AMERICAN UNIVERSITY OF BEIRUT

A CASE STUDY ON THE EFFICACY OF PYXIS TRAINING FOR REGISTERED NURSES AT AUBMC

by
LOUAY FOUAD MOUSSA

A project
submitted in partial fulfillment of the requirements
for the degree of Master of Human Resources Management
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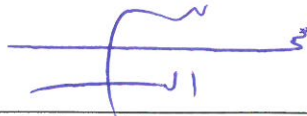# A CASE STUDY ON THE EFFICACY OF PYXIS TRAINING FOR REGISTERED NURSES AT AUBMC

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AN ABSTRACT OF THE PROJECT OF

Louay Fouad Moussa   for   <u>Master of Human Resources Management</u>
                                          <u>Major</u>: Human Resources Management

Title: <u>A Case Study on the Efficacy of Pyxis Training for Registered Nurses at AUBMC</u>.

Automated dispensing cabinets are quickly becoming the solution of choice for medication dispensing and administration. They are highly computerized medication storage cabinets that improve safety, availability and medication administration efficiency. Aligned with its 2020 vision, the American University of Beirut Medical Center (AUBMC) launched the Pyxis Carefusion automated dispensing cabinets on May 4th,2018 which changed the whole landscape of medication administration at the medical center. Registered nurses at the AUBMC were the front line users of this new system; hence, their training was pivotal in the success or failure of the launch. With that being said, the nurses faced several problems in handling the various processes of the Pyxis cabinets, which affected the quality of care given to the patients. This was tracked back to the training program they acquired. Hence, this case study aims to examine the efficacy of training done for the registered nurses at AUBMC regarding the Pyxis automated dispensing cabinets. The names and scenarios in this case study are ficticious. It would be significant for both graduate and undergraduate courses on human resource and management; specifically in the training and development aspect. The students are required to analyze the training that was done at AUBMC and draw recommendations for areas of improvement which would improve the efficacy of the training.

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EXHIBITS

To

My Beloved Family

CHAPTER I

LITERATURE REVIEW

Automated Dispensing Cabinets

Automated dispensing cabinets (ADCs) are quickly becoming the solution of choice for point-of-care medication administration (Stachowiak, 2013). They are highly computerized cabinets for medication stocking and dispensing. Indeed, with the rise of technology, hospitals around the globe are implementing ADCs and new up to date hospital information systems (HIS) in order to improve the quality of care. Literature shows that implementing a health information multifunctional system has several benefits that include enhanced monitoring and surveillance, increased guideline based care delivery, decreased redundant care, and reduction in medication errors (Chaudhry,Wang,Wu, Maglione, Mojica, Roth, Morton&Shekelle, 2006). With that being said, the implementation of these systems is not without its drawbacks especially for registered nurses who are the main users of these cabinets and systems. The process in general is to go to the ADC; remove medications for just one patient at a time from the drawers (one medication at a time and one drawer at a time); administer the medications; open another computer and chart the administration; then repeat the process for each patient(Stachowiak,2013). However, new problems have risen from these ADCs, which include delay in nurses' access and retrieval of medications. This is due to several aspects one of which and most importantly is inadequate training for registered nurses (RNs) on how to properly handle these new cabinets. Thus, when implementing a new system that affects a whole organization and not only nursing alone, it is essential to manage this change adequately to achieve positive results.

Change Management

Markus (2004) stated that organizational change management experts argue that change efforts should focus on the people affected by the change.Several tactics are needed to ensure success. These include assessing people's readiness for change, devising new ways to manage and reward people, training them and involving them in planning the implementation of change (Markus, 2004). The training as well as the involvement of the employees is perhaps the most important aspect in the success of any major change that occurs in organizations especially in information technology. When it comes to change management, John Kotter who is a pioneer and expert in the field believes that organizational, change can be managed using a dynamic, nonlinear 8-step approach. The steps in his model include the following: increase urgency, build guiding teams, get the vision right, communicate for buy-in, enable action, create short-term wins, do not let up and make it stick (Campbell, 2008). In his article "Leading Change: Why Transformation Efforts Fail", John P. Kotter identifies several steps needed in leading and managing change in an organization. Two important steps are forming a powerful and guided coalition and consolidating improvements. The first includes assembling a group with enough power to lead the change as well as encouraging them to work as a team. The latter includes hiring, promoting, and developing employees who can implement the vision as well as reinvigorating the process with new projects, themes, and change agents (Kotter, 2009). Thus, for any change to be successful, the initial coalition needs to be powerful and built on information, expertise and relationships (Kotter, 2009). In AUBMC, this initial coalition includes the nursing administration as well as the Nursing Clinical and Professional Development Center (CPDC), IT and Pharmacy departments. More importantly, it is the

promotion or hiring of change agents that is essential in guiding and applying the change in the organization. The guiding team needs to increase the commitment that individuals and groups have toward the change project. This means getting change initiates to take action and participate in the change project (Campbell, 2008). In the case of integrating ADCs in a hospital setting, the change agents include "super users" who are registered nurses that are trained more extensively on how to handle ADCs. They have the duty to create and communicate the vision as well as the responsibility in training the registered nurses in properly handling the ADCS. Super users act as a resource and liaison between several hospital departments and IT. They have the role of assisting in the design and standardization of electronic documentation templates to meet regulatory standards (McNeive, 2009). In addition, super users have the task of educating the staff about electronic system changes and updates. Hence, they play a major role in training end users about the new system. Furthermore, super users play a role in establishing and maintaining documentation guidelines for electronic documentation through collaboration with ancillary departments (McNeive, 2009). They have the responsibility of identifying and solving system problems related to interfaces, order entries and pharmacy (McNeive, 2009). As a result, the training program for super users and subsequent end users that is essential for the success of the implementation of these cabinets. Top management needs to invest and include their employees in the training process. More importantly, Kotter stresses the pivotal role of training in the empowerment process and he has broad empirical support for this assertion (Appelbaum, Habashu, Malo&Shafiq, 2012). Indeed, for a change of such magnitude to succeed, organizations have to include all levels of hierarchy in the change process with emphasis on empowering their employees through proper training, and engagement.

Training Benefits

For training, every session's main objective is to add value to the performance of the employees (Elnaga& Imran, 2013). The training is done to enhance previously attained skills or acquire new skills that would improve job performance. It allows employees to build their competencies and skills in order to perform their job adequately and effectively. Training has several benefits for both individuals and teams in organizations. These benefits include improved performance as well as variables that relate to performance directly and indirectly. Direct performance variables include innovation and tacit skills, adaptive expertise, technical skills, self-management skills, cross-cultural adjustment. On the other hand, indirect variables include communication, planning, and task coordination in teams (Aguinis&Kraiger, 2009). However, the scope of training surpasses the individual and team to even larger levels that include the organization. For organizations, these benefits can also be direct or indirect. Direct benefits positively affect organizational performance through profitability, effectiveness, productivity, and improved quality while indirect benefits include employee turnover, organization's reputation, and social capital (Aguinis&Kraiger, 2009). In addition, training is pivotal in achieving a competitive advantage as the success or failure or an organization relies on the performance of its most valuable resource, whichis its employees. As a result of these benefits, designing and implementing a training program is of high priority to any organization seeking change. Thus, organizations must invest in training programs to improve employee and organizational competency and productivity (Elnaga&Imran, 2013). They must focus their training keeping in mind the needs of both their individuals and the organization as a whole. The program must have clear and attainable goals and objectives (Elnaga&

Imran, 2013). The target is to maximize the benefits of training to their employees.

There are several methods to maximize the benefit of training. According to Aguinis&Kraiger, the emphasis is on pretraining states, design and implementation, and post training evaluation (Aguinis&Kraiger, 2009). Conducting a need assessment allows the identification of gaps and competencies that the training must focus on while subject matter experts provide the knowledge and experience needed to plan and organize the training. This is highly important when implementing information systems in healthcare as the nurses are not familiar with the technological aspect. As for the design and delivery, the application of appropriate training design and delivery methods can help maximize the benefits of training (Aguinis&Kraiger, 2009). Here comes the role of the leading team in regards to planning and implementation.

Planning & Implementation

Ehie&Madsen (2005) divided the planning and implementation process into five main phases. Phase one is project preparation where the leading team must perform a comprehensive planning process that would determine the budget targets and the project plan that will follow.The project manager or team is responsible for assigning roles and responsibilities to other team members, developing and maintaining timelines, tracking the progress of each aspect of the implementation, and managing routine issues that arise (Weathers &Esper, 2013). Phase two is the business blueprint where the project team must analyze existing business processes as a background for appropriate system selection and extensive training on the processes (Ehie& Madsen, 2005). Here the analysis plays a major role to provide a baseline for which the project management framework can be built upon. Phase three is realization, which develops the technical foundation of the system. The project manager or team must coordinate with the vendor

in order to map out all the steps and changes that will occur during this change process. All data must be analyzed and edited for efficiency and accuracy. Decisions around data conversion, specifically what, how much, and in what form old data should be brought into the new EHR, will have significant post implementation consequences (Weathers &Esper, 2013). Hence, careful planning and coordination between the leading team and the departments involved must be carried out efficiently. After the correct data is cleared, the team must begin hardware installation by assessing the need for every floor in order to set up the correct amount of dispensing systems. Construction, hardware, and infrastructure needs should be simultaneously assessed while workflows analysis is occurring (Weathers &Esper, 2013). It is important to coordinate with the IT department as they play a major role in installation, maintenance and supply of network equipment. After all is set, a timeline should be created and the go-live date set and communicated; no absences from the practice should be allowed during this time (Weathers &Esper, 2013). The selection of this date is integral for the implementation process with assistance from the vendor's project manager. Sessions must be held for review of new data and workflows and must be accessible to all staff of practice. The end users will have a view of what the end-result will look like in order to be better prepared for it. They should be satisfied with the proposed workflows and build (Weathers &Esper, 2013).

Phase four is the final preparation where the end user and any employee who will have direct use of the system will go through an education and training process in order to understand the data flow and system processes (Ehie& Madsen, 2005). As for training itself, the end user training plays a major role in the success or failure of implementing a new automated dispensing system. Adequate and role specific training must be implemented with emphasis on not only the technical aspect but also the

workflows of updated policies and procedures (Weathers &Esper, 2013). Since applying a new medication dispensing system is a complicated matter, extensive sessions must be done. Multiple training modules that demonstrate different software functionalities must be presented through extensive training (Marler, Liang &Dulebohn, 2006). The trainers will break down the system into learnable parts, which will allow the trainees to learn different small tasks easily. Scheduling, frequency and resources used in the training differ from one organization to another. Thus, careful assessment and planning is essential before any training. After the formal training is done, employees must have access to the system in order to practice their skills between the time of training and implementation as the learning process must continue outside the classroom (Marler*et al.*, 2006). After the training is done the fifth and final phase is the go live and support phase where the system is launched and evaluated for further modifications (Ehie& Madsen, 2005).

Post-Training Evaluation

For post training, a continuously overlooked aspect includes the post training evaluation. The goal for evaluation is to improve training by identifying which aspects were successful and which need improvement (Topno, 2012). Evaluation can assist in determining whether the training objectives are met, deciding who should participate in future trainings, gaining insight for effective future programs, and conforming to updated policy guidelines (Topno, 2012). Hence, proper evaluation is essential for future success of training program at any organization. There exist several evaluation models that can be used to evaluate a training program. The most commonly used is the Kirkpatrick model. This model measures four outcomes that should be achieved in any effective training program. The first is reaction, which includes evaluating the

participant's feelings towards the training. The second is learning which measures the extent the trainees learned new knowledge and skills. The third is behavior, which evaluates the extent job behavior had changed as a result of the training that occurred. Finally, the Kirkpatrick model measures the result, which is an evaluation of the effect of training on the business environment such as profit, and return on investment (Topno, 2012). Though other models are used for evaluation, this model is the most commonly used as it focuses not only on results, but also on behavioral outcomes of training(Topno, 2012). Hence, usingpost-training evaluations is a great method to measure the success of the training program while allowing the evaluators to identify gaps and deficiencies that can be used to improve future trainings.

Automated dispensing cabinets are quickly becoming the leading method for medication stocking and administration in hospitals around the globe. They possess several benefits including efficiency, safety and accuracy in dispensing and administering medications. With AUBMC being a center of excellence and a leader in the medical and nursing field, it launched its 2020 vision that aimed to provide the highest levels of quality patient care. As a result, they launched the Pyxis Carefusion automated dispensing cabinet on May 4th 2018 which revolutionized several medication related processes. However, this launch was hindered by several problems including failure to retrieve, override and document medication administration by the nurses. This was tracked back to the inefficient training done for the registered nurses at AUBMC regarding this new system. Therefore, this case study aims to highlight the efficacy of the Pyxis training done for registered nurses at AUBMC. This case would be significant for both graduate and undergraduate course on human resource and management; specifically in the training and development aspect. It emphasizes the importance and impact of proper planning, designing and implementing a training module for nurses on

a new kind of technology. It will allow the students to understand the benefits of

training. In addition, it will enable them to tackle the various aspects of planning and

implementing a training module for nurses as well as recommend methods to evaluate

the effectiveness of training.

CHAPTER II

CASE STUDY

Training of Registered Nurses on Pyxis Carefusion at the American University of

Beirut Medical Center

On August 3rd 2017 a life threatening sentinel event occurred on the Neuro

medicine floor at AUBMC. A 25-year-old male known to have a history of epilepsy was

admitted for an increase in his seizure activity. The medical plan was to monitor the

patient for any seizure activity and administer the appropriate pharmacological

treatment once they occurred. Upon receiving the patient from ER and during transfer to

his bed, the incident occurred. The patient's eyes suddenly up rolled accompanied with

tongue biting and vigorous shaking of all his extremities. The patient was in what is

known as status epilepticus, a life threatening seizure event. The medical plan was clear

which involved immediately giving him 10mg of valium on site. However, due to lack

of availability of the medication on the floor as well as the slow medication dispensing

and delivery process, the valium took more than 30 minutes to be administered. By

then, the patient's seizure had caused respiratory distress by which he needed intubation

and transfer to the intensive care unit. As part of the medical center's sentinel event

process, an incident report highlighting the details of the event was documented and

sent to the nursing director Rania. Upon receiving the news, Rania collected all the

similar previous incident report relating to medication administration delay. She was

shocked to find out that medication delays/ errors occur at a high rate at the AUBMC.

Rania then sat in her chair with a sense of shock. These results did not reflect

AUBMC's reputation as a center of excellence and a leader of patient care in Lebanon

and the Middle Eastern region. As a result, several meetings were done with various

directors of Medicine, Pharmacy and IT. They discussed several organizational changes

that needed to be done in order to improve this alarming issue. One of these changes

was to implement the Pyxis Carefusion, which is a new automated dispensing cabinet

system that has been proven to improve safety by decreasing medication errors,

efficiency by reducing drug stock and consumption and availability of medications on

the units, which allows for faster medication administration. The launch of this system

was successful in several medical centers globally and has positively impacted their

quality of care. It is also aligned with AUBMC's 2020 vision of continuously updating

their processes and integrating technology to provide the best patient care. Hence, an

agreement was done between all the departments in order to begin planning and

implementation of this much-needed system.

Healthcare Technology

Clinical informatics is an applied and interdisciplinary field, at the intersection

of information science, computer science, and clinical medicine, providing improved

patient care by harnessing and optimizing information technology (Miriovsky, Shulman

& Abernethy, 2012). With the increased technological advancements present nowadays,

organizations from several fields are integrating information technology (IT) throughout

all their systems to increase the potential of profitability and prosperity. This has

impacted several fields positively including the health care field. Improved provider

performance, cost savings, quality enhancement and greater engagement by patients are

some of the main benefits that health information technology (HIT) has the potential to

improve (Buntin, Burke, Hoglin& Blumenthal, 2011). Hospitals all around the world

have accepted these benefits and have launched several initiatives to use that technology

in their health care. Previously, with the use of more limited systems, hospitals and

health care providers were not able to provide up to date and timely care to their

patients. There was minimal clinical decision support to health care providers with the

already existing hospital systems (Bates, 2002). This lack of technology created several

problems in the health care field ranging from difficulty in extracting important

information to lack of communication and providing quality clinical decisions (Bates,

2002). Healthcare systems such as inpatient and outpatient were disconnected (Bates,

2002). As a result of such problems and with the availability of high tech systems in the

market now, hospitals have opted to invest in health information technology (HIT) to

limit those drawbacks and improve the quality of care being given.

AUBMC: Center of Excellence

The American University of Beirut Medical Center (AUBMC) was established

in 1902. Since then, it has provided quality care for its patients across Lebanon and the

region. According to the AUBMC facts and figures sheet of Spring 2018, AUBMC

leads Middle Eastern medical institutions as the first to earn five international

accreditations of Joint Commission International (JCI), Magnet,College of American

Pathologists (CAP), JointAccreditation Committee for EBMT and ISCT

Europe(JACIE), and the Accreditation Council for GraduateMedical Education -

International (ACGME-I). It has a great impact on the medical sector in the Arab world

through its superior quality and patient centered care in the fields of nursing,

pathology/laboratory services, and medicine. AUBMC is considered the main

tertiary/quaternary referral medicalcenter in Lebanon and the region. It operates 376

beds, serving42,230 in patients annually. The outpatient facilities receive

404,958outpatient visits annually (323,523 private, 25,646 outpatient department,and

55,789 emergencies). It has four clinical Centers of Excellence: the Abu-Haidar NeuroscienceInstitute (AHNI), the Children's Cancer Center of Lebanon (CCCL), the Naef K. Basile Cancer Center(NKBCI) and the AUBMC Nehme andTherese Tohme Multiple Sclerosis (MS) Center,the first MS Center in the Middle East.AUBMC will also be opening a Heart andVascular Center of Excellence in the near future. In addition, the AUBMC has expanded its facilities through several projects such as the new Medical Administration Building (MAB) and the New Medical Center (MNC). Most recently, AUBMC launched its Epic electronic health system (EHR) in its quest to continuously integrate technology in its various processes to provide the best patient care. The Epic system is one of the most advanced healthcare systems worldwide and AUBMC became the first medical center to implement this system in Lebanon. This system allows easier accessibility for patient records to both caregivers and patients themselves. It provides increased privacy through electronic software protection as well as efficiency in decreasing the need of duplicating test results previously provided on written records. Epic provides a clear and simple method of information sharing across all health care unites and patients. For the patients, they can now access their medical records through a free application that can be downloaded on any smart phone or computer. This application can allow them to message their healthcare providers and schedule appointments with ease. Epic supports AUBMC's long term growth plan and revolutionizes the way patient care is given. It highlights a new era in technology at the medical center that enhances the overall patient experience at the AUBMC.

AUBMC 2020 VISION

Constantly aiming to thrive and grow, Dean Sayegh announced back in 2009 an ambitious new vision known as the AUBMC 2020 which would ensurethat the needs

of patients, researchers, and healthcare professionals in the region are met at a level never seen before in the region. This vision will build AUBMC's strong foundations through improving its facilities and capacity by the establishment of new advanced centers of excellence that will provide new treatments for illnesses in the Arab world. In their company website, the AUBMC stated in their report "AUBMC 2020 Vision" the paths to achieving this vision include:

- Providing patients with the highest standards of patient-centered care

- Recruitment of top-caliber, highly specialized, and accomplished faculty

- Academic innovation through the creation of clinical and research centers of excellence, and the provision of outstanding medical education

- Establishment of strategic partnerships and collaborations locally, regionally, and internationally

- Investing in and expanding our facilities to meet the needs of the people of Lebanon and the region

- Supporting the health of local and regional patients in need by ensuring their access to care.

This 2020 vision aimed to revolutionize the way patient care is done. For that, the AUBMC shifted its old systems into a more technologically advanced route. Of the various changes involved, perhaps one of the most important includes medication dispensing between the pharmacy and the nursing departments. The main reason patients are admitted to the medical center is to receive treatment for their illnesses. Hence, timely and effective medication dispensing and administration is a key element in providing quality patient care.

Medication Ordering & Dispensing

Previously, the AUBMC medication dispensing occurred in the following steps. First, the registered nurse would obtain the patient history or a need for medication (example: pain) from the patient and document them in the patient's medical chart. Then, the medical team would be paged and informed about these medications accordingly. Once the team arrives on the selected floor, they would write the medication treatments on an order sheet. The nurses would verify the medications, scan the sheet, and link it to the selected patients which would be sent to the pharmacy for verification electronically. After that, the pharmacy employees would order and then dispense the medications by a selected pharmacy staff who would perform a walking round on all the patient's floors with the medications. Upon arriving to the selected floor, the pharmacist and the nurse in charge of the patient would verify the correct quantity and doses and then would sign off their initials on a sheet. One sheet would be taken by the pharmacist back and the other would remain on the floor. The medications would be placed in medication carriages assigned according to the room numbers on the selected floors. These carriages are accessible using a 4 digit code that the nurses and floor staff are aware about.

Pyxis Carefusion

On May 4th 2018, AUBMC in collaboration with the Nursing Department launched the Pyxis Carefusion at different units in the center. The Pyxis was a new automated dispensing cabinet (ADC) for medications; the first of its kind in Lebanon. These ADC's allowed for decentralized medication management which ensured safety and efficiency. The flexibility of this system provides more accurate medication dispensing without affecting the pharmacy workflows. The modular system in Pyxis
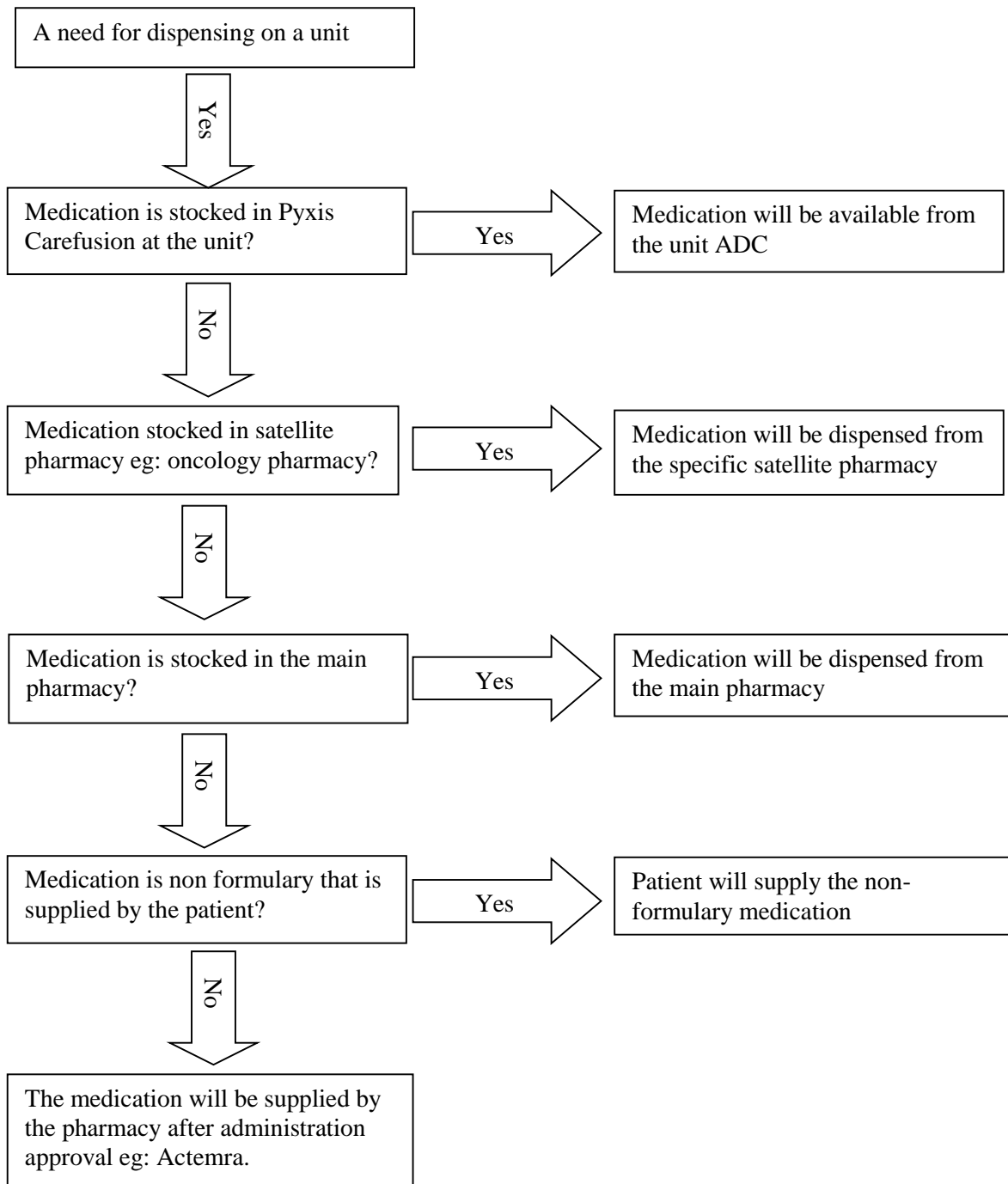
allows for reduction in medication errors, diversion and time consuming non value

activities. As noted in the AUBMC website report "Pyxis Carefusion by AUBMC",

Petra Khoury the Chief Quality & Compliance Officer stated that,

> "This project will provide secure medication storage on patient care units, with timely access to medications for emergencies. It will enhance first dose availability and facilitate timely administration of medication. It will also eliminate the dispensing of unused "as needed" doses thus decreasing potential for administration errors".

Since the system is more efficient than the already existing medication

dispensing methods, AUBMC hence installed 52 ADC's on all patient floors in the

center. Their implementation aligns with the AUBMC 2020 vision goals which were

followed by implementing the EPIC electronic health record system. Now, whenever a

medication needs to be given the nurse would inform the medical team about the need.

The team would write the order on the EPIC health information system using any of the

computers present in the facility. After that, the pharmacy would directly be able to see

the order and verify it. On the floor, the Pyxis dispenser is already filled with a large

number of medications where its cabinets are filled to their maximum capacity

according to the need. Once a cabinet has become empty, the pharmacy is notified

electronically or by phone and a technician would refill the empty cabinet again. Hence,

most medications are easily accessible to the nurses on the floor once verification is

done. If the medication ordered is not available in Pyxis, a pharmacy technician will

dispense it on the floor while rounding on the hospital's floors in a patient specific

cabinet. This bypasses the need for the medical team member to be directly present on

the floor to write the order. It also bypasses the need for the nurse to scan and link the

order to the pharmacy. As a result, the Pyxis allows for more availability and faster

retrieval of medications (see Exhibits 1 & 2).

Exhibit 1

Medication Dispensing Flow

```
┌─────────────────────────────────┐
│  A need for dispensing on a unit │
└─────────────────────────────────┘
                │ Yes
                ▼
┌──────────────────────────────┐        Yes    ┌──────────────────────────────┐
│ Medication is stocked in Pyxis│──────────────▶│ Medication will be available │
│ Carefusion at the unit?       │               │ from the unit ADC            │
└──────────────────────────────┘               └──────────────────────────────┘
                │ No
                ▼
┌──────────────────────────────┐        Yes    ┌──────────────────────────────┐
│ Medication stocked in satellite│─────────────▶│ Medication will be dispensed │
│ pharmacy eg: oncology pharmacy?│              │ from the specific satellite  │
│                               │               │ pharmacy                     │
└──────────────────────────────┘               └──────────────────────────────┘
                │ No
                ▼
┌──────────────────────────────┐        Yes    ┌──────────────────────────────┐
│ Medication is stocked in the │──────────────▶│ Medication will be dispensed │
│ main pharmacy?               │               │ from the main pharmacy       │
└──────────────────────────────┘               └──────────────────────────────┘
                │ No
                ▼
┌──────────────────────────────┐        Yes    ┌──────────────────────────────┐
│ Medication is non formulary  │──────────────▶│ Patient will supply the non- │
│ that is supplied by the      │               │ formulary medication         │
│ patient?                     │               │                              │
└──────────────────────────────┘               └──────────────────────────────┘
                │ No
                ▼
┌─────────────────────────────────┐
│ The medication will be supplied │
│ by the pharmacy after           │
│ administration approval eg:      │
│ Actemra.                         │
└─────────────────────────────────┘
```

*Source:*Created by the Author based on AUBMC Policy

Exhibit 2

Dispensing Time Frame

The pharmacy technicians will refill the Pyxis Carefusion according to a preset schedule when the stock is critically low.

STAT orders shall be processed, prepared and dispensed to the selected units by the pharmacy aid within 30 minutes of ordering.

Standing orders shall be processed, prepared and dispensed on the unit within 2 hours.

Intravenous medications will be refilled on the floor at least 30 minutes from due time for administration.

For continuous intravenous drip infusions, the registered nurse will send a message to the pharmacy 2 hours ahead of infusion end time to ensure timely preparation and dispensing.

Source: Created by Author based on AUBMC Policy
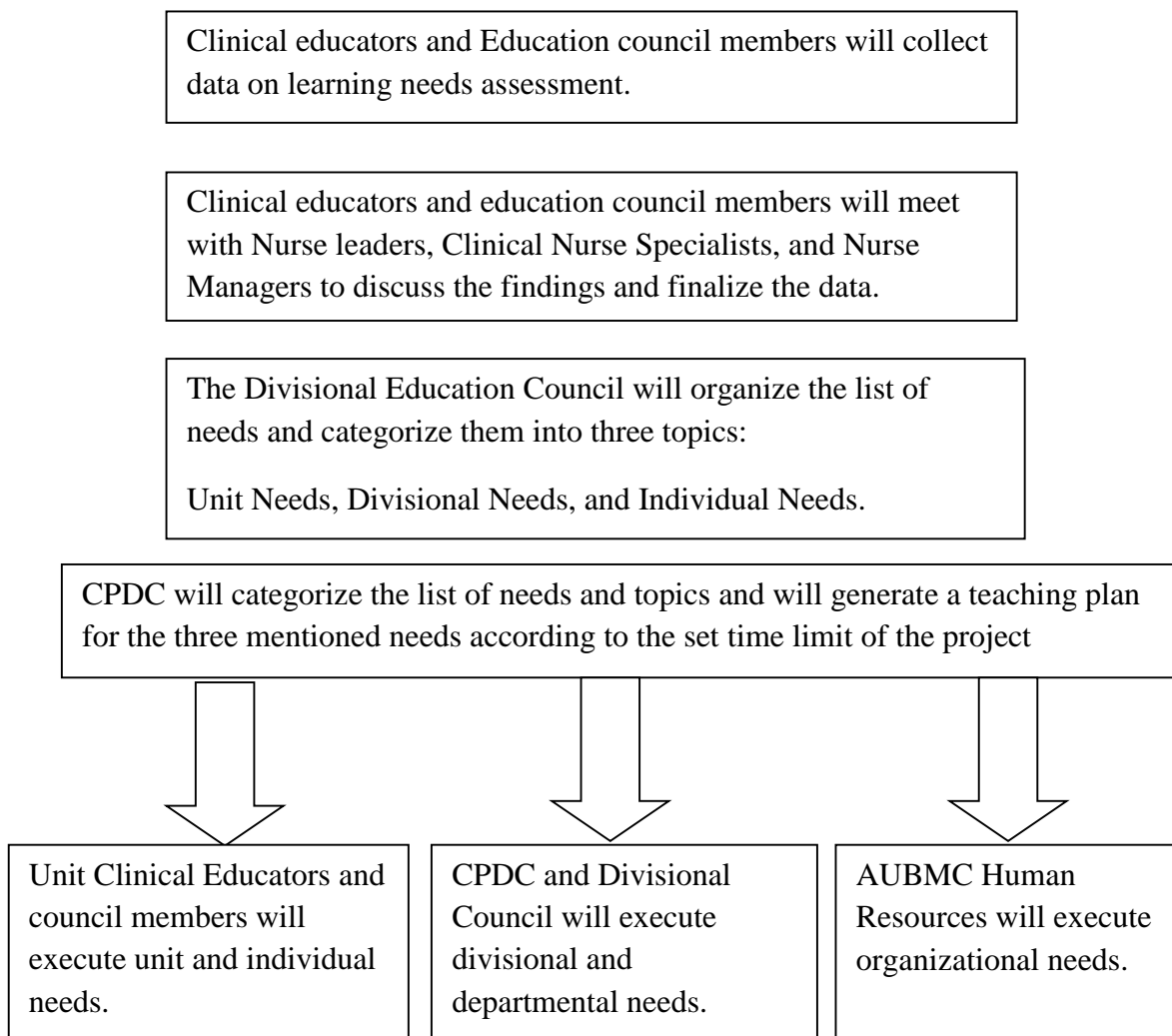
Pyxis Training

Since the Pyxis Carefusion is a new and advanced method of medication storage and dispensing, extensive training on the usage of this system needed to be done. The AUBMC administration created a core team of individuals who would lead the planning and implementation process. This core team was a result of a collaboration between the pharmacy, nursing and information technology departments. They handled matters including data conversion, policy updates, infrastructure, hardware installation

and workflow analysis. However, no direct care nurses were involved in the planning

process. As for the training itself, the initial plan was for representatives of Pyxis to

perform the training as they are experts in the hardware and software matters of the

dispenser. However, due to the nature of training in a hospital setting where scheduling

and attendance is a major problem, the nursing Clinical and Professional Development

Center (CPDC) were given the bulk of training all nurses two months before

implementation of the system. The CPDC had 8 full time educators and 3 part timers.

They are clinical educators whose role is to train nurses in the hospital on various

processes related to their patient care delivery.They were trained by two Pyxis BD

company representatives about the various processes of Pyxis. These members had

prerequisite trainings as well as online resources from BD Company to prepare them for

their tasks. After meeting the criteria, the CPDC performed a post test and a criteria

checklist that they had to meet before training the nurses. After that, they prepared

presentations for the training of super users who would aid in training the end users.

These super users also performed a pretest on Moodle and a posttest after their training

had finished. After that, both CPDC members and super users trained the end user.

First, a learning assessment process was done between CPDC, clinical educators and

education council members (see Exhibit 3). As for the nurse training, 586 nurses

needed to be trained. Thus, 100 training sessions were planned to be done between the

period of March and April 2018. These were 1 hour sessions repeated every hour during

working hours to allow as many nurses to attend from their shifts. The nurses received

the same training regardless of their units or specialties. The training was in class

presentation using the updated policies the nursing and pharmacy departments prepared

as well as videos retrieved from BD Company. Nurses had to attend only 1 session

while super users attended an additional session. The super users were available on an

hourly basis to provide hands on training using the Pyxis machines that were already

present in the pharmacy department. Outside of the classroom, the policies and training

modules were placed on the Hospital Information System (HIS) as well as Moodle

which is the learning management system.The training modules involved an outline of

nursing processes related to Pyxis such as removing and refunding medications,

narcotics checking and removal, and psychotropics checking.

Exhibit 3

Learning Assessment Process for Nurses

Clinical educators and Education council members will collect data on learning needs assessment.

Clinical educators and education council members will meet with Nurse leaders, Clinical Nurse Specialists, and Nurse Managers to discuss the findings and finalize the data.

The Divisional Education Council will organize the list of needs and categorize them into three topics:

Unit Needs, Divisional Needs, and Individual Needs.

CPDC will categorize the list of needs and topics and will generate a teaching plan for the three mentioned needs according to the set time limit of the project

| Unit Clinical Educators and council members will execute unit and individual needs. | CPDC and Divisional Council will execute divisional and departmental needs. | AUBMC Human Resources will execute organizational needs. |

Source: Created by the Author based on AUBMC policy

A booklet regarding these processes was placed on every Pyxis machine. Before the go live, the CPDC prepared refresher sessions for nurses to attend again. Post training, only subjective observations were done for the nurses as a form of evaluation with no preset criteria to be observed.

Post Pyxis Implementation

On Saturday May 5th 2018, Sarah the floor manager of Neurology medicine department at the American University of Beirut Medical Center (AUBMC) came to work with a sense of excitement she hadn't felt before. It was an exhausting yet thrilling few months leading to the launch of the new Pyxis automated dispensing cabinet on that particular night. Little did she know upon arriving to the floor that her worst fears would come to life. As soon as she walked in, she heard a loud voice shouting on the desk threatening the staff and the organization. As she approached the source, Sarah found out that it belonged to one of her patient's family members that were occupying room 415B. She tried to calm the man down, but with no success. She then identified herself as the floor manager and asked the man to join her in the office to discuss the issue. The man obliged and they went in. When asked about the problem, he replied that his son was in severe pain at night after a complicated craniotomy surgery and the nurse took two hours to give him pain medication. He elaborated that it would have been faster if he himself went outside the hospital and brought the medication. The manager was shocked, knowing that such a delay in delivering pain treatment for post operation patients is not acceptable and is not within the hospital standards. What was more shocking was that the purpose of Pyxis was to allow for quicker and more efficient medication dispensing and administration for patients. She assured the family member that she will find out the cause of this delay and disciplinary measures will be

taken. She then brought in the nurse responsible for the patient and asked him what happened. Fouad the nurse replied that he could not remove the pain medication from the new automated dispensing system as there was an error in integration. Neither he nor his colleagues knew how to override the system and the IT team took a long time to respond as they were overwhelmed with several problems during the launch. The manager recalled that during the Pyxis training, all users were instructed on how to override the system in the case of emergencies, and therefore he was wondering why the nurse didn't proceed in such a manner. The nurse replied that he did not know how to do that. Sarah then excused the nurse and sat there in her chair wondering how the nurse did not know how to override the medication. "Could it be that he was not paying attention during the trainings?" Sarah wondered. However, she knows that Fouad is one of her best RN's on the floor and that's why she placed him during the Pyxis launch shift. Her attention shifted to another issue. "Maybe they did not train the nurses effectively on how to override medications?" she asked herself. Determined to solve this matter and ensure patient safety, satisfaction and well-being, Sarah embarked on uncovering the cause of this problem by conducting several meetings with her nurses and other nurse managers to ensure it never occurs again.

How to Improve the Training Process?

After meeting with all her floor nurses and obtaining data on the trainings received, Sarah organized a meeting with CPDC, administration members, and other nurse managers. She described the incident that happened as well as what her nurses told her about the training. Apparently, overriding medications was one of several Pyxis related processes the nurses did not know how to do such as labeling intravenous medications and narcotics documentation. Since previous Pyxis launches were more

successful, the training of nurses at the medical center was at fault. Hence during the

meeting, several questions were discussed between the members. What was the problem

with the Pyxis training? What changes needed to be done to the existing training

methods? What action plan should AUBMC officials implement to fix these matters?

With AUBMC's 2020 vision highlighting safety and service excellence, a need for

improvement in the training process was agreed upon.

CHAPTER III

TEACHING NOTE: TRAINING OF REGISTERED NURSES ON PYXIS CAREFUSION AT THE AMERICAN UNIVERSITY OF BEIRUT MEDICAL CENTER

Synopsis

The American University of Beirut Medical Center is a leader and a center of excellence among Middle Eastern medical institutions. It was established in 1902 and has been a pioneer in medical and nursing services since then. With five international accreditations and four clinical centers of excellence, it has a great impact on the medical and nursing sector in the Arab world providing quality patient care throughout all its services. Constantly aiming to grow and succeed, an ambitious new vision named AUBMC 2020 Vision was announced back in 2009 which aimed to raise the standards of patient care through medical innovations, strategic partnerships and investing in the best resources available.Due to AUBMC's high levels of medication administration incident reports,an agreement was done between AUBMC officials on implementing a new automated dispensing cabinet system that would reduce their medication errors and improve patient care. Hence, on May 4th 2018, the medical center launched the Pyxis Carefusion, a first of its kind automated dispensing cabinet (ADC) in Lebanon. Being a new and complicated technology that altered several of the medical center's processes, extensive training had to be done to ensure quality and efficiency of medication dispensing and administration. The main target group was the registered nurses as they will be the main department that will use the ADC's. After the launch, several problems were identified including failure to override medications, labeling intravenous medications, and documentation. This caused a delay in medication administration

which in turn created dissatisfaction and harm to both the patients and their families.

The cause of such inability to handle the ADCs processes was tracked back to the

training the registered nurses took part in. Hence, nurse managers from several units

met with administration and Clinical and Professional Development Center (CPDC)

members to determine the causes of the problems in the Pyxis training and the action

plan that was needed to be implemented in order to solve them.

Target Group

This case would be significant for both graduate and undergraduate course on

human resource and management; specifically in the training and development aspect. It

emphasizes the importance and impact of proper planning, designing and implementing

a training module for nurses on a new kind of technology.

Learning Objectives

This case will allow the students to understand the following:

- The benefits of training on both the individual and organizational level.

- How to plan and design a training module for nurses in a hospital setting.

- What resources should be used to maximize the efficiency of training on

ADC's.

- How to implement the training module on a new technological system.

- How to apply the Kirkpatrick model to in order to draw recommendations

for training evaluation.

Assignment Questions

- What are the pre training tasks the project leaders must conduct before

embarking on the implementation phase of the training?

- During the implementation phase, what is the role of CPDC in regards to training?

- How can super users assist in training? How should they be selected and trained?

- How should the effectiveness of training be evaluated using the Kirkpatrick model?

Teaching Strategy

This case can be covered in an 80 minute class. We recommend the following:

- Discussion on the Pyxis concept and its alignment with AUBMC 2020 vision: 15 minutes

- The collaborative role between Nursing, Pharmacy and IT departments: 15 minutes

- The role of CPDC in planning and implementation: 15 minutes

- Utilizing nurse super users as an efficient aid to training: 15 minutes

- Evaluation methods for the efficacy of training: 10 minutes

- Additional discussions: 10 minutes

Analysis

- *What are the pre training tasks the project leaders must conduct before embarking on the implementation phase of the training?*

The project manager or team is responsible for assigning roles and responsibilities to other team members, developing and maintaining timelines, tracking the progress of each aspect of the implementation, and managing routine issues that

arise (Weathers &Esper, 2013).Organizational change management experts argue that change efforts should focus on the people affected by the change. Several tactics are needed to ensure success. These include assessing people's readiness for change, devising new ways to manage and reward people, training them and involving them in planning the implementation of change (Markus,2004). Thus, before initiating the implementation phase, project leaders in the medical center must first assess the targeted departments for their readiness for change and their training needs. They must first create guiding teams that will communicate the change in processes for the selected departments. These teams have the role of increasing urgency and engagement of employees through clarifying tasks, communicating consequences, and empowering their employees by allowing them to participate in the planning of the training program. The latter is perhaps the most essential as direct care nurses are the most exposed to the medication administration process. Hence, they possess valuable knowledge on the processes and limitation that will aid in the training program. Involving every layer of the hierarchy is essential in the success of the training program.

For pretraining, two ways to maximize the benefit is to include conducting a needs assessment using experienced SMEs and to make sure trainees are ready and motivated for training (Aguinis&Kraiger, 2009). The project leaders and trainers have the role of conducting a needs assessment on various nursing departments. This is important as each department has a set of skills and competencies that are unique and specific to the selected unit. For example, nurses who work in medical surgical units have different competencies and roles than those who work in critical areas. As a result, this needs assessment will provide the project leader and trainers with unit specific gaps and competencies the training module will focus on.

Additional subject matter experts (SME's) must be utilized since this is a new

technology the medical center is acquiring.The leaders must include members from the

Pyxis BD company that will aid in the training process. A collaboration between

different departments such as Pharmacy, Nursing and IT is needed along Pyxis to

ensure that all the aspects of training will be covered. The message of the change

process must be communicated to the employees through formal sessions and online

resources such as emails and Moodle (online learning management system) for them to

understand and be well prepared for the change. Updates or changes in processes must

be directly communicated to all nurses.After all is set, a timeline should be created and

the go-live date set and communicated; no absences from the practice should be allowed

during this time. The end users will have a view of what the end result will look like in

order to be better prepared for it. They should be satisfied with the proposed workflows

and build (Weathers &Esper, 2013).

- *During the implementation phase, what is the role of CPDC in regards to*

training?

When it comes to nurse training at the AUBMC, the HR department does not

play a role. Instead the CPDC which is a training center for nurses tackles the task of

training and development. The CPDC members are trained clinical educators who are

responsible for any training done for the nurses. Hence, they play a major role in the

training program for Pyxis. First, the CPDC members must coordinate with

administration, Pharmacy, and Pyxis vendors through core group meetings on the

training topics. These include: policy updates, timelines, Pyxis processes, medication

dispensing, and Go Live date. Before implementing any training, the CPDC members

must be trained by the Pyxis vendors themselves on the ADC's. Training sessions and

videos from the BD Company are provided which the CPDC members take part in.

They included customer learning portals and training applications on the BD website.

They had several courses that needed completion which highlighted Pyxis aspects such as inventory count, resolving discrepancies and unloading medications. Their training was a combination of hands on experience and tutorials. After completing the training and meeting the criteria set by the vendors and administration, the CPDC members embark on training the nurses on all levels.

For the training, nurses on all departments are requested to register on the selected training dates. Attendance is mandatory for all. To ensure everyone is trained, there is often a delay of 1 to 2 months between the time formal system-specific training is provided and when the new software ultimately replaces the older software (Marler*et al.*, 2006). The CPDC must utilize several training methods from formal classroom presentations to online resources. Multiple training modules that demonstrate different software functionalities must be presented through extensive training (Marler*et al.*, 2006). The trainers will break down the system into learnable parts which will allow the trainees to learn different small tasks easily. At AUBMC, they created multiple online training modules for the nurses on Moodle in coordination with Pyxis vendors. These training modules tackled different software functionalities related to Pyxis such as medication retrieval, documentation, and updated policies. The CPDC must provide formal training sessions for all nurses in the form of classroom presentations highlighting the selected training topics. There must be an emphasis not only on the technical aspects, but also on the workflows of updated policies and procedures (Weathers &Esper, 2013). At AUBMC, 100 sessions delivered on an hourly basis was done in order to allow as many nurses to attend from their shifts. Since they had to cover three shifts (day, evening and night), the CPDC planned training sessions during the following times. At 7:45am for night staff, 2pm for evening staff and day staff training rotated between 9am, 10:15am, 11:30m and 12:45pm. One staff member from

each unit will attend one of the selected sessions. After all the trainings were done, the

CPDC created refresher sessions before the Go Live. It is important to note that training

should not be restricted to the classroom environment. Employees must have access to

the system in order to practice their skills between the time of training and

implementation as the learning process must continue outside the classroom (Marler*et

al.*, 2006). However, at AUBMC, the end users did not have access to the Pyxis

automated dispensers after the formal training which is a major drawback as they could

not practice their knowledge acquired after the training.

- *How can super users assist in training? How are they selected and trained?*

The 8 full time and 3 part time CPDC members had a major task of training

586 nurses within 2 months. It is a huge task for any training center that requires

utilizing every available resource in the company. This can be solved by either using

external trainers from Pyxis or internal ones through nurse super users. However, in the

case o AUBMC, using external trainers was not practical as these trainers are familiar

with only the technological aspects of Pyxis and not the nursing processes that occur in

the medical center. Hence, recruiting internal trainers in the form of super users is a

more viable option. As literature states, the addition of super users during any major

change increases its chance of success.The superusers are an important aspect when

integrating technology into an organization. They are essential to optimize clinical IT

systems as they link the information technology (IT) world with the patient care world

(McNeive, 2009).They do not need to be computer wizards but must possess certain

valuable traits such as being patient teachers, willing champions of change and good

communicators (McNeive, 2009). They act as a liaison between IT and end users and

collaborate with hospital hierarchies for problem solving and system optimizations. It

has been found that nurses respond more favorably to other nurses teaching and

supporting them thannon-nurses. Hence, super users have several major roles in effective training for nurses (see Exhibit 4). The number of super users needed depends on the organization's size project magnitude. In the case of AUBMC, 1 to 2 super users per unit were required according to recommendations from Pyxis. For selection, volunteering for the position is more favorable as the choice to participate is a greater predictor of super users' effectiveness than their technological savvy (Yuan, Bradley &Nembhard, 2015). Hence, nurses were allowed to volunteer as super users on their units. This also aids in identifying unit specific needs and competencies that the training must tackle since as stated before each unit differs from the other. The super users take part in more extensive training than end users and must also meet the criteria for completion before embarking in training. Before the training, they are required to complete a prerequisite training on Moodle before attending any session. They are encouraged to practice on the system in the software's playground environment as soon as possible and as often as possible (Mcintire& Clark, 2009). This will allow them to refine their skills and while also identifying new problems the trainings failed to highlight. Once that is accomplished, they can aid the CPDC and offer coverage in training sessions on every shift.

- *How should the effectiveness of training be evaluated?*

Topno (2012) stated that there are several models for evaluation. One of the most commonly used is the Kirkpatrick Model which we will use in this teaching note (see Exhibit 5). This model is divided into four parts which include reaction, learning, behavior and results. For reaction, the trainers would evaluate the participant's feelings about the training program they took part in. The learning would evaluate the knowledge and skills learned by the trainees. Furthermore, the behavior would evaluate the way the job behavior had changed after attending the training. Finally, the results

would evaluate the extent to which the results have been affected by the training

program (Topno, 2012).

Exhibit 4

Super User Roles

Attend	Attend the training classes, sessions and meetings.
Demonstrate	Demonstrate the knowledge in use of Pyxis system
Highlight	Highlight the use of Pyxis features for better efficiency
Support	Participate in the Pyxis Go Live
Instruct	Instruct end user on how to use the Pyxis
Explain	Explain Pyxis related policies and procedures at AUBMC
Communicate	Communicate any updates to end users regarding medication management
Exhibit	Exhibit a professional demeanor and positive attitude regarding Pyxis processes

Source: Created by Author

Exhibit 5

Kirkpatrick's Training Evaluation Model

Reaction	Measures the participant's reaction to selected parts of the training as well as the overall program.
Learning	Measures the knowledge that was absorbed during the training.
Behavioral	Measures the behavioral changes in performance after the training.
Results	Measures the impact of the training on organizational performance.

Source: Created by Author

Reaction level: This type of evaluation involves two approaches ; the formative or internal evaluation and the summative or external evaluation. In formative evaluations, the results can be used to modify and redesign the contents of the training program (Topno, 2012). On the other hand, the summative evaluation allows the evaluators to determine the value and effectiveness of the training and thus decide on whether to continue, terminate or expand the training. The main purpose of reaction evaluation is to enhance the quality of the training program which will lead to improved performances based on the participant's reactions to the program (Topno, 2012). This evaluation does not only measure the participant's reactions to the overall program, but also towards specific components such as topics, methods, and instructors. In the case of AUBMC, the training was only evaluated through observations and verbal reactions which were noted and analyzed. No feedback forms, online evaluations, surveys or questionnaires were used for the nurses. Hence, this aspect of the Kirkpatrick model is essential for the post training evaluation and is recommended to be done by AUBMC officials.

Learning level: This type of evaluation aims to measure the increase in knowledge and intellectual capabilities before and after the learning experience (Topno 2012). It will focus on the learning objectives that were covered in the trainings that include skills, knowledge and attitudes. One way of using this level is to perform a pretest and posttest for the trainees. In the case of AUBMC, the CPDC members and nurse super users who received additional trainings performed pretests on Moodle and the BD company website and performed a posttest after the trainings were done. They also had to meet the criteria in the competency checklists and demonstrate practical skills regarding Pyxis handling before conducting the training on the end users. Even

though the trainers were evaluated, however the end users were not evaluated post training which is major cause of the various problems faced by the nurses after the Pyxis launch. Hence, it is recommended that the nurses are evaluated for their knowledge of Pyxis processes after the training was done in order to identify gaps and members who need additional trainings.

      *Behavioral level:*In this evaluation, changes in behavior are examined either immediately or months after the training (Topno,2012). It aims to measure the transfer in the learner's job behavior and performance after the training program through testing the participant's skills while on the job. One drawback this method has is that it is difficult the measure job behavior since not all participants change in the same way. Hence, it is more difficult to interpret than reaction and learning evaluation (Topno, 2012). Methods used in this level include observations, interviews, self-assessments and 360 degree feedback. However, in the case of AUBMC, only observations were used after the trainings were done and the system was launched. Hence, several forms of evaluations are recommended to be done in order to obtain more data on the behavioral changes that nurses acquired after the Pyxis launch.

      Result level: this level measures factors that contribute to the functioning of the organization. These include financial outcomes (increased profits and positive return on investments), improved quality of work, fewer errors (in this case medication errors), higherproductivity and satisfaction (Topno, 2012). This method is the most time consuming as collecting, organizing and analyzing data can be more difficult and costly than the other three levels. However, when reviewed in the full context of its value, it is worthwhile (Topno, 2012).

CHAPTER IV

CONCLUSION

For any organization such as the AUBMC that aims to be a leader and a center of excellence in its field, constant growth and expansion is necessary. Such organizations seek to continuously update and surpass previous systems for better efficiency and quality of care. In this case study, adopting the Pyxis Carefusion automated dispensing system was one of the changes implemented that was aligned with its 2020 vision. These ADC's have been proven to improve costs, time, and medication administration errors for nurses in their practice. However, supplying these ADC's on the hospital units is not sufficient for their success. Training the nurses on all levels and units on how to properly handle the Pyxis processes is key for the success of their implementation. As this case study shows, training has several benefits on both the individual and organizational level. Hence, adequate and role specific training must be done specially when implanting a new technological system at the hospital. This case study highlights several significant aspects of training in a hospital setting. When it comes to training, all levels of hierarchy have major roles that work together for the benefit or failure of such a large scale change. Top management and project leaders have the responsibility of assigning roles and responsibilities, maintaining timelines and tracking the progress of implementation. Clinical educators and the CPDC have the role of training end users on this new system. Their involvement in training includes acquiring the knowledge from the vendor company, meeting the competency checklist and developing the training program. With the nursing field being one of the most complicated fields to train, their task is essential for the success of the system

implementation. These members must use all available resources both electronic and human in their training. For electronic resources, online learning modules that provide end users with PowerPoints, videos and data must be used. For human resources, identifying and selecting super users who play a major role in training is significant. These super users act as a liaison between different hospitals hierarchies and have several roles such as assisting in the design of electronic documentation, educating the staff about updates and maintaining guidelines through collaboration with ancillary departments. Once the training is done, perhaps the most significant aspect includes the post training evaluation. Several models exist for such a task, thus organizations must carefully select those which hold the best benefit for future implementations. This case highlights the complexity of implementing a new automated dispensing cabinet at such a large scale as it is not an easy task for any organization. However, when applying adequate and up to date change management and training models, such organizations can ensure the success of these complicated yet significant organizational changes. No large scale change is done without some degree of error, thus it is important to continuously learn from and evaluate the experience as a whole in order to identify gaps and deficiencies that can be tackled in future programs.

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