthcare facility can obtain this seal by following the international standards which can be both voluntary and mandatory depending on the medical facility location. However, most medical facilities will seek the accreditation of the Joint Commission in order to obtain and meet the requirements of the Centers of Medicare and Medicaid Services (Wilson, 2014). It is not mandatory for a medical facility to acquire accreditation of the Joint Commission, but the medical facility is required to abide by all standards of the Joint Commission to obtain the seal (Wrzesniewski, 2017). The Centers of Medicare and Medicaid Services is a government agency that will reimburse healthcare facilities who extend special care to senior citizens and the poor (Wilson, 2014). The Joint Commission expresses risk-based approach which include training and support of new technology (Grimes, 2014). The Joint Commission does not have legal authority; however, their goal is to improve

medical safety for patients and reduce risks that may cause harm (Wrzesniewski, 2017). The regulations and standards must meet the guidelines of the law even though the standards have been collaborated and developed amongst medical professionals, experts, consumers, and government agencies (Wrzesniewski, 2017).

Physicians are constantly faced with technological challenges as medicine evolves to improve medical procedures. Even though physicians are highly educated, they experience challenges associated with a learning curve when introduced to, and performing, new procedures utilizing new technology (Jaffe et al., 2017). A study was conducted between two Midwestern medical facilities concerning patient safety when physicians are utilizing new technology (Jaffe, et al, 2017). The hospital or medical facility is responsible for ensuring physicians meet credentialing and privileging qualifications to improve patient care and prevent harm that will be associated with new implementation processes (Jaffe, et al, 2017; Levac et al., 2015). The medical facilities implemented a "one size fits all" approach amongst its physicians which displayed variances (Jaffe, et al, 2017). The intensity of compulsory training for new technologies is unknown because of the physicians' experience, training requirements, and knowledge-based application concerning the technology (Jaffe, et al, 2017). The variances amongst physicians ignited concerns for patient care and efficient use of new technology (Jaffe, et al, 2017). The practice of "one size fits all" deemed to be inadequate because of the variances of the learning curve amongst physicians (Jaffe, et al, 2017). The learning curve amongst physicians is very significant, tedious, and can be detrimental to the patient if it is not addressed by stakeholders. Physicians' knowledge, credentialing, or privileges is not enough to ensure patient safety in the medical facility. It is imperative for physicians to spend an adequate amount

of time training by educating themselves on new technology before implementation and performing procedures on patients.

Lack of knowledge with new technology can decrease patient care and cause fatal results (Vockley, 2015). Simulations have increased to reduce the learning curve amongst staff and the liability claims against the medical facility (Aydin et al., 2017). The Joint Commission has established requirements for all medical staff to become acclimated with new technology, terms, processes, safety, training classes, simulation environment, hands on training, and scheduled monthly meetings that will answer complexities (Vockley, 2015). Surgeons are held responsible for assuring they are familiar with new technology and techniques to improve patient care (Stefanidis et al., 2014). They are accountable to inform patients of new techniques and safety guidelines that are being utilized to improve patient care and reduce hazards (Matsen, 2014). They are responsible for hands on training, enrolling in formal courses and obtaining knowledge to offset liability (Stefanidis et al., 2014). It is imperative for all medical staff to acknowledge the learning curve amongst staff whether it is by the group or an individual staff member; however, there are many options in which the facility may select to assure the learning curve and liability is reduced and patient care is improved.

Summary

This research showed the process for introducing new technology in the medical facility. It is imperative that stakeholders understand the importance of researching the product, the challenges that may occur before and after the 'Go Live' date, and the success the medical facility and patients will continue to embrace because of training and education. It is imperative that the medical industry remain abreast of new technology that will aid in the efficient care of patients.

There is a process in which stakeholders should consider before implementing new technology within the medical facility. The conceptual framework in Figure 1 labels the pertinent components that will attack a learning curve within the facility. Choosing the correct technology is essential to ensure the product is able to produce the needs of the patients. The process for implementation must be analyzed for a comprehensible understanding of timing, cost, training, education, competencies, capabilities, and steep learning curve. The challenges can range from minute to an immense amount. The organization may underestimate the cost, timing for training, timing for educating employees, and the intricacy of the product which will modify the milestones and increase the learning curve. Implementation processes are pertinent because this is the stage where stakeholders will observe the processes and the effectiveness of the software while employees are using it. It is important to have a consultant or a frequently asked questions sheet/binder for any issues that may occur during working hours. Many issues may occur with implementation; however, stakeholders can curtail some issues by utilizing simulations or repetitive training to ensure employees are comfortable and knowledgeable of the new product in use. Finally, there is a liability in which the organization will absorb because of any error that may transpire; however, the facility can reduce or possibly almost eliminate liabilities by continuous training that will diminish and minimize the learning curve in the facility.

A steep learning curve in the facility can be detrimental to the patients and the employees. Knowledge of the product must take precedence during implementation to adhere to regulations and condense liability. If there is an error in which the patient or employee suffers an injury due to lack of training or not adhering to guidelines, then the medical facility will be held responsible. The consequences can range from verbal reprimands, closing down the facility,

possible lawsuits, and incarceration. All of the components depend upon each other because it leads to the success of the next component along with understanding the bigger picture of implementing new technology with a minimal to none learning curve.

Chapter 3: Research Method

The problem to be addressed is identification of the issues that learning curves may have on the implementation of new technology and identify guiding principles that consider the learning curves of employees. The purpose of this qualitative case study was to recognize the concerns when implementing new technology and develop a standard or platform that accounts for and minimizes the issues associated with the learning curves of employees.

The following research questions are devised to accumulate information that will perfect execution processes when introducing new technology to the medical industry.

Q1. How can medical facilities account for, and moderate the effects of the learning curve of employees when implementing new technologies?

Q2. What strategies can be employed to proactively address the potential issues with the introduction of new technology to increase acceptance and utilization for enhanced efficiencies?

Q3. How does management implement training and education to avoid liability?

This chapter will consist of discussing the research methodology, the population sample, materials/instrumentation, study procedures, data collection and analysis, assumptions, limitations, delimitations, and ethical assurances for this research study. The research methodology utilized case studies of medical facilities that will gather information via interviews and recording. This data will give descriptive detail on the challenges of a learning curve when implementing new technology. The information will give insight for future technological implementations and the challenges in which institutions will face concerning learning curves.

Research Methodology and Design

Qualitative and quantitative are the two types of research methods which can be utilized; however, the research method that was utilized to discuss the implementation of technology in the health industry is a qualitative approach. Qualitative research is not found in a laboratory, but it is gathered from the researcher through a naturalistic social setting (Cristancho et al., 2018; Harper & McCunn 2017; Helmich et al., 2015; Jin & Bridges, 2016; Tavakol, & Sandars, 2014). Qualitative research assesses, scrutinizes, questions, and investigates processes or situations in the real world which produces conceptual information that is comprehensible and transferrable to other contexts (Cristancho et al., 2018; Helmich et al., 2015; Tavakol, & Sandars, 2014). This type of research is dependent upon verbal statements from participants to give a realistic descriptive account of their experiences which support the identified information in research (Cristancho et al., 2018; Tavakol, & Sandars, 2014). Qualitative research will give a descriptive form of participants' actions, feelings, endurances, lessons learned, errors, amount of training, and the learning curve during a new technology implementation process. Qualitative methodology is deemed most appropriate for this study given the purpose of this research and the associated research questions.

Quantitative research is another type of method utilized to gather quantifiable information. This research consists of deductive reasoning that eithers rejects or supports a hypothesis, uses statistical formulas to analyze data, uses a large population, and consists of experimental and correlation designs to collect data (Abramson et al., 2018; Atmowardoyo, 2018; Jin & Bridges, 2016). This design was not appropriate for this research unless it was going to measure, for example, the percentage rates of the learning curve in various facilities, age / gender differences, and using a large population (Mouncey, 2017; Tavakol & Sandars, 2014).

Quantitative research consists of three designs, such as, quasi-experimental design, experimental designs, and surveys (Tavakol & Sandars, 2014). Experimental design consists of a hypothesis and controlled data in which the researcher manipulates a variable to ensure a particular outcome (Atmowardoyo, 2018; Mouncey, 2017; Tavakol & Sandars, 2014). This design was not appropriate because it does not have a hypothesis and a controlled variable. The second design is quasi-experimental which allows the researcher to manipulate a given variable but cannot assign the participant to a control group (Abramson et al., 2018). This design was not appropriate because there was not a control group neither was there manipulative data to ensure another outcome based on this research. The third design is a correlation study in which the researcher finds the coefficient correlation between two variables using statistical formula (Atmowardoyo, 2018). This design was not appropriate because there is not a hypothesis nor statistical data.

Qualitative research consists of designs in which the researcher would choose based on the data to be collected. The first design is ethnography which allows the researcher to observe participants within their social setting while experiencing the subjects' influential culture (Cristancho et al., 2018). The researcher is immersed into the culture; therefore, obtaining a first-hand experience of the pressures, developments, and routines to explore and understand the virtual dynamics of the culture (Cristancho et al., 2018; Helmich et al., 2015). This design could be utilized for this research to gather information from the introductory process presented to the stakeholders thru the 'Go Live' date. However, this design would have taken more time than what is allotted to complete this research and the researcher would have had to have predetermined knowledge of new technology being implemented within a medical facility. The second design is grounded theory which allows the researcher to draw conclusions and make

general observations upon understanding the collective practices and behaviors of participants (Cristancho et al., 2018; Hussein et al., 2014). This design was not conducive because of time constraints, reduplication and analyzation of information which is predicated upon the researcher observing patterns (Cristancho et al., 2018). This research consisted of semi-structured interviews to show the improvement of patient care or the lack of improvement when technology is not embraced to enhance health industry services. The third design is descriptive research which allows the researcher to observe the obstacles of processes with participants and predetermined agreements or disagreements of preidentified obstacles in which the researcher describes the present existence of the problem (Abramson et al., 2018; Atmowardoyo, 2018; Hennink et al., 2017). This design was used because an issue has been identified; therefore, the researcher documented the existing situation and utilized semi-structured interview questions to obtain insight on the learning curve when new technology is implemented. Interviews, a type of data collection, were used in medical facilities with professionals to understand the execution and observation process of implementation when learning new technology (Atmowardoyo, 2018; Avgar, Tambe, & Hitt, 2018). Interviews were chosen because they met the following criteria for this research: it will give answers to the 'how' and 'why', it will not influence the performance of the stake holders, it will convey personal experience, and expose variances in the occurrences (McEntee & Happel-Parkins, 2016). Interviewing participants presented descriptive information on the experiences of introducing new technology into a medical facility. This information was captured with direct interviews and captured information via recording. This gave an in-depth knowledge of the introductory process, such as, the beginning stages of presenting the idea to stakeholders, training employees, educating employees, consultants, configuring a 'Go Live' date, the pros and cons of implementation, lessons learned, and details

of the improvement process of the facility. Triangulation was used to improve the validity of this project. Semi-structured interviews were recorded and used for data collection along with case studies (Carter et al., 2014). Validity was expressed because of the variable's relationship with the implementation of new technology and the cost which were dependent upon each other. For instance, the medical facility may need to introduce modern technology, but the stakeholders must consider the cost of implementation and the processes (Zavadsky, 2015). A tracking system that will collect data to compute complex issues will be needed to assure all information is understood without a technology or language barrier (Hara et al., 2017).

Harvey and his colleagues utilized an empirical study which researched four organizations when executing new technology in the industry (Harvey et al., 2018). Harvey et al.'s qualitative study utilized interviews to gather information that was conducive for reviewing the implementation process (2018). The sites who received external help with implementation were more progressive because there were individuals that were there to walk them through every aspect of the process (Harvey et al., 2018). On the other hand, the sites that utilized internal facilitation did not make much progress and encountered issues with stakeholders and differences for funding, training, and other processes (Harvey et al., 2018).

Population and Sample

The population and sample size for this research consisted of representatives from various medical facilities. The representatives were physicians, managers of the facilities, and a representative from the new technology company. These representatives were chosen because the physician was able to give his/her perspective on decreasing the learning curve while maintaining a consistent workload. The manager was able to give his/her perspective of introducing technology to the workplace and the constraints while the technology representative

was able to expound on introducing new technology to the medical facility, training, education, and simulation processes to reduce liability. The population sample consisted of 11 nurses, 3 medical clerks, 1 Admissions Director, 1 physician's assistant, and 1 dental hygienist.

This sample was appropriate because each individual either had previous knowledge of the technology, such as, the consultant or each individual had to endure working through the learning curve by utilizing various techniques that can be professionally explained in its entirety. These individuals were able to articulate the positive and negative aspects of obtaining knowledge on the new product, educational training, intricacies, constraints, effectiveness, and comparison of improved patient care.

Purposive sampling was used to identify candidates for the interviews and recordings. This type of sampling selects participants that are easily identified and designated to be a part of the sample and recruitment process (van Hoeven, Janssen, Roes & Koffijberg, 2015). Purposive sampling allows the researcher to choose a sample or individuals within a specific criterion, such as, nurses, physicians, or medical director from a large population within a facility that will provide insight or best practices to identify failures or successes and utilize that information across other health facilities (van Hoeven, Janssen, Roes & Koffijberg, 2015). This information will aid in educating stakeholders on the learning curve and its effects, acceptance and effectiveness of new technology, and training to avoid liability. Each interviewee was asked the same questions along with follow up questions to ensure processes and procedures for implementation are captured.

Participants for this study received a phone call or email asking for their participation in this research. The eligibility requirements for participation were as follows: the participant must have been 18 years of age or older, worked in the health industry, experienced implementation of

new technology in the health industry, and experienced a learning curve with new technology. It is believed chosen representatives accepted the interview invite with the evolution of new technology and the desire to increase quality patient care (Asghar, Cang & Yu 2018; Bucci et al., 2019; Burkoski et al., 2019; Chiu et al., 2016; Chiu et al., 2019; Gan, Chua & Wong, 2019; McNally, Frey & Crossan, 2017). The information that was collected from this research was recorded and notes were taken to ensure replication of the study.

Materials/Instrumentation

Field Study. A field study was used to extract experience and knowledge from Subject Matter Experts (SME) to provide perspectives on the issue being examined by giving feedback on the interview questions related to this research (Cristancho et al., 2018; Hartwell, Johnson & Posthuma, 2019; Malsch & Salterio, 2016). The collection of data for this field study came from interviewing and recording information (see Appendix A) from managers and/or physicians who have gone through this process or will be preparing to go through this process. Interview questions were distributed to five SME's, with the following qualifications: a minimum of ten years of experience in the health industry and reports of personally being affected by the implementation of new technology and its learning curve. Respondents consisted of the following positions: registered dietitian, medical doctor and director of radiation emergency assistance center, registered nurse, clinical nursing instructor, and assistant director of patient transport. Responses were received via email, text, and verbal report. Overall, four of the responses communicated the interview questions were valid, covered all areas of the implementation phase, and confirmed a consistent challenge with learning curves as technology continues to evolve. The fifth response thought the interview questions were good but needed modifications, such as, word changes for clarity, avoidance of multiple questions in a sentence to

allow participants to focus on one question at a time. This feedback was taken into consideration and modifications were made to the interview questions.

Study Procedures

The information was captured by scheduling interviews with managers/physicians that shared the step by step process when first acknowledging the idea of implementing new technology and discussing the challenges with a learning curve. The data was gathered from three hospitals in the Knoxville, Tennessee area. Approved managers and physicians were interviewed on the interrelated areas from Figure 1 with emphasis on the challenges of the learning curve for all participants which consists of stakeholders, implementation team, managers, physicians, and patients. This data was collected verbally from this group during a question and answer period which will capture learning curve information. The data consisted of the following information: the reason for new technology, researching the product, determining the accurate product, analyzing the process for introduction, process for training and education to confronting the learning curve, length of time for training and simulation courses, determining a 'Go Live' date, limitations during the process, lessons learned, and encounters of liabilities. The interviews were conducted during a designated scheduled time in which managers and physicians are free to communicate this information during business hours. This information can be replicated by following the same procedures and/or asking the same interview questions to another medical facility to understand their overall challenges with a learning curve and the resolutions for improvement in that area.

Data Collection and Analysis

The data that was collected during the process was coded by an alternate name given to the interviewee; however, the position / job title of the interviewee, number of participants,

location, length of time, and type of interview will be provided (Chiu et al., 2016; Chung, Hwang & Lai, 2019; Cristancho et al., 2018). The information was communicated by giving life examples from each medical facility and utilizing the study procedures given in the above section.

The collected information answered each research question in its entirety, as well as give insight on other areas for future studies as it pertains to the challenges of a learning curve in medical facilities (Wilberforce et al., 2017). Composed information was analyzed by displaying explicit written details of the implementation process and its learning curves for each health facility (Milosavljevic et al., 2015). This will give the reader a comprehensive understanding of the issues in which learning curves have on the implementation process and identify guiding principles that will take the learning curves of employees into account. The data communicates the intricacies of potential issues, effects of the learning curve, implementation of training to avoid liability, and variances amongst each facility, as well as the lessons learned that will aid in future extensive research.

This qualitative case study displayed the variances among each health facility. The data gave descriptive accounts on the processes for implementing new technology and dealing with the challenges of a learning curve in the facility. The epistemology research approach used authoritative knowledge which gathers the information from people, in this case, to express the strengths of this research (Nassehi, Esmaeili, & Varaei, 2017). The cases were labeled according to the facility's procedures for confronting learning curves. The responsibility of the researcher was to present an objective triangulation method that will give an account from each medical facility, such as, timeframes, challenges, and variances on the learning curve (Barnham, 2015).

Assumptions

An assumption is a statement(s) or position in which the researcher has deemed true without evidence until an opposing or conflicting idea is proven for a specific principle (McClelland, 2017; Simonson, 2016; Webster, 2017). It was the assumption of the researcher that the participants would answer the questions in an unbiased and straightforward manner. The participants in the study met the inclusion criteria for this research (Hoover, Strapp et al., 2018). All participants have experienced this same or similar occurrence for this case study. The participants were not offered any incentives for their participation in this research and participated of their own consent and discretion because of sincere interests in this study (Hoover et al., 2018). The rationale behind the assumptions was to ensure data was unequivocally trustworthy when capturing the challenges and processes of a learning curve that will deem insistently urgent when dealing with the lives of patients and future research.

Limitations

Limitations are elements of the research in which the researcher has no control and may possibly affect the study (Abramson, 2015; Helmich et al., 2015). The limitations may consist of unknown conditions or factors where biased answers will take precedence. A medical facility may have received funds or been government mandated to implement new technology within a specific timeframe; therefore, responses to questions may be biased. The interviewee may be answering questions from recollection; however, if the interviewee does not recall all information, there may be some pertinent information not captured or deemed questionable in the research. The researcher ensured the internal validity of this research by asking follow-up questions that gave an in-depth overview of challenges and processes experienced in the medical

facility (Batt-Rawden, Björk, & Waaler, 2017). Interviewing several participants in the facility

mitigated these limitations as all data will be interpreted and weighed.

Delimitations

Delimitations are elements in the study in which the researcher has control over variables

to limit the scope and ensure manageability (Abramson, 2015). This study included

professionals from medical facilities within the Knoxville area. The delimitations for this study

were exactly opposite of the limitations. Variables to consider in future research but were not

elaborated upon in this research was the size of the facility, finances received for the product,

religion based medical facility, age of participants, experience of participants in the medical

field, global experience, nationality, and gender. The previously listed characteristics were not

included in the research due to population, location, and time constraints for conducting broad

research. It was with great intent to capture the challenges of implementing new technology and

the challenges of a learning curve within the medical facility. The external validity will deem

important to further research on the implementation of new technology as it pertains to more in-

depth research for comparison on a global, age, and possibly male or female dominant

perspective.

The decision to eliminate the delimitations as weighted variables in the research was due

to focusing on the challenges and the seriousness of the learning curve when implementing new

technology. The delimitations placed constraints on this study to ensure the data was focused on

collecting and managing the precise information for successful research. The study was

designed to understand the learning curve and mitigate the liabilities to patients when new

technology has been introduced and implemented. It is pertinent to understand the technology,

analyze the process, challenges with new technology, implementation process, and liability responsibility to ensure overall quality care for patients.

Ethical Assurances

This research study received approval from Northcentral University's Institutional Review Board (IRB) prior to collection of data. The study met ethical standards for performing research with human subjects. This was designed to expand knowledge to the entire population with the intent to amplify and intensify global research that will contribute to the health industry.

Anonymity / Confidentiality was achieved by using pseudonyms for both the site and the interviewees to maintain confidentiality during research. The data was presented to protect all subjects during this study. Once information / data was collected, then according to Northcentral Post IRB Approval and Data Collection, the information was unidentifiable and protected.

The role of the researcher was to collect data and ensure it was in compliance with the policies and procedures of Northcentral University's IRB. There were some biases that may have become present, such as, a medical facility may have been mandated to implement new technology, stipends may be given for utilizing the product, and/or the stakeholder may have received information from a colleague concerning the product (Feuerstein et al., 2018; Larrison et al., 2018; Strong et al., 2014;Thomas, 2017; Zeng, 2016). My professional experiences with this topic have occurred on two separate occasions: in hospital and a business organization. My experience in 1992 took place in New Orleans, Louisiana in a hospital. The procedures and technology have changed since this implementation and it will be intriguing to understand the changes and view the similarities concerning the learning curve within this vast timeframe. The biases that have been presented earlier were preventable by the researcher. The data was presented to influence the processes for understanding the challenges of the learning curve when

implementing new processes to improve quality care in the health industry. The research questions were designed to remain within the constructs of the framework to assure accuracy in gathering data.

Summary

The research methods for this study consisted of the research methodology and design which utilized case study and interviews to gather data on the learning curve in medical facilities when implementing new technology. Descriptive information was given from the interviews via recording to give in-depth knowledge on the various phases of implementation, training, consulting, and configuring a 'Go Live' date. The materials/instrumentation used were the recordings from interviews which give insight to the researcher and allow follow-up questions for comprehensive knowledge and clarity. The study procedures consisted of the exact steps that were used to gather data, established categories and locations from which the data will be extracted, and participants job titles to show the learning curve affect throughout the facility.

The collection of the data was not identifiable to protect all subjects within the research. Pseudonyms were utilized for the facility and participants to protect their information and avoid any risk of breach. The researcher considered the assumptions, limitations, and delimitations of the data and guided the research based on the framework that was introduced in Figure 1. The research questions were chosen to ensure presented data is internally viable and gave insight on learning curve challenges with the intent to improve quality patient care.

There are biases in which the researcher had to take into consideration, such as, stipends, familiarity with the technology, and mandates from another source; however, the research questions and the framework gave structure to viable data. The findings from this research gave

accurate information and allowed the researcher to present the challenges of a learning curve when implementing new technology to improve overall healthcare in medical facilities.

Chapter 4: Findings

This research was conducted to understand the learning curve in the medical field amongst medical professionals when new technology has been introduced to the facility. Seventeen interviews were conducted for this study which consisted of eleven nurses, three clerks, one Physician Assistant, one Dental Hygienist, and one Admissions Director. This chapter will discuss the findings of those interviews as it pertains to the research questions. It will discuss how facilities moderate the effects of the learning curve of employees when implementing new technologies, the strategies which can be employed to proactively address the potential issues during the introduction of new technology to increase acceptance and utilization for enhanced efficiencies, and how management implements training and education to avoid liability. This chapter will give an inside view of the obstacles in which medical staff undergoes utilizing their personal professional experiences and views to speak about the learning curve as technology continues to evolve in medical facilities.

Trustworthiness of the Data

The candidates signed consent forms and agreed to be recorded during the interview process. Each candidate was an expert in his/her field and experienced various changes with the implementation of new technology; therefore, each one was able to expound on the subject giving various examples of processes and walking the interviewer through a vivid workflow of implementation. This study's dependability is based on the expertise of these candidates which consists of years of experience, multiple medical positions, various facilities, and in-depth knowledge of practices, and numerous technological implementations. Once candidates were contacted, then a brief synopsis of the study was explained along with asking the perspective candidate the eligible questions for becoming a qualified candidate. All interviews were

scheduled for an hour. Some interviews were conducted face-to-face and other were conducted over the phone due to the pandemic. Once a candidate was considered viable, then a semi-structured interview was conducted and recorded.

This exploratory qualitative study was conducted utilizing interviews which were recorded on an approved device. There were 17 participants in the study which consisted of 11 nurses, 3 clerks, 1 Physician Assistant, 1 Dental Hygienist, and 1 Admissions Director. The years of experience consist of a range from 5 to 52 years with all candidates currently active in their fields. Candidates were either recruited via phone calls, attending banquets / seminars, and some candidates called me, the researcher, because they wanted to participate in the research. Some of the interviews were conducted face-to-face and others were conducted over the phone due to the pandemic. In this qualitative study, triangulation was utilized to consider various perspectives to attain credibility to ensure the study was not biased, to ensure the investigative process was validated, and enhance knowledge and findings (Brown et al., 2015; Santos et al., 2020; Varpio et al., 2017) .

Methodological triangulation utilizes more than one method to ensure validity and avoid bias (Fusch, Fusch, & Ness, 2018; Mayer, 2015; Santos et al., 2020; Varpio et al., 2017). There are other methods that could have been used to show trustworthiness of the data, such as, data triangulation, investigator triangulation, theory triangulation, and member checking (Fusch, Fusch, & Ness, 2018; Mayer, 2015; Santos et al., 2020; Varpio et al., 2017). Each of these methods consist of a different criterion to ensure validation of the study. There are studies which have shown the intricacies of implementing new technology within medical facilities and the learning curve amongst employees (Golnari et al., 2016). Interviews and research articles were the two methods used to validate the results of this study. The conducted interviews gave a

present account of medical personnel experiences concerning the learning curve during

implementation of new technology. The articles gave a view of medical personnel experiences

concerning the learning curve with new technology within a facility. The articles utilized

interviews to capture the feedback of medical personnel experiences during implementation;

therefore, this information was compared to the results of this study for commonality. These two

methods gave an in-depth view of the collected data that portrayed various views for validation

and trustworthiness. This study consisted of candidates which were interviewed either in a

private room in a library, an office, a classroom, or by phone with each session lasting

approximately one hour. Other data sources such as articles / case studies were used to aid in

validity and data saturation.

Results

Interviews were conducted with medical staff from various medical facilities to obtain a

different perspectives and validation. Each candidate works in a medical facility and was

allotted the same amount of time which was an hour for the interview. They were allowed to

verbally communicate and share their professional experiences throughout multiple years of

experience during the interview. Most of the candidates worked in hospitals and the others

worked in a smaller medical facility. Some candidates expressed concerns dealing with the

learning curve and not having enough time to learn new information whereas others expressed it

was a specific population complaining about new technology even though employees were given

enough time to learn the new technology. The pros and cons were consistent amongst the

candidates concerning the learning curve.

The learning curve in the medical field expands across all departments. The first research

question was how can medical facilities account for and moderate the effects of the learning

curve of employees when implementing new technologies? Candidates from billing and coding to physicians in neurological surgery explained the intricacies of learning new information while maintaining workloads and ensuring patient liability. This issue is transferable in other areas of the world, such as, the dental field, fire departments, and small medical facilities (Harrington, 2018; Obadan-Udoh et al., 2020). This information will be able to give other industries insights on the significance of the learning curve with its employees and possible ideas to declination. BioMed Central Public Health conducted research on implementing new technology in a work environment where employees were becoming overly fatigued, prone to sickness and increased absences due to being under continuous occupational hazardous conditions (Spook et al., 2019). Employees of all ages were affected and complained about the harsh conditions in which they were working; therefore, management decided to review new sensor technology that will aid in reducing work exposures (Spook et al., 2019). This shows that the implementation of new technology is not only necessary to improve workflow and processes, but it simultaneously shows that there are barriers with implementation across various industries.

The findings of this research show there is a learning curve in the medical industry, and it is dealt with in various ways. Candidates were willing to speak about the topic expounding upon their experiences and utilizing real life examples. They did not have any previous knowledge of the interview questions; but they were willing to speak on this topic to share knowledge that will give insight on decreasing the learning curve. The second research question was what strategies can be employed to proactively address the potential issues with the introduction of new technology to increase acceptance and utilization for enhanced efficiency? Some candidates expressed leadership and consultants did not ask for feedback after implementation which would have been profitable for future or ongoing implementations. Surprisingly, there were some

candidates who worked at different hospitals, utilized the same software, and shared the same complaints concerning the software. This information was consistent across the board because the information showed most of the nurses were having the same issue with this software during recent implementation. However, the nurses have been placing the needed information in a different area of the chart because of intricacies, mainly with not having enough time to find the appropriate area and balancing patient workload simultaneously. Ironically, all interviews have been consistent with the nurses placing information in a default area known as the 'Notes' section. It is amazing that every nurse which was interviewed utilizing the same software defaulted to this section. The conformability of these results came strictly from the interviews. Other interview candidates did not utilize the same software; however, they shared the same principle concern, same issues, such as, not being asked for feedback, and similar times for completing trainings.

Training and education for employees are essential when introducing and implementing new technology. Employees need ample time to learn and become proficient with new technology to utilize it with less errors as possible to decrease patient liability. The final research question was how does management implement training and education to avoid liability? The amount of time for training and education vary in facilities and amongst employees. The variances amongst training and education can result from finances to the amount of time allotted for training while simultaneously handling workloads during busy hours. The results concerning training and education varied across medical facilities. Training and education have been deemed necessary and vital to reduce liability along with finding alternate help aids to ensure employees possessed the knowledge as well as the ability to ascertain contact information in case of technology difficulties.

Demographics for the study consist of participants who are considered a sample representation of a diverse targeted population (Burton, 2019; Hinds & Joinson, 2018). The targeted population consisted of medical staff working in medical facilities; however, interviewing mass numbers of medical staff would be overwhelmingly impossible to ascertain. The sample population consisted of 17 participants, 16 were female, and one male; therefore, the study consisted of 94% females. The participants had to meet the eligibility age requirement for the study which was 18 years or older. All of the participants met the age requirement and thus were eligible to participate in the study. All of the participants worked in a medical facility that was less than 50 miles from the other medical facility.

Semi-structured interviews were conducted utilizing 13 interview questions found in Appendix A. The questions in Appendix A referenced monitoring the learning curve in the introductory phase, strategies in which the medical facility used to introduce the product, explaining the process for training, simulations, and maintaining workloads, the issues of acceptance, conflicts, and constraints, identifying and decreasing learning curve, duties of the consultant for training staff, areas of improvement, the timeframe for completing training, and the lessons learned during the training process. The questions presented to medical staff were designed to gain insight on finding the correct technology, analyzing the process, challenges with new technology, implementation processes, issues of implementation, and liability responsibility.

Research question 1. How can medical facilities account for and moderate the effects of the learning curve of employees when implementing new technologies? Participants communicated the implementation process within their facilities to reduce the learning curve amongst employees. Several participants discussed the process for implementation and length of

time for training. Transitioning to a new charting software system was a very common

characteristic amongst 14 of the sample population.

Implementation Processes. When new technology is introduced into a medical facility

management must construct a plan to disburse processes and procedures amongst medical staff.

Some cases revealed either management, super users, or job aids for guided training to teach

employees the new system which would in hopes curtail the learning curve by giving employees

a direct knowledgeable contact. Participant 1, a medical clerk, stated, "Management worked

with employees to make sure they were well versed with the technology; however, new

employees are oriented to the system more carefully". The participant communicated how

management would help employees during this time by working one-on-one with employees and

extending trainings to ensure employees possessed the knowledge. Participant 12, a nurse,

stated,

> Okay we in our office are really lucky I guess because we have a very hands on manager,
>
> who is very accessible and all you had to say is I'm falling behind here because I'm stuck
>
> on what I need to do. And she or one of the super users would, you know be right in there
>
> because we always, always say, the patient has to come first. We cannot compromise
>
> them, because we're trying to figure this out.

This same participant explained how the facility ensured they were trained, the participant stated,

"We had good training. They placed trained nurse managers known as super users of the

product, when they had reduced patient assignments, throughout the unit to spend more time

helping those individuals with the new system." Participant 3, a nurse, communicated that there

are trainings in which the employee has to complete every six months to remain abreast of

changes and updates in the facility. The participant stated,

They usually start slowly with the medical assistants, the nurse practitioners and the doctors usually because we're the ones seeing the patient, the most I mean, the nurses as well but usually we're the ones doing the paperwork side of things. So, for example like we're just starting this telehealth program right now because of the Coronavirus. So now, they're into implementing doing office visits over the phone or FaceTime. The higher uppers they usually come in and they like will take a couple of individuals, like the medical assistants and then they will take them aside, teach them how to do it, and make sure that they didn't have any questions. Select veterans will implement it with the medical assistants and we'll learn it just all together but usually it's a couple of medical assistants first, then the nurse practitioners, the doctors and then everyone else, usually kind of shifts throughout the company after that.

Participant 6, a physician assistant, stated,

A new electronic charting system was implemented and representatives from the software company that came to give us a one on one course, kind of the standard with hands on practice. It was trial and error for many of us, we used different providers and if we had an issue, we would call the other providers or the office manager for help. We were given one hour to learn the software with hands on and questions were answered during that time before we proceeded to the next step.

Management utilized the design of either management training employees or employees training employees to account for and moderate the learning curve within facilities. This design ensured there was always a knowledgeable person on staff that would be able to answer questions or show employees how to navigate through the system.

Timeframe for Training. There is an allotted time in which information has to be learned; however, this timeframe varies across the medical industry. Mandatory scheduled trainings were pertinent to diminishing the learning curve amongst employees. Management insists the trainings are learned and conducted during specific times in order to meet the given 'Go Live' date before the eradication of the old system. The data displays a wide array of time variances for learning new processes depending on the technology. The variation range for training and education with nurses varied from 4 hours for one day, one week, 3 weeks, one month, 6 weeks, and 6 to 8 months.   The timeframe range for training and education with medical clerks varied from one hour, depending on the technology, to 6 weeks. Participant 8, a medical clerk, stated, "We've gotten more hands on, because they've realized that a lot of people need hands on training and not just classroom book learning". The timeframe range for training and education for the Admissions Director was one month. The timeframe range for training and education for the dental hygienist was not given because timing was dependent upon the amount of information that needed to be learned. Participant 2, a dental hygienist, stated,

> Of course, it depends on what you're looking at if it's, you know, if it's digital x-rays that
> was pretty quick if it was something that you have to be licensed in or registered and you
> have to go take separate courses and then you have to wait on licensure after you get those
> specific courses, like say for example, if you were going back for a laser course you'd have
> to commute. I had to travel, about three hours away stay overnight, a couple of nights go to
> class and then get the certification that way. So, some of it was hands on, a lot of it was
> just, you know, written work, coursework.

Consultants from the software company were not a common fixture at the medical facilities. These were the individuals that trained managers to use the new software and then that

information was passed to the employees. The resolution for reducing the learning curve varied

amongst facilities which was calculated on the facilities finances to outsource for continuous

help or use and train current employees as power users. Participant 3, a nurse, stated,

> Well they've hired more IT experts to help us, 24 seven, they're available online and they
>
> are at the facility quite frequently. So, they're always on hand and they'll come at any time.
>
> Sometimes during downtime there is time to upload things so maybe probably every three
>
> months we have some type of download since it's only been the first year that we have been
>
> using it. There's some type of new download where they are updating the system, but it
>
> hasn't affected work, I think it just affects the speed that we're able to use our stuff.

Every medical facility does not have the luxury of having a 24/7 IT department that can aid them

through new processes. Participant 8, a medical clerk, stated, "We didn't see a consultant.

Management might have been trained by the consultant, but we didn't see anybody.   We were

given the information and told this is the information you need to know. Management trained

the employees and answered questions."

Research question 2. What strategies can be employed to proactively address the potential

issues with the introduction of new technology to increase acceptance and utilization for

enhanced efficiencies? Everyone learns differently and management may not realize the

various learning styles when under pressure and time constraints to have employees learn new

technology. The strategies that were identified through the interviews are Improve

Implementation Processes, Challenges with New Technology, and Analyzing the Correct

Technology.

   Improve Implementation Processes. Medical personnel expressed various issues during

implementation across various areas of the facility. Each job position communicated issues

during implementation which shows there is a learning curve in every area. Participant 8, a medical clerk, stated, "I will keep saying it out loud, we need more hands-on approach to everything. Everything should not be rush rush. This can't be last minute because we deal with government payers and insurances. They just need to give people the chance to actually learn it". Participant 10, an admissions director, stated,

> The only thing that I can think of as far as decreasing the learning curve is to try to give the information to you on paper first so you can actually see it. I'm one you can give me or tell me something all day long, it goes straight over my head; I have to put my hand on it. The IT department is outsourced; therefore, the call volume for help is too high. There are too many passwords with the system and a very short time to maintain the password without a notification that the password will expire. We have to call an 800 number to get help to frequently.

Integration of two systems can be an issue for healthcare professionals when information does not populate into the new system. Participant 5, a nurse, stated,

> A doctor may say, we'll see a patient in six months, but maybe the patient was seen the previous year. So, in the process of backloading everything that was in the old system trying to get that into the appointment books, some information fell off. So, there were some people who kind of got dropped out of the system or maybe it did not cross over into the new system. For example, the patient saw the doctor in November, and he was supposed to see the doctor in three months. Somehow, on some people it didn't show up. For example, maybe one doctor had already saw the patient, and he said okay we're going to repeat certain labs in three months, those labs didn't cross over so therefore you had to go back into the old system read the last dictation and see what his plan of care was in

order to come up with what the patient's do to have. We're still in some cases still having to do that because of the fact that we've had some doctors who did not like the system and left the facility; therefore, their documentation does not reflect the history of the patient.

Challenges with New Technology. This is a continuous cycle and can become very frustrating for employees. Participant 6, a physician assistant, stated,

The attending physicians corroborated on the new software but could not agree on the same version. There was a lot of pushback between the physicians and the hospital. Sometimes the hospital would choose the software in which the physician preferred but the software would be changed within a short period of time due to finances or different complications with the software.

Participant 1, a medical clerk, stated, "Everyone did not understand it because it was not easy enough; everyone is not computer literate". The technology challenges were experienced by all medical staff because of complacency with the old system and the battle of embracing change. Participant 7, and ER nurse manager, stated,

One of the biggest issues was change. Changing from the old system to the new system or the old way to the new way. Nursing is unique, you can have a very young population of staff, you can have a very much older population of staff. Some of my older nurses refused to learn the electronic system, which forced them to retire before they were ready, because they just couldn't. They could not learn it, nor did they want to learn it, and it pushed out some of our physicians as well who just learned the old system. People did not want to progress with the electronic system.

Participant 16, a nurse, stated, "The challenge was having to redo your caseload and having more work to do either before or after training because the work still has to be done". The challenges

with new technology have been either finances, training, workloads, and deciding which

software is more intuitive and whether it meets the need for the medical facility. Participant 2, a

dental hygienist, stated, "It is trying to get in the mindset that this is really going to happen. We

are not going to be processing x-rays anymore the old-fashioned way. So, it's just a mindset and

an acceptance and just having to train on it doing it over and over again".

Analyzing the Correct Technology. Participant 7, an ER nurse manager, dealt with the

guidelines of finding the correct technology. The participant stated,

> So, from the management level what we did initially was we, at the time, we were doing a
>
> plan. And after we formulated that, then we decided which system we would go with, we
>
> looked at the scope to see which product we could get that would best fit our needs, at our
>
> facility, in the sense that it was going throughout all of the system. We had to find
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> something that would be applicable to not only the doctor's offices, but to our clinics, and
>
> to our hospital. So, we had to find something that was kind of meshed in between that
>
> would go across all three of those boards. Once we found that product that we wanted, we
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> negotiated the price. And then we started to implement, then we had to build the system
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> for each individual category of needs, such as, the hospital clinic and outpatient areas. So,
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> we built this with management, and with the physicians, because we had to actually build
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> the things that we wanted to audit documents. This would prevent unnecessary
>
> documentation because that's how we get paid, on our documentation. So, depending on
>
> what the government was looking for curtailed how we built our programs, so that we
>
> could audit those specific areas.

Participant 7 was the only interviewee which played a role in helping the medical facility find

technology that would meet the needs of the various areas of the hospital. The participant

continued by stating, "I would say that we knew we had $2.5 million to spend on a system which was in our agreement. The company had to do what they said they were gonna do and follow through with that". The other participants were not aware of the processes for finding new technology.

Research question 3. How does management implement training and education to avoid liability? Patient care is top priority in healthcare. Technology continues to evolve in every area of medical facilities; therefore, management and medical staff must be aware of liabilities before, after, and during implementation. Themes related to Training and Education are Areas of Improvement and Liability Responsibility.

 Areas of Improvement. Participants expressed areas which needed improvement and concerns for future implementations. Participant 7, an ER nurse manager, stated,

> They could have gotten feedback, they could have gotten us back in there after we had real time hands on with real patients. Upper management did a disservice to my staff. Once we started a new system and it was rolling, they should have met up for feedback with each other on how the system was working; this did not happen. They should have brought the team together after working in the system for a few months and asked questions, such as, do you have any questions? What have you learned? What can you do, what can't you do? A lot of nurses were having trouble finding things in the system. I feel like this is where we let our staff and patients down because our staff still to this day struggle with 'where' and 'how' finding things and 'how' do you charge and we've had the system for two years with the same problem.

Participant 1, a medical clerk, stated, "Management should have spent more time in the system before bringing it to us. We experience a lot of errors during implementation. They continued to

work with individuals basically one on one to make sure questions were answered". Participant 14, a nurse, stated, "Errors were documented as they occurred and communicated to other employees to avoid future errors". Participant 5, a nurse, stated,

> There are some areas where we hit limited access. First, they gave us that access but then they took it away. I'll use for example, I could never understand, I'm a nurse, but yet there was a medical assistant who had a button which allowed permissions or access to certain patient information. The medical assistant was able to see patient medication from the pharmacy and the last time they had the medication. The nurse practitioner and the doctor had that accessibility but as the nurse, I didn't have that on my program. So, we questioned the permissions and they took that access away from the medical assistant. Access was only given to the doctor and nurse practitioner. This is a continuous issue because nurses don't have access to this information because it is a violation of HIPAA. For instance, if a patient has a prescription filled at Walgreens, I won't be able to see what's being filled because it's a violation of HIPAA. I feel, I should be able to see this information because patients sometimes mispronounce medications, or they don't remember which can cause an error. Management is still looking into this process improvement.

Participant 9, a nurse, stated,

> Management could have allowed us to spend a little more time in the system because some are nursing students and have to deal with a whole new experience. There are some experienced nurses that are a little too proud to ask for help, so, other nurses will help. However, management conducts audits to make sure information is correct and if an error is found then management will ask the nurse for clarity.

Liability Responsibility. Patient care is essential and should not be compromised under any circumstances. Participants communicated avoidance of liability during a learning curve while learning new technology. Participant 17, a nurse, stated,

I am totally focused on patient care and totally fearful of making mistakes. Sometimes, I feel like that all of this technology gets somewhat in the way of what's most important to me and that's being with the patient and being sure I am not distracted by charging or anything I feel like technology wise I have to do; that's because it comes with more difficulty for me. I have to be sure that I don't let that get in the way of taking care of my patient because I don't want to hurry and make poor decisions because I have to chart on the computer. Overall, I see it both ways, I see quite a lot having spent time in the hospital with my brother and various family members and how some of this technology is getting set up to taking care of the patient. The nurse comes in your room, and she's got a computer on wheels. And she stands behind that the whole time she's in there, talks to the patient, never goes and gets on the other side of the computer and touch the patient. If that is your focus, then you are going to miss things, you're gonna make mistakes, but, I, also, see them using that as a medicine card, no double-checking armbands but clicking on medicines to see if it is a match for the patient and that decreases the margin of error.

Participant 15, a nurse, stated,

We need to be really comfortable with the equipment that we are using, be open and honest at what you need because everyone is learning at a different pace. Education is knowledge, and knowledge is making you feel better. You have to get the proper training and education as needed for any change; therefore, healthcare professionals must speak up when they need more time to learn.

Participant 1, a medical clerk, stated,

It is important to know the program, know what you're supposed to do, know what needs

to be submitted, be knowledgeable of the program before actually trying it on a patient and

this will reduce liability and the learning curve because the employee will have more

confidence when using the new software.

Participant 6, a physician assistant, stated,

It would be interesting to have modules done with the whole joint team together.

Typically, they will give a small modular course for the team, then the demonstrations for

me and my attending are separate. So, it would be really interesting to see how things

might improve if we could do it all together. A lot of issues are made or kind of when our

procedures get slowed down, for example, the tech hasn't used this particular system in a

while because they haven't been working with us, they've been working with other

surgeons because it's kind of a random schedule, so they don't remember some of the

nuances of the system. This is the same situation for the second shift group whereas

they're not commonly with the neurosurgery group, so, then they get thrown in at the end

of the case where it's no longer the hardware stuff and they just have no idea what they're

doing because they're not exposed to it. It would be beneficial to take courses with the

whole team and the attending physician and have the second shift train as well, but that's

costly and they're going to say well they don't do it very often so it's not worthwhile for

them; however, it would definitely be worthwhile to help make things go a lot smoother

and help decrease the learning curve.

Evaluation of the Findings

The analysis indicates that there is a learning curve in medical facilities amongst medical staff when new technology is implemented. The findings expound on the conceptual framework, identify the learning curve, and address how to minimize the learning curve amongst medical staff during the implementation of new processes.

Research Question 1. How can medical facilities account for and moderate the effects of the learning curve of employees when implementing new technologies? The themes for moderating and accounting for the learning curve amongst employees consist of Implementation Processes and Timeframe for Training. The results confirmed the essential need for management to acquire beforehand knowledge of information training before passing it on to other healthcare professionals and the effective use of job aids which assists with frequently asked questions and 'how to' guides. Application consisted of training management, medical staff via courses, access to IT staff, and super users. Healthcare professionals were able to grasp the knowledge of the product, extensively train employees, answer questions, reduce caseloads in some facilities, and adapt to instant changes due to the pandemic (Musaji, Schulze & De Castro, 2020; Rubinkiewicz et al., 2020; Soliman, et al., 2020) . Medical staff was very concerned about balancing workloads and learning new software without compromising patient care. Training started with administrative staff before moving up the hierarchy to ensure patients were considered top priority.

The timeframe for training on new software varied amongst medical facilities. Ranges were vastly different amongst facilities ranging from 4 hours a day to 8 months. However, depending on the training, the healthcare professional may have to undertake more trainings to obtain licenses and certifications which may consist of travel if the simulation course is not

offered at that facility. Overall, data shows management worked with medical professionals on every level to ensure there was time to learn the newest software and balance workloads.

Research Question 2. What strategies can be employed to proactively address the potential issues with the introduction of new technology to increase acceptance and utilization for enhanced efficiencies? The strategies used to proactively address issues with introducing new technology and increasing acceptance for enhanced efficiencies consisted of being knowledgeable of implementation issues, knowledgeable of challenges, and finding the correct technology for the facility and staff. The results confirmed the challenges of doctors wanting or needing preferred software, but the facility had reasons for utilizing a compatible software due to finances or government mandates (McKenna, Dwyer & Rizzo, 2018). Other challenges consisted of 'computer literacy' which affected the tenure population who did not adapt well to change (Meyerhoefer et al., 2016). This caused medical facilities to lose experienced nurses and doctors because of the learning curve they experience, incomprehension of the newest software, nonacceptance of change, and increased workloads. The data did not display a definitive answer for the best strategy to obtain acceptance because the final answer is based on the 'mindset' of the employee. The employee has to take the allotted time to learn the new software to remain employed and knowledgeable of new features that will aid in patient improvement (Rubinkiewicz et al., 2020). Medical facilities continued to move forward to meet training deadlines and making decisions on the best software for its facility. Communication was the essential key with staff to ensure they were aware of changes and trained in a timely manner.

One of the ultimate issues was finding the correct technology. A medical facility may utilize different types of software; however, the software had to be applicable to that specific

area. The results showed management collaborated and analyzed several software products

which may have been tweaked for various areas of the facility to ensure employee access and

integration between systems. There were limited results on finding the correct technology

because the data only shows one candidate's participation on this team. Other candidates were

not aware of the processes in which upper management used to choose the correct technological

product for the facility.

Research Question 3. How does management implement training and education to

avoid liability? Participants communicated areas of improvement to avoid liability after

completing training. Participants expressed the need for upper management to collect feedback,

on training and after the 'Go Live' date. Results showed that upper management did not revisit

with staff to gather information concerning the pros, cons, or lessons learned for improved future

processes. More areas of improvement consisted of management spending more time in the

system, working continuously with employees one-on-one, access to previous patient file history

for improved patient care, allowing more time for hands-on training, encouraging staff to ask

questions, and conducting frequent audits which will increase improvement and decrease errors

(Daud et al., 2019; Gustafsson et al., 2019; Hatala et al., 2019).

These areas of improvement will offset liability and increase patient care. Data

confirmed that patient care is the number one priority in the medical facilities, regardless, of the

new technology. Staff will ensure the patient is not in a crisis, tend to their needs, and avoid new

technology distraction especially if they continue to view themselves as a novice before risking a

liability to the patient. Other areas to avoid liability are communicating with the patient,

verifying medical armbands, becoming affluent with the software before introducing it to a

patient, training working teams together instead of separately, frequent training with backup

teams to increase proficiency and employee confidence that will decrease both the learning curve and liability in the facility.

Summary

The results confirm that there are variances in training and education across medical facilities. Training is essential in decreasing both the learning curve and liability in facilities. Medical professionals have expressed the necessity to become more familiar with new technology in order to feel confident to utilize the product in the most efficient and safe way for patient improvement. It is pertinent for upper management to analyze technology and make the appropriate decisions based on the mandates received; however, it is their responsibility to ensure employees are versed, knowledgeable, and their reactions are taken into consideration to understand the daily problems and concerns that could be curtailed or avoided for patient safety.

Data has shown medical staff is continuously working with a learning curve and striving their best to avoid liabilities in the workplace. It is imperative to decrease the learning curve in medical facilities by considering the voice of medical staff, listening to their experiences while working with patients, recognizing the hurdles of trying to learn new technology, understanding the hurdles of being unfamiliar with new technology and balancing heavy workloads, continued software support, and more frequent hands-on training. The learning curve remains within these facilities as medical staff has found a workaround process when they are not able to find or insert pertinent information in the deemed designated area. Management has to conduct frequent audits to ensure information is logged in the assigned area for proper reporting and reduction of liability.

Chapter 5: Implications, Recommendations, and Conclusions

The problem addressed was the identification of issues learning curves may have on the implementation of new technology and identify guiding principles that consider the learning curves of employees. The purpose of this qualitative case study was to recognize the concerns when implementing new technology and develop a standard or platform that accounts for and minimizes the issues associated with the learning curves of employees. This chapter will discuss findings based on the interviews, and related to research articles, on medical facilities and the moderating effects of the learning curve on employees when implementing new technologies. It will discuss employed strategies to proactively address potential issues when introducing new technology to increase acceptance and utilization for enhanced efficiencies, and ways in which management has implemented training and education to avoid liability.

Qualitative descriptive research was used for this study to capture the perception and personal experiences of medical personnel during the existence of a current problem. Semi-structured interviews were utilized to capture more detailed information concerning on the learning curve and feedback for process improvements to decrease this issue. The interviews were scheduled to be conducted in person but due to the pandemic some interviews were conducted over the phone. Participants were willing to participate in the research brought awareness of the learning curve which is experienced by many during implementation of new technology. The research was structed to capture the conceptual framework which consisted of finding the correct technology, analyzing the process, challenges with new technology, implementation process, issues of implementation, and liability responsibility.

The results have shown a learning curve in medical facilities amongst employees. Participants expounded on the learning curve, training, timing allotted for training, challenges,

and liability during interviews. The evolution of technology is inevitable and medical staff will continue to experience learning curves through the implementation of new technology; therefore; it is pertinent to listen to the feedback of medical staff and take into consideration the lessons learned and time for training to build confidence and knowledge when using technology. These qualities will increase patient care and decrease liability.

The limitations for this study consist of the elements in which the researcher has no control during the process. The results show one participant which mentioned they were given a specific amount of money in which they were mandated by the government to meet guidelines. Therefore, the implementation process and chosen technology would consist of the required standards given by another party in which the facility supported. There were other limitations in the study which consisted of changing in person interviews to phone interviews due to the pandemic. Another limitation was depending on the knowledge of the participants to recollect process and procedures for choosing and analyzing the correct technology; however, most participants were not exposed to this previous knowledge.

The chapter will conclude with implications, recommendations for practice, recommendations for future research, and a conclusion.

Implications

The learning curve which resides in medical facilities is an important issue in which upper management will need to remain abreast. According to this study the effects of the learning curve is experienced from medical clerks, nurses, physician assistants, dental hygienists, and an admissions director. This affects a great majority of medical personnel which have taken the oath to save lives; therefore, it is of the utmost importance to decrease liability and improve training processes to enhance confidence and knowledge amongst staff. Research has

corroborated with participant 17 in communicating that new systems required medical staff to learn its functionality which require adjustments in timing, for example, a physician stated, "It takes more time to create the same document that I could either have hand written or, more frequently, dictated. It just takes more time, more time to go from screen-to-screen, more time to generate the diagnosis code, the orders, the dialogue of the plan, the plan of management" (Meyerhoefer et al., 2016; Parthasarathy et al., 2018).

   Research Question 1. How can medical facilities account for and moderate the effects of the learning curve of employees when implementing new technologies? Research has shown that medical facilities can moderate the effects of a learning curve through implementation processes and lengthening the timeframe for training (Coustasse et al., 2018; Harvey et al., 2018; Holland, Hatcher, Meares, 2018; Zeng, 2016). The implementation process and the timeframe for training were two key themes which participants mentioned during the interviews.

   During the implementation process management notified employees of a new software and then scheduled tutorial classroom instructions and demonstrations for application. Participants mentioned management working with employees during the training process or the use of super users which are individuals chosen to learn the product to help medical staff learn the product during training or answer questions after implantation. Friedman et al. and other studies have shown that during the installation of new software, workloads were reduced for employees to learn the system to have adequate hands-on experience to develop confidence and lower the learning curve rate amongst employees (Friedman, 2017; Hatala et al., 2019; Meyerhoefer et al., 2016; Panek et al., 2020; Parthasarathy et al., 2018).

The timeframe for training employees is very essential to ensure they have become familiar and comfortable with the software. Participants in the study have communicated more hands-on experience and extra time for training will increase productivity with software and decrease liability with patients. Case studies have shown physicians reduce the learning curve and liability to a patient when they have frequently and consistently utilized software and conducted procedures with multiple trainings consisting of hands-on-experience (Nachira et al., 2018); Panek et al., 2020; Parthasarathy, Steinbach, Knight & Knight, 2018; Schaeffer et al., 2019). Increased and frequent trainings with hands on experience decreases the learning curve amongst users.

Research Question 2. What strategies can be employed to proactively address the potential issues with the introduction of new technology to increase acceptance and utilization for enhanced efficiencies? Strategies to proactively address potential issue with the introduction of new technology to increase acceptance and utilization for enhanced efficiencies are understanding the issues of implementation, understanding the challenges with new technology, and finding the correct technology. Participants communicated issues during implantation of software which consisted of not enough time to learn and train on the software, various learning abilities, outsourcing the IT department which means longer wait times before receiving a resolution, lack of permissions in the system to obtain patient information, and poor integration whereas some of a patient's information may not have crossed from the old system into the new system. There have been several case studies where medical facilities have experienced these issues. Depending on the length of a patient's history, the entire file may not cross over into the new system which can cause harm to the patient and it will take longer to

review the old system for the patient's history (Burrowes, 2014; Nielsen, 2015; Schreiber, 2013; Vaughn, & Breeden, 2016).

There are challenges with new technology that must be taken into consideration during implementation, such as, cost of the product, complacency with the old system, rejection of change, workloads, and possible certifications. Participants discussed complacency with the old system which merged into the greatest challenge which was rejection of change. Medical staff had become comfortable with current systems; therefore, learning a new system and undergoing change was not accepted by all personnel. Case studies have shown rejection of change amongst employees due to different comfort levels with technology (Birkhead, 2017; Parthasarathy et al., 2018; Thomas, 2017).

Most hospitals receive guidelines from another entity such as the government which requires the facility to implement technology that meets guidelines to obtain funding and improve processes for both the staff and patients. There was only one participant in this study who elaborated on management analyzing technology and ensuring the chosen technology met the guidelines due to the source of funding. Other participants in the study were not aware of funding or the analyzation process for finding the correct technology. Studies have shown management has to consider the overall organization, for instance, the hospital and clinic, analyze the process across the board and ensure the technology will meet the needs in its entirety (Alami et al., 2020; Bowling, 2015)

Research Question 3. How does management implement training and education to avoid liability? Increased liability in healthcare can become costly for both the patient and the facility. Management has to decrease the learning curve amongst medical staff in which studies have shown that it will simultaneously decrease liability. Participants have expressed feedback

as an area for improvement. Research has shown feedback from employees during and after training, documentation of errors, documentation of questions, access permissions, more training time, working together as teams, and frequent audits helps to improve employees' skills for increased productivity. Existing research has shown feedback is essential to obtaining an adequate assessment of performance and incorporate information for future practices (Avgar, Tambe, & Hitt, 2018; de Godoi Montes, Rodrigues & de Azevedo, 2019; Nissim et al., 2017). The information gathered from employees can be utilized to solve frequently asked questions, correct aspects of the system that are visited more frequently and improve timing for entering information into the system and decrease the learning curve.

Each medical personnel along with the facility is responsible for the liability of the patient. The overall goal is to ensure that patient care is the top priority and should not be sacrificed at any cost. Research has shown medical personnel criticize new technology when they have to spend more time inserting information into the computer than spending time with a patient. However, this study has shown medical personnel will ask for help from coworkers who find the system more feasible to insert information while the patient is receiving care. Research has shown liability is reduced when the learning curve has been reduced by frequent trainings which allows the employee to become confident with new software (Aydin et al., 2017; Griffin, 2016; Richards, 2016).

Recommendations for Practice

There are two triggers which will implant fear and lack of confidence in experienced professionals and possibly cause the medical field and/or facility to lose its more experienced personnel in the industry and that is 'change' and 'new technology'. Replacing old knowledge and skillsets with new techniques can be overwhelming for a professional who has practiced the

same technique for years causing a lack of confidence in continuing in the field or learning new software. This study has shown there is a significant learning curve amongst medical personnel which can increase liability for the facility. Medical personnel continue to experience changes with technology as it continues to evolve. The findings display that medical personnel would like management to gather feedback from medical personnel during and after the implementation process, as well as allow more time for training. Case studies depict a significant relationship between the reduction of a learning curve and multiple simulations or hands-on experiences with new software. Rigorous training, documentation of errors, repetitious use of new technology, and feedback from employees are essential to decreasing the learning curve and will aid in implementation for future technology.

Recommendations for Future Research

Based upon this research, future researchers can begin to build upon this study by studying and observing specific groups in a medical facility, such as, a group of nurses or a group of physicians. The researcher can examine a closer look at the feedback of personnel within groups to aid in designing a plan or giving a better understanding of the needs for that group to decrease learning curves and liability. This will aid in understanding the relationship between repetitious training, feedback, and errors as it relates to the learning curve of new technology. Second, another aspect for research would be to inquire about the software, in other words, investigate if the issue is with the same software across hospitals within the same city or if the issue and complaints are with that specific product. If it is the same product, then the feedback from staff can be submitted to the technology company on trying to make the system more intuitive, less time consuming, and effective can ignite a win-win situation for both the facility and the technology company. Real time examples of the bottlenecks during use of

technology will be instrumental in curtailing the prominent negative aspects of the software.

Third, another aspect for research would be to conduct an ethnography study amongst the staff

and write from experiences by submerging in the culture. This will allow the researcher to

understand balancing workloads, timeframe for learning new technology, and the intricacies of

the learning curve while developing a tentative plan for improvement. Finally, another aspect for

research would be to examine and calculate the experienced talent which is forced into

retirement or exiting the medical field due to the learning curve or new implementations of

software and the affects it will have on the industry or the medical facility.   This will allow the

researcher to gather information that may limit the premature departure of needed experience in

the field.

The limitations for this study consist of mandates from other entities which require

medical facilities to either find a product to meet guidelines within a given price range or it

mandates the facility to implement a specific technology; therefore, responses may be biased.

Another limitation for this study is the recollection of the interviewee. There may be some

information unknown, forgotten, or not articulated in a way for the researcher to capture

findings. This can be improved by communicating with upper management or personnel who

has been given the authority to setup processes for training staff or the individual who oversees

the implementation project or reviews the contract/proposal.

The next logical step in this line of research is to bring awareness to medical facilities on

findings while research continues to expound on this topic. Awareness will give management

knowledge of obstacles that may have become hinderances during implementation while giving

them another view for refining trainings and simulations for success. Also, bringing awareness

to the software company for more intuitive products or create a document for 'things to know'

will aid employees in understanding the software.

Conclusions

Advanced technology is inevitable and will continue to revolutionize the medical field as

techniques progress towards better healthcare and patient recovery. The healthcare industry

wants to continue to introduce innovative ideas that will allow medical personnel to review

patient information with a touch of a button, transfer patient information and medical orders with

a touch of a button, allow patients to review their results, protect patient information, and give

staff the best tools/equipment to treat patients for improved care. Technology is the key to

meeting various needs in the industry but in order for it to be effective personnel must have the

proper training to reduce the learning curve and liability.

In the past few months, the medical industry has needed all hands-on deck as the world

experienced a global pandemic. During this crisis, medical facilities became desperate and

pulled the verbal alarm for all medical personnel whether retired or active to report to work.

Medical personnel traveled across the country to hotspots leaving their families to risk their lives

to save others. Technology continues to be essential in saving lives; therefore, it is imperative to

have personnel who understands the technology to easily show others, for technology companies

to create intuitive software for times of crisis, and to inquire and gather feedback from the

individuals who utilize the product during slow and heavy workloads utilizing that information

to help reduce learning curves and liabilities amongst facilities. This is an issue that will not go

away; however, it is an issue that can be improved to save many lives.

The results of the study have shown there is a significant relationship between repetitious

training, learning curve, and liability in the medical industry. Research has shown a substantial

difference in the learning curve and liability when staff has been allowed to repeatedly train on software. Results show a decrease in the learning curve when employees continue to utilize a product, learn the errors, improve upon those errors, and multiple sessions of hands-on experience or find alternative avenues to be effective. It is imperative to choose the correct technology, analyze the process, understand the challenges with technology, implementation process, issues of implementation, and the liability responsibility to have an effective product.

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Appendix A: Interview Questions

1. How does the facility monitor/consider employee learning curves during the introductory process?

2. What strategies has your medical facility used to introduce new technology?

3. Explain the process and procedure for training, simulations, and maintaining workloads?

4. What are the most important issues which staffing faces for acceptance of implementation (of new technology?) and what were the conflicts and constraints?

5. How did the managers secure and ensure implementation for patient improvement?

6. Describe how the facility identified and decreased a learning curve amongst staff?

7. What was the duty of the consultant to ensure staff were properly trained before implementation?

8. What were areas of improvement from implementation?

9. How were errors utilized as a lesson learned during the training process?

10. What was the timeframe for completing training?

11. Were there any allowed variances in the timeframe for training completion? Please explain.

12. Explain improvement processes for decreasing the learning curve in a medical facility before execution of the program.

13. With your expertise and experience, what would you change to improve patient care when dealing with a learning curve to avoid liability?