ASSESSING RETENTION AND ADEQUACY OF EMERGENCY RESPONSE TRAINING FOR A POINT OF DISTRIBUTION (POD) EXERCISE

by

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I dedicate my Dissertation to my parents for their overwhelming inspiration and love.

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GLOSSARY

Asynchronous training – Training that is not happening at the same time that it is recorded.

CADE - This is the Center for the Advancement of Distance Education which is a self-supporting unit within the School of Public Health at the University of Illinois at Chicago. (Livingstone)

eTraining - Training online or in this case a mobile device.

Education - the process of receiving or giving systematic instruction, especially at a school or university

Just-in-time training – where learning is available on demand, and can be obtainable at any time of need

Synchronous training – Training that is happening at the same time it is recorded or given.

Training - the action of teaching a person a particular skill or type of behavior.

LIST OF ABBREVIATIONS

ACMC	Asynchronous Computer Mediated Communications
CIT	Computer and Information Technology
CMC	Computer Mediated Communications
JITT	Just-in-Time Training
OLS	Organizational Leadership and Supervision
POD	Point of Dispensing

ABSTRACT

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The goal of the research is to help government agencies and non-profit-organizations (NPOs) better prepare for events that require a point-of-dispensing (POD) unit. The research team developed a training exercise that simulated a real world anthrax outbreak, by using groups of untrained nursing and pharmacy students. These students were then separated and trained in two different groups: asynchronously and synchronously. By outlining how to successfully reuse a point-of-dispensing (POD) unit during emergencies, the researcher compared Qualtrics surveys that were distributed at the beginning and end of the exercise. These surveys were meant to show students' understanding of POD exercises and then evaluate their understanding of pivotal concepts (retention, cost, new algorithms, and teaching methods). It was found that the retention of new material dropped drastically after two months regardless of the type training. The first month retention dropped to 77% and the second to 46%. On top of the retention needed, eight trained volunteers would need to be stationed for every 100 people attending the POD. No city would be able to supply the amount of trained professionals required to satisfy these requirements, so untrained civilians would need to be used. The cost associated with consistently training this amount of untrained citizens would surpass any budget. The only feasible chance to train the amount of volunteers needed, would be to have the material readily available ahead of time. Asynchronous training is the only viable means to producing a training program with the scale and retention levels that a real world event would require.

CHAPTER 1. INTRODUCTION

1.1 Significance

The significance of this study was to demonstrate that just-in-time training can have higher retention levels, lower costs, and multiple methods to deliver the asynchronous training. Incorporating new surveys helped to examine retention over 2 months. These surveys help to detail the retention curve when volunteers are given new information. Even in instances where employees are completing the same task every week, the data has shown a decrease in the accuracy and effectiveness of their security. Aside from the retention, the cost of the training that companies provide every year could be better used in order to develop an asynchronous program. This training could not only be used over again but updated and upgraded easily. Once the core material is developed employees could view the tasks and instructions as needed. The videos used in the current exercise totaled 10 minutes, which could easily be viewed before working/volunteering. It is hoped that this data will give rise to more companies incorporating just-in-time training in their programs.

1.2 Scope

This research addresses if governments and companies can afford to continually use traditional methods of training their employee. This study consisted of a developing a Navy funded course that simulated this concept. By outlining how to successfully reuse a point-of-dispensing (POD) unit during emergencies, the researcher compared Qualtrics surveys that were distributed at the beginning and end of this course. These surveys were designed to demonstrate students' understanding of POD exercises and then evaluate their understanding of pivotal concepts (retention, cost, new algorithms, and teaching methods). The research team chose to use an asynchronous program to train the subjects. The evaluation process ultimately compared asynchronous versus synchronous training.

This study was based on research that originally examined the nursing and pharmacy students' retention after receiving training. Training consisted of asynchronous and synchronous classes that were conducted 1 day before the POD exercise. Each group went over materials followed by a quiz to insure 100% retention. They continued training until the 100% criterion was achieved. This would help to show that each student regardless of ability would start with 100% retention.

1.3 Statement of Purpose

The goal of this paper was to help prove how traditional methods need to be exchanged for a more updated method that can both maintain retention levels throughout the year, or be used just-in-time to ensure 100% retention on the day it is needed. If the errors and throughput times are the same between the types of training, there is no reason companies should not incorporate just-in-time training into continuous improvement programs. Just-in-time training should be used to help maintain retention of the required material. Just-in-time training is not meant to replace education but be a means of training employees on a day-to-day or month-to-month basis. This program would serve to keep retention at acceptable levels in the case of an emergency event.

1.4 Research Questions

The questions that were answered in this paper:

1. Can traditional methods of training still solely be used with retention dropping significantly?

2. Can the retention and adaptability of just-in-time training outweigh its costs when compared to traditional training?
3. Can training methods impact staff needs for the conduct of a Point of Distribution (POD) event?

1.5 Assumptions

The following assumptions were used in this study:

1. All volunteers completed tasks to the best of their abilities
2. All volunteers were trained with the same material
3. The measurements taken accurately reflect the retention of the volunteers
4. A point of dispensing (POD) exercise represents other disasters

1.6 Limitations

The following limitations were used in this study:

1. The study is limited by the truthfulness of the volunteers
2. The study is limited by the ability of each volunteer's ability to learn information quickly and accurately
3. Statistical significance due to the amount of surveys recorded
4. The study is limited to the effectiveness of the data
5. The study is limited by the effects of andragogy, how adults learn differently from the college students that were observed

1.7 Delimitations

1. The data was drawn from volunteers at a Purdue University's nursing and pharmacy classes

2. The amount of retention surveys able to be conducted
3. The amount of time to conduct the study, which was a three-hour block of time for the POD unit

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

Security risks can originate from users, software, hardware, and networks (Shaw, Chen, Harris, & Huang, 2009). Even though disciplines of security are established to protect something or someone of value, the success of those responsible for the security is paramount. Thus, users' awareness and training for risk management becomes critical to the organization's stakeholders (Shaw et al., 2009). Individuals who work in disciplines of security should be able to distinguish and manage risks associated with their systems and job functions, as well as possess knowledge of the appropriate measures required to mitigate those risks (Barnett, 1996). In any security-based role, it is necessary to be able to identify any irregular or abnormal phenomenon, analyze its causes and effects, and make appropriate judgments to resolve the issue (Roper, Grau, & Fischer, 2006).

In security operations, the resources also may be limited or constrained in terms of time, money, manpower, and other factors (Roper et al., 2006). Security based training and education helps responsible parties consider all possibilities associated with the problem, and provide awareness of the tools, techniques, and solutions (Barnett, 1996). The training of security personnel is necessary for then to appropriately apply their breadth of knowledge to the situation (Barnett, 1996). Training and education programs help the recipients build fundamental skills and focus them on specific aspects of a problem or scenario.

2.2 Education vs. training

Before exploring the training and educations programs for security professionals, it is important to understand the fundamental differences between training and education. Both areas influence the effectiveness of programs and efficiency of individuals. The process of training involves the development of specific skills, while education is the process of learning via an institution (Hussain & Singh, 2017). Training programs are built to help individuals increase performance in their roles by developing skills, knowledge and information. On the other hand, education programs are created to instill overall principles and policies in individuals. These programs help develop purpose and rationale.

While education covers an overarching breadth of knowledge and critical reasoning, training focuses more on improving performance and productivity for specific tasks and jobs (Burrus, 2017). This reasoning exemplifies “You train people for performance. You educate people for understanding” (Burrus, 2017). It is inferred that training focuses on preparing individuals for short term task and roles, while education provides the framework for one’s long-term knowledge. From a security training perspective, Roper et al. (2006) claimed training would involve assisting individuals to comprehend the “who, what, when, and where” of specific security based undertakings (p. 22). Security education help individuals recognize the underlying causes and reason for those undertakings. While there exists a difference between education and training, security-based education and training programs can be developed and optimized so as to provide the maximum benefit.

2.3 Training and Education Programs

As stated by the National Institute of Standards and Technology (NIST) standards for effective security programs, “Learning is a continuum; it starts with awareness, builds to training, and evolves into education” (Wilson & Hash, 2003, p. 7). Thus, training and development programs in security aim to highlight the need for security, develop security competencies, and develop professionals with the ability to respond to security problems. To ensure the training and education programs developed for security education are effective, the training must be best adapted to fit the employee's needs and the role's requirements (Roper et al., 2006). The program should be based on considerations of current status versus the coverage of needs. Security programs should ideally be provided with consideration to the organization's entire user base to integrate security throughout that organization (Wilson & Hash, 2003).

One of the factors for effective program development is frequency of training, which should be done at repeated intervals and continuously over the entire period of employment (Roper et al., 2006). The materials used for training should be based on security standards developed by government and industry as well as those defined based on the organizations policies. These programs should be emphasizing security as an integrated component into the role-based responsibilities (Wilson & Hash, 2003). Shaw and colleagues (2009) found hypermedia-based instruction (graphics, audio, video, plain text and hyperlinks used together) has the highest usefulness and efficiency for training methods compared to any other method. Once the training method is developed, a significant predictor of success is mediums of dissemination, in other words, means and method of providing education and training (Roper et al., 2006). This method could be standard briefings, seminars, lectures, videos, web-based training material, etc.

Among the various method of dissemination, two commonly used approaches are in-person instructor-led sessions, and web-based or computer-based sessions. Overall in-person methods can be inexpensive to implement, while technology dependent methods might require more resources (Wilson & Hash, 2003). However, the costs resulting from employee turnover, might make already developed computer or web programs less expensive to maintain. This study aimed to assess whether in-person or web-based trainings would be more effective for companies in terms of costs (Wilson & Hash, 2003). In-person trainings are considered synchronous costs, while online material is asynchronous cost. For in-person trainings, organizations will have continuous costs.

However, for web-training, the initial cost would be high, but future costs would be lower. The study aims to compare the cost synchronous versus asynchronous training.

There is both inductive and deductive teaching methods. Prince and Felder (2006) argued that the inductive methods that were researched, were consistently at least equal to deductive training. In most scenarios the inductive training methods were generally found to be more effective than deductive methods. The difference between inductive and deductive training is that the conclusion in inductive is probable as opposed to certain. Inductive training begins with an observation of the information and more commonly involves a deeper understanding of the material. This type of complex learning can help to shape practical implications. Merriënboer, Kirschner, and Kester, (2003) argued that the theories of learning involve real-life tasks as the main theme. Though there are many theories and components to consider, the addition of just-in-time training should be able to help with complex learning and strategies.

One hindrance of standardized training is that it does not consider how adults and adolescents learn differently. Merriam (2001) attempted to capture how adults and youth learn differently. She primarily trained college students. It is known that there is a greater connection between emotions and learning with adults. Developing just-in-time training that could incorporate different learning strategies into the same program would make it easier for all ages to retain the information. Smith (2002) stated that there are four main differences between andragogy and pedagogy. The differences with the learner are their experience, readiness to learn, orientation to learning, and dependence or independence from the teacher. Riel (1998) states even though there are certain dangers that come with, these types of training will most likely increase the need for highly skilled teachers to transform classrooms into learning communities. These communities will better help students to learn as a collective and have the group to rely on for discussions. This should enable those students who are falling behind to have a support system that can help guide them through the material they find difficult.

Hulshof and De Jong (2006) examined the effects of giving students access to prior knowledge through just-in-time training. They hoped that access to “knowledge tips” would help increase the students learning and not interfere with it. They found that those students who started with lower pre-test scores benefited more from the knowledge tips. These students attained a higher post-test score increase than those low scoring students who were not given the knowledge tips. Supplementing the course with these “tips” did not appear to impede those students with higher scores, as they simply didn’t need to use them as much. Cho, Schmelzer, & McMahon (2002) state how this style of education can help to develop critical thinking and collaborative learning between students that is necessary for an ever-evolving world of technology. Enabling students to have readily available information and assessments is becoming a necessity. Giving students the experience to have around the clock opportunities to review current information issues will help to increase their cognitive ability.

Brown (2000) discussed how important learner participation, program design, and implementation tactics are, in order to foster learning and retention. Brown stated that classes should not only involve material to learn but incorporate problem solving with critical thinking skills. Critical thinking helps students understand the material and increase retention. Bargeron et al. (2002) found there was no difference when students were split between asynchronous, live, and solo classrooms. However, he did report that those students in the live group were more likely to wander off topic during class sessions than those in the just-in-time or solo training. Having students learn in a group results in accountability and improves retention. Having students learn in these groups helps to bolster critical thinking that Brown deemed necessary for effective learning and retention. Based on the age of the students it is important that critical thinking and assessment occurs.

Govindasamy (2001) stated how student support and assessment are key to effective just-in-time training. He noted how just-in-time training enables a student who needs performance support can simply communicate their needs and be given a programmed interaction that should provide enough support. These assessments are simply there in order to help guide and reinforce what the students learn during their classroom sessions. Keegan (2005) studied how mobile learning could be a possible solution when operation with the mainstream. Mobile learning is the training or education conducted by mean of portable computing devices. This type of training would simply be there to supplement and assess student's abilities and schedules so that they are able to access those materials that they deem necessary to spend more time on. These days' phones are more powerful than some of the computers that are still in use today. It makes more sense as technology advances to start implementing just-in-time training software on phones either through safari or applications. This enables a better feedback loop, and the ability to introduce collaborative learning groups where students can post and respond to questions at their convenience. Cafias et al. (1998) stated how this same technology also is being used by the National Imagery and Mapping Agency. The future work of these prototype programs should help to show just-in-time training and its applications.

Bukhari, Wojtalewicz, Vorvoreanu, and Dietz (2012) conducted an exercise using social media as a training tool. This program used key words on different platforms to gain insight into the public's perceptions of Super Bowl XLVI. Using this type of program could help to gain insight of student's perceptions of the material and whether they perceive themselves as properly trained.

Another questions that arises is whether social media have a place in public health emergency response. Black, Dietz, Stirratt, and Coster (2015) concluded that using social media is a way to quickly gather information on a given topic. The only problem is the accuracy the information obtained. The spreading of news and videos to social media outlets is quicker than ever, but sifting through the relevant material might difficult. As it stands, this type of program is best used to warn of an upcoming or ongoing event. This type of program is not quite ready to be used for fact gathering until a better algorithm is compiled.

Stolovitch and Ngoa-Nguele (2001) argued that one of the best potentials for just-in-time training can be utilized by the storage and access of valuable information. They stated how just-in-time training can be developed in a cost-effective manner. Using just-in-time training to bolster retention and effectiveness for new tasks that arise could help save companies money and time by training all employees as needed as opposed to once a year. Watson and Temkin (2000) examined combining just-in-time training with more central practices of action learning. When business clients have an immediate problem, employees can split into groups with the instructor giving information based on the material needed to be presented to the corporation. This helps employees learn the information and skills based on what is needed for a specific assignment. Bailey and Forbes (2005) implemented just-in-time training as a warmup and assessment exercise to help guide the interactive learning during classroom sessions. The feedback from these assessments helped the instructors to learn where the students needed more help, which in turn resulted in adjusting the speed in which the material was presented. Much like the real-world case studies, it is important to know when and where individuals need additional material and help in order to foster retention.

Nishisaki et al. (2010) developed a study to test the effects of just-in-time training with nurses and therapists for 30 minutes at the beginning of each work day. No significant difference was found between those with the additional material and those without. However, using this material as a refresher for those rarer events as opposed to common event might result in a significant difference. Much like Collins el al. (1997) study that was developed in order to track employees with specific expertise and strong areas, just-in-time training could be used in order to ensure the best possible nurses and therapists available for each job are assigned to each position according to their scores. Ensuring the best possible practitioners are assigned each event could be a selling point not only in medical but all business ventures.

Stanley and Jarrell (2005) argued that surveys can rarely establish an approximate consensus. They used regression analyses to provide as a means to replicate the data, so future models could map out a more unanimous consensus. It is important that the results are replicated over and over until there are enough data points that the research is more reliable and valid. With the retention data that was used for this study going for 2 months, it could hinder some of the defensibility of the research. In order to become a body of knowledge the exercise would need to employ surveys that test retention up to a year after to see what the regression really looks like if no training update is given.

Beckers et al. (2007) constructed a mock cardiac arrest scenario with 59 medical students that received no previous medial training. These subjects were given a test before and after they received training. In addition they were also tested after 6 months. The study noted the time of first shock, the electrode positioning, and the volunteers safety throughout the exercise. Six months after the training a significant increase in time to first shock was recorded. This was after having received the 15 minutes of instructions. Northington et al. (2007) also developed an observational study around the same time that assessed training retention for out-of-hospital providers. These providers were given a test that assessed how well they could don and doff personal protective equipment (PPE). As with Becker's exercise, providers were called back after 6 months. They were to don and doff the PPE as before. Only five out of the 36 subjects were able to complete their task without committing any critical errors. Only two of the seven subjects having prior hazmat training passed without any critical mistakes, showing once again how retention drops significantly after 6 months.

2.4 Synchronous Cost

For this study, the focus was on assessing synchronous versus asynchronous cost over time for security training. Since this is from a homeland and state-based perspective, data were collected from the US Department of State. Training provided by this organization is used by law-based agencies and personnel, and estimations were calculated based on trainings offered by the U.S. Department of State. The Department of State is comprised of the Bureaus of Administration, Budget and Planning, Comptroller and Global Financial Services, Consular Affairs, Diplomatic Security, Bureau of Human Resources, Information Resource Management, Bureau of Overseas Buildings Operations; as well as Director of Diplomatic Reception Rooms, Foreign Service Institute, Office of Management Policy, Rightsizing, and Innovation, Office of Medical Services and Office of White House Liaison (U.S. Department of State, 2018).

Synchronous costs, in the current study, involve all security trainings provided in person by the U.S Department of State. The Bureau of Diplomatic Security (DS) focuses on developing and conducting specialized security related training sessions and programs for individuals. The trainings are structured around training Department of State professionals and; federal agencies personnel; and their dependents. They provide cybersecurity training programs at their Diplomatic Security Training Center that started in July 2010. This program is based on the principles of Information Assurance. While the cost of these in-person cybersecurity trainings are not dircetly stated, the courses cost less than contracting for new services (U.S. Department of State, 2018). The Federal Cybersecurity Training Events (FedCTE) program also is provided by the Department of State's Diplomatic Security Training Center with financial support from the U.S. Department of Homeland Security. This training involves in-person one-day training sessions which focus on current cyber threats and mitigation strategies; there is no cost per seat to the parent agency (U.S. Department of State, 2018).

Other than the Bureau of Diplomatic Security (DS), the only other part of the Department of State to provide security-related training is the Foreign Service Institute. While DS focuses on cybersecurity trainings, the Foreign Service institute focused on multiple aspects of security and provides training to local government employees and dependents, private sector corporations, and study abroad administrators. One of the major trainings provided by the Foreign Service Institute is the Private Sector Security Overseas Seminar. In involves a 3 day in-person seminar-based training session which covers the topics of international personal security, cybersecurity, explosives, sexual assault awareness and response, hostage survival, overseas security advisory council, operations centers, cross-cultural awareness, and crisis management. This training costs about $695 per person for each 3 day session. (U.S. Department of State, 2018)

The Security Overseas Seminar is a 2 day in-training session in the topics of risk management, personal security, sexual assault, cyber security, detecting surveillance, overseas residential and road safety, fire safety, weapons of mass destruction, counterintelligence, hostage survival, evacuations and contingency planning, and coping in a crisis. The non-state tuition cost for this training is $560, while the state tuition cost is zero. The same office also provides an in-person High Threat Security Overseas Seminar which teaches threat and situational awareness training against criminal and terrorist attacks while working in high threat regions. While the tuition cost is not exclusively stated on the website, this training covers the topics of risk and security, health, surveillance detection, personal protection defensive driving, road safety, kidnapping prevention and response, and explosive countermeasures.

Overall, while the U.S. Department of State provides some other trainings, these are the only in-person trainings provided which could be synchronous costs to organizations and individuals paying for the trainings. While the costs of trainings vary significantly, and are adjusted based on individual quotes, average costs can be estimated. For this study, average cost is calculated based on the statistical mean Based on these calculations, if an organization or individual were to pay for these trainings, the average synchronous cost per user would be approximately $350.

2.5 Asynchronous Cost

Asynchronous costs take more resources up front than synchronous courses. This is because the material that is to be used for training need to be developed ahead of time and in a professional matter. This means using expensive resources such as green screens, actors, and video editing professionals. Normally these videos cost approximately $5,000-$6,000 a minute. (Byrom, 2017) On the other hand it is cheaper to make a screen recorded video and simply add a voiceover to the images to help explain the material. This time costs around $60-$120 an hour, which is a more cost effective training tool appropriate for the materials. The website business shows how a CEO spoke in his own video and spent a total of $4,500 as opposed to $50,000 for a professional production. A website called TAR talks about how all video production prices are a compromise between how good, fast, and cheap they are. They explain how setting goals and explaining the best possible outcome of the video is very important to help best predict the cost and effectiveness that it will have. (Ryan, 2018). There are more cost-effective methods available, but the $5,000 price will be used to compare to synchronous versus asynchronous costs. This is realistic because most government organizations hire professionals to develop their training videos.

Whalen and Wright (1999) argue that cost and return is what drive companies and organizations. The lower variable costs that are associated with maintaining and updating this type of training is what can help make it worth the investment. Asynchronous training takes less time to deliver and can be delivered and used multiple times. Not to mention how many employees this type of training can accommodate. Mincer (1962) stated how on-the-job training costs have grown at a fast rate for higher skill fields. Just-in-time training might be considered as more cost effective in those fields with higher skills required than constant information updates.

2.6 AnyLogic

AnyLogic is a modeling software that helps to provide a visual representation of the asynchronous and synchronous costs over time. The model that was constructed shows the cost per year and the number of individuals undergoing training. It is a simple model that multiplies the cost per month by the number of individuals. This tool is useful in helping to show how long it would take for synchronous costs to match asynchronous costs. This basically tells us how long it would take the asynchronous training video to start being cost effective, and worth the investment.

Kirby, Dietz, and Wojtalewicz (2012) developed a model to improve the speed of an urban area evacuation. Using AnyLogic they showed how the number different resources and processes that would be needed for an effective evacuation of a secure shelter. This model showed possible completion times and optimal routes that could save hundreds of thousands of dollars if a real-world exercise was developed. AnyLogic continues to update and upgrade its modeling capabilities. Using this software can help to develop real world strategies for events that should help increase efficiency and reduce error rates. Glass (2017) focused on strategies to reducing these error rates throughout POD exercises.

From Table 2.1, it can seen how long it would take for each duration of video to be cost effective in regard to the number of individuals trained. Assuming the price per min and the price per person to be cost effective within a year one, 15 people would need to be trained for each minute of video produced. For each minute of video added, another 15 individuals would need to be trained per year to make the video cost effective in under a year. This is just the average cost for a person for a single training session, though in most cases individuals would most like go through a few of these a year.

Table 2.1 Training Costs Results

Asynchronous Cost (Byrom,2017) ($5,000 per min)	Cost Per Person (U.S. Department of State, 2018) ($350)	Number of Years to be Cost Effective (Calculation)
1 min video	5 people	2.8 years
1 min video	10 people	1.4 years
1 min video	15 people	0.9 years
2 min video	5 people	5.7 years
2 min video	10 people	2.8 years
2 min video	15 people	1.9 years
3 min video	5 people	8.5 years
3 min video	10 people	4.2 years
3 min video	15 people	2.8 years
4 min video	60 people	0.9 years
5 min video	75 people	0.9 years
6 min video	90 people	0.9 years
7 min video	105 people	0.9 years
8 min video	120 people	0.9 years
9 min video	135 people	0.9 years
10 min video	150 people	0.9 years

Originally the focus of the research was to compare the error rates of the asynchronous and synchronous training. Eventually a third verification step was added called the accuracy station. This station provided a final check that would serve to eliminate most if not all errors from the volunteer's calculations. It also served to count the number of errors occuring at the time of the POD as opposed to sifting through all the data after the POD concluded. In a real-world event, should the number of volunteers permit, there would be enough trained professionals to check over the medications before they were dispensed incorrectly.

2.7 Conclusion

Based on the estimates presented above, it is apparent that in most cases a program could be cost effective within a year. When it comes to emergency training for incidents such as hurricanes, viruses, and other natural disaster, the researchers believe this would be the most cost-effective way to train government employees. Not only would employers not have to send the employees anywhere, but the material would stay relevant for several years. In the future, it would be helpful also add upkeep costs for asynchronous training, but no real data could be located for these costs. These costs would include updating of materials and possibly paying for the handling and dispersing of the training material.

CHAPTER 3. METHODOLOGY

3.1 Framework

The asynchronous and synchronous groups were merged to gauge retention over time. This was due to the research done previously which concluded that asynchronous and synchronous training had no significant difference on the outcomes of throughput times and effectiveness during a POD. The costs associated with each type of training was averaged to account for the vast difference in organization sizes and venues for just-in-time training. The costs associated with each type of training were compared regarding upfront and update costs. Where traditional methods evaluate annual cost every year, the just-in-time training method includes upfront update costs. It is difficult to ascertain when these costs would occur because there might be variations by professional fields. The retention rates can be extrapolated to show how they would reduce over years. This study is the culmination of 3 years of work concluding the original training; with 50 completing the survey. Future research should include follow-ups throughout the year for a better indication of the retention curve.

3.2 Research Methods

The research conducted was a case study. The study explored the retention of information, training and costs associated with traditional and just-in-time training methods. This study hopes to show that traditional methods are not a sufficient way to train, and should either be replaced or used in unison with just-in-time training.

3.2.1 Coding/ Accuracy Methods

In order to preserve anonymity, an identity code was developed for each participant. Identifying each participant provides the opportunity to determine if certain students skew overall accuracy and whether data were properly collected or filled out. Synchronous tables are always to be labeled 1/A with the presenters name (Ryan). Asynchronous tables are always labeled 2/B. When examining the POD from the entrance, the synchronous training is on the left and the asynchronous is on the right.

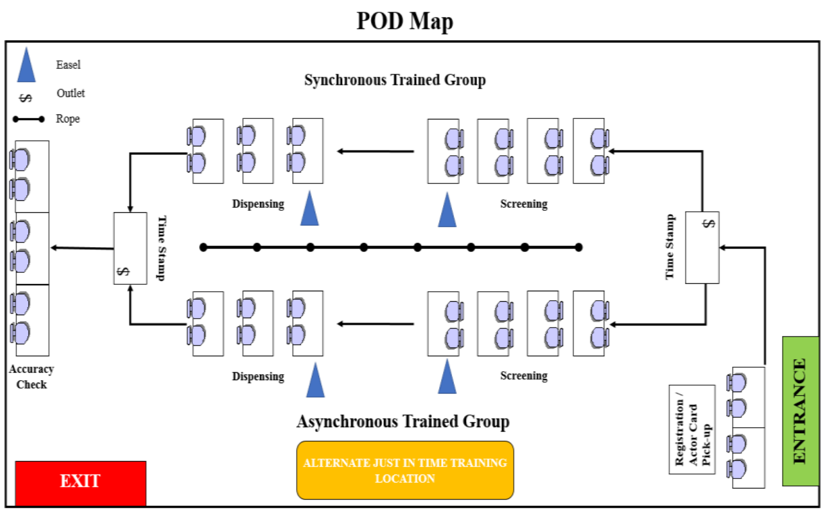


Figure 3.1. POD Map

The code itself has three identifiers. The first refers to the set of the exercise, the second refers to the type of training students were administered, and the third refers to the seat that the students took in regard to their respective roles. A sample of the code looks like this, “1S14”. This code means that it is the first set, the student had synchronous training, and was assigned to seat 14. The codes were from 1S1 and 2S28. For a certain set, 1S1-1S14 would be synchronous, while codes between 1S15-1S28 were all asynchronous. This was replicated for set 2. Each set had a total of 28 seats, with 14 for each training group. To simplify the code so that the same numbers in a row are correlated with a type of training, the left/ Synchronous side were seats 1-14; and the right/Asynchronous were seats 15-28.

3.2.2 Qualtrics

The Qualtrics portion of the exercise was completed on any smart device the student brought with them. The assessment had timers built to each page of the surveys, which recorded spent time at each station. The training helps to navigate the students through the POD, in addition to keeping track of the time they spent at each station. A sample of the assessments are shown below. The main reason for this assessment is to gauge time spent on each station. The reference to the screening table number tells what type of training the student has received. (1 = Synchronous, 2 = Asynchronous) The only other question on the survey refers to whether there was an accuracy check during the round. Previously, there was an accuracy check for only one of the rounds. As the exercises continued, accuracy checks were incorporated for every round. The assessment also records the date that the survey was taken, which was useful in comparing current and past POD exercises.

3.3 Sampling Approach

Each of the nursing students who completed the POD exercise and received training were also used to gather the retention data. Respondents were students that were not graduating and had time to take the survey. These students were not a real-world representation of the volunteers at a POD exercise. Though it would be advantageous to have volunteers with experience in medication staff the PODs, these individuals would not be available due to full-time responsibilities and number of volunteers needed. Untrained citizens would be the next available group.

3.4 Sampling Size

The sample size was between 60-80 nursing students depending on iteration. The two retention surveys had a total of 93 respondents recorded over the span of 2 months. Due to the number of students, multiple exercises conducted to collect adequate data points. Once accuracy stations were added to the POD, professionals in their respective fields also were included to boost accuracy of medical distribution and help to check the accuracy of the screeners and dispensers.

3.5 Population

The population for the study was the nursing and pharmacy students within Purdue University. The characteristics and knowledge of the population is all assumed to be equal regardless of field. The exercise also employed the help of the Purdue Homeland Security classes in order to help guide and distribute all vital information and materials to the volunteers.

3.6 Variables

The variables measured were retention rate, cost, and number of volunteers needed to effectively staff a POD. These demonstrate the effectiveness of POD exercise, and training activity. AnyLogic was used to model cost. The accuracy of the distribution of medications also was considered for a different study (Glass, 2017).

3.7 Units of Measurement

The units that this study compared were cost and retention rate. The focus was to see how often training would need to be viewed to be effective. The costs associated with asynchronous training can range greatly. This also is true for costs for different companies allocated for training their employees. Averages of costs were used in the modeling software.

3.8 Assessment Instruments

Qualtricswas used to collect data about retention rates of training information from 1 month to the next. The Qualtrics survey also was used in order to track throughput time. A station at the end of the POD was used to track accuracy of prescriptions. Stopwatches were used to assess volunteer throughput for the stations, then throughput time were added. In some cases, students would add incorrectly or misread the stopwatch settings. The Qualtrics provided accurate information by automatically timing students as they went from station to station.

3.9 Data Collection Methods

A spreadsheet comparing retention rates was used in order to track the degradation of memory. The rest of the data incorporated Qualtrics and AnyLogic modeling software in order to evaluate throughput time and the costs associated with just-in-time training. Qualtrics data can be transferred into Excel spreadsheet, while the AnyLogic software requires multiple iterations of data ran in order to produce accurate results. Where Qualtrics provides real-time data, AnyLogic is to simulate a real-world events.

3.10 Analysis

The retention and costs were compared between traditional and just-in-time training. This was used to provide insight into the amount of money and time that could be saved. The retention analyses should help to justify the worth of just-in-time training when compared to more traditional methods.

3.11 Chapter Summary

This section introduced the methods and measurements use. The methods were designed to collect data pertaining to retention and costs. The exercise plans developed for the POD can be found in Appendix A and provide details about what the recent PODs included.

CHAPTER 4. POD EXERCISE TRAINING METHODS

4.1 Introduction

The goal for the PODs was to develop a reproducible training that could easily be customized and replicated for a number of situations. An anthrax outbreak was assumed in this study. Students were then trained 2 days before the POD, to screen and dispense medications appropriate for antrhax in a timely and effective manner. The more PODs exercises, the lower the throughput times. Also, there was an increase in recording accuracy of students.

4.2 Concept

- The POD exercise occurred 2 days after the students received training.
- Training would be given asynchronously and synchronously, splitting the students in half.
- Times and accuracy for each group would be compared in order to validate the superiority asynchronous training.
- Students received no other training or help with their screening and dispensing duties before the POD.

4.3 Training Method

The goal was to educate the students using (just-in-time training). When study began 2014, just-in-time training was still new, but there is now more information about it in the extant literature. The videos used were developed at Purdue University. There were originally three videos that presented an overview about screening and dispensing. A criterion referenced was used:

each student was required to score a 100% before they could submit the survey, ensuring that each student mastered the training. Figure 4.1 depicts an example of what the students would use.

Figure 4.1 is the original algorithm that was used for the first POD exercises. Over the course of 2 years, it was suspected that the algorithm might be responsible for lower effectiveness percentages.

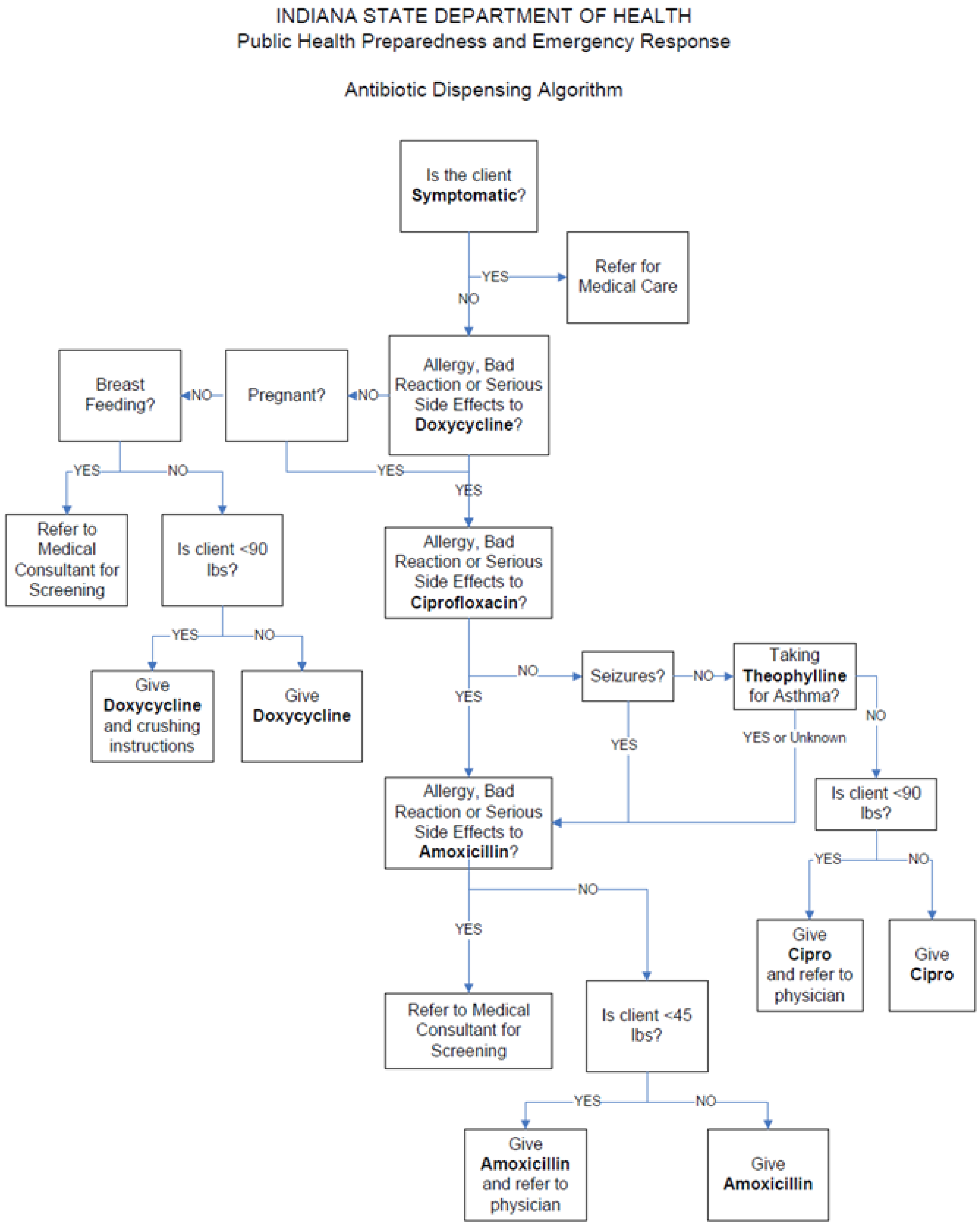


Figure 4.1 Survey Answers Flow Chart

It began to seem that students did not follow the algorithm but skipped around. A positive result was throughput times at the expense of screeners and dispensers effectiveness and accuracy. It was then suggested that a new algorithm be used to reduce or possibly eliminate a volunteer's ability to skip through the algorithm. The algorithm was set up with overarching attributes that would enable the volunteer to almost instantly know which of the algorithm sheets to choose. Once the correct sheet was chosen, the available medication choices were list from top to bottom ranging from the most likely to be given to the rarest. Each choice shows if-then statements that are outlined for each type of medication that can be administered.

The photo below shows how some of the original training for the asynchronous groups were set up. This technique was effective for providing training to multiple volunteers one, but failed to give individuals the chance to review the material independently if they were not comprehending the presentation. Later PODs, introduced materials via iPads and headphones. Thus, volunteers could learn at their own pace, and review the material when and if needed.

Figure 4.2 Volunteer Training Photo

4.4 Setup

In the early stages of the PODs triage, screening, and dispensing tables were used. A sample of the setup can be seen in Figure 4.1. As studies went on more screening tables were used due to a bottleneck that kept occurring during the exercise. Bottlenecks occurred because screeners were required to provide initial recommendations about which medications to use. The dispenser simply checked over the screener’s recommendation and supplied the volunteer with their medication. Eventually, an accuracy check station was added to the POD to not only help with data collection but to improve accuracy and identify problem areas. The most recent POD setup incorporated four screening and four dispensing tables. No bottlenecks were noticed during the most recent exercise. This is most likely due to a revision of the algorithm. Students expressed their concern with the difficulty of the original algorithm, mentioning how difficult it was to navigate quickly and effectively. The new algorithm started with the most relevant medications and cycled down through the rarer medications. This gave students the ability to decrease the amount of time it took to screen each of the volunteers. The new algorithm can be seen in Appendix A.

4.5 Evaluation Method

The PODs were evaluated based on throughput time and accuracy. To evaluate the time it took to go through stations, Qualtrics was used. This survey allowed us to track the time the volunteers were at each station, as well as the total time in the POD. Throughput times were useful in deciding how many tables should be incorporated in the next exercise. As mentioned above, the most recent POD had four screening and four dispensing tables for each type of training. This seemed to be the most efficient set up.

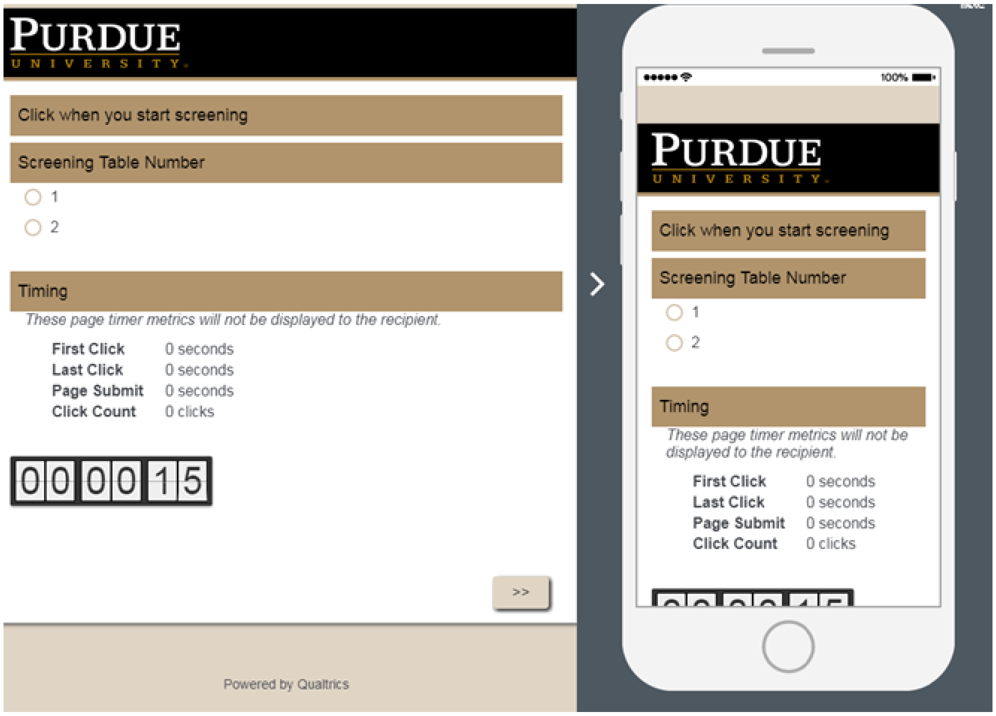


Figure 4.3 Qualtrics Survey

Along with the Qualtrics tool, the exercise also employed the use of YouTube. This made it easy for volunteers with a smart device to watch the training material at their discretion. The video for the overview can be found at https://www.youtube.com/watch?v=baB0Hog6AZ4. An overview of the POD is provided within the video represented in figure 4.4, which would be used for information on the stations and how the students would be assigned. Below is a representation of what would be seen when accessing the video.

Figure 4.4 Training Material (YouTube)

4.6 Relevance

The extant literature shows no significant difference between the asynchronous and synchronous methods. Assuming that this is true, this type of training was incorporated to other areas of research like large event security. A few of the large event stadiums could benefit from this type of training since most of them hire security firms to work their events. Especially those events that employ volunteers with no knowledge of what is expected. Much like the students who traverse the POD or who screen and dispense, these volunteers could learn what is expected in as little to twenty minutes. This just-in-time training could be a new method to train and refresh event employees to maximize their tasks in a timelier and efficient manner. For example, security has been observed at a few different large event venues. From the information gathered there, these venues need help to reinforce proper tactics and methods. This type of training needs to be customized. Training that can be instantly used on any device with internet is an invaluable resource that should be adapted and used in more areas.

CHAPTER 5. RESULTS

5.1 Introduction

Below is all the metadata that was collected in relation to the PODs exercises that were conducted in the Purdue Co-Recreation center. The exercises were developed to not only help train pharmacists, nurses, and public health volunteers, but to gain an insight into the amount of time required to operate a training event. Differences in time were compared to the types of training provided, synchronous or asynchronous. For the first POD, the total throughput time was compared for both the screening and dispensing stations based on the type of training received. This was not only based on training but whether there was an accuracy check that was implemented at the end of the POD.

Additionally, data was combined without any training or accuracy station biased that observed mean times throughout the study. This helped to reference all of the data from the multiple PODs without having to separate them based on the criterion. During the second POD conducted on 11/9/2017, there was an addition of accuracy stations as well as a training post-test that required students to receive a perfect score in order to pass. A month after the conclusion of this POD a retention test was administered in order to see ascertain memory of the information. This marks the first time that a retention test was implemented. The third POD was held on 03/29/2018. This POD included the accuracy station and retention test as well but incorporated a new algorithm. The new algorithm incorporated was made to help eliminate errors and reduce bottlenecks. The retention test for this POD exercise was given 2 months after the students received their training in order to develop a retention curve. There are only two data points. However it is still possible to show an extinction curve to validate how often training might need to be administered.

5.2 Data POD 1

POD 1 incorporated the accuracy station for the first time. There were a total of 103 responses for synchronous and 112 for asynchronous. The mean completion time for the synchronous screening station was 46 seconds, while the mean completion time for the dispensing station was 51 seconds. When mean times for completion are added, total mean throughput time of synchronous POD per volunteer was 134 seconds. The asynchronous mean completion time for the screening station was 55 seconds, while the mean completion time for the dispensing station was 51 seconds. Adding the mean times for completion, total mean throughput time of asynchronous POD per volunteer was 141 seconds. Below is a table for comparison of values; based on the type of training.

Table 5.1 Asynchronous vs. Synchronous Training Effectiveness

	Screening	Dispensing	Total Throughput
Synchronous	46 secs	51 secs	134 secs
Asynchronous	55 secs	51 secs	141 secs

The next comparisons are whether an accuracy check station was included or not. During the time the exercise was completed with the addition of the accuracy check, there were additional stations added to eliminate bottlenecks. Since there was no effect on the screening and dispensing stations due to the accuracy check station being added, only the total throughput mean times are discussed. The total mean throughput time of the POD with an accuracy check was 116 seconds, while the time without an accuracy check was 170 seconds. As stated above, this increase in time without an accuracy check station is most likely due to the number of tables added to the screening stations during this time. One would expect to see at least a slight increase in total throughput time with the addition of another station. The reason this data is included is to show how having the right number of stations affects throughput. Below are the times of each station that show the importance of using a proper layout for the POD and incorporating an appropriate number of stations.

Table 5.2 POD 1 Training Times (Accuracy Station)

Accuracy Check	Screening	Dispensing	Total Throughput
Yes (Additional Screening Stations)	41 secs	44 secs	116 secs
No	66 secs	61 secs	170 secs

The last data to examine is unbiased and only based on observed throughput times without any regard to type of training or whether there was an accuracy station added. The observed mean screening station time was 48 seconds, while the mean time of the dispensing station was 49 seconds. The total mean throughput time was 130 seconds. This shows that on average each participant with an optimal time should be processed at each station in around 2 minutes.

5.3 Data POD 2

The data for the POD on November 9, 2017 was split in order to show the difference in training times associated with each type of training. In addition, the overall completion times were added in order to show the POD flow rate regardless of training type. In this instance the mean completion time of the asynchronous training was on average, 19 seconds faster. On average students take around three and a half minutes to traverse the POD. Less time traversing the POD means a greater increase in the amount of people that could be served in a day. Accuracy is always important to make sure the patients receive the correct medication and do not have adverse effects.

Table 5.3 POD 2 Training Times

Station	Regardless of Training	Synchronous	Asynchronous
Screening	50 secs	52 secs	50 secs
Dispensing	90 secs	94 secs	78 secs
Accuracy	75 secs	74 secs	74 secs
Total Throughput	213 secs	221 secs	203 secs

In order to increase accuracy, this POD began implementing a retention rate Qualtrics assessment shows how long students remembered the algorithm used to distribute medication. A month after the exercise, students were given the retention quiz. The average for the quiz was a 9.2 out of 12 possible points or 77% retention.

5.4 Data POD 3

The POD conducted on March 29, 2018 incorporated a new algorithm. The new algorithm can be seen in Appendix A. As discussed above, the new algorithm was developed in order to reduce mistakes and bottlenecks. The previous algorithm enabled students to jump to random parts of the chart without following prescribed procedures.

Table 5.4 POD 3 Training Times

Station	Regardless of Training	Synchronous	Asynchronous
Screening	50 secs	54 secs	51 secs
Dispensing	77 secs	66 secs	69 secs
Accuracy	27 secs	27 secs	27 secs
Total Throughput	155 secs	147 secs	147 secs

A breakdown of the stations times can be seen below. This iteration of training showed an identical total throughput time, with only slight differences in screening and dispensing. This data can most likely be contributed to the new algorithm that was incorporated. Based on the comments received after the POD, students preferred the new algorithm as opposed to the old one. The only downside was that the new algorithm is three pages where the prior was only one. This time the retention assessment was administered 2 months after the POD as opposed to one. The assessment was 5.5 out of 12 or 46%. This was much lower than expected and is 33% lower than the one-month average. Looking at the tables side by side is apparent that the additional iterations of the POD exercises helped to lower the throughput time. Total throughput regardless of training was 170 secs in the first POD, 213 seconds in the second POD, and 155 seconds in the most recent POD. During the second POD the number of tables were reduced in dispensing during the first of two runs. This could be why such an increase is seen in the average time it took students to complete the dispensing stations. When comparing the second and third PODs, a drastic decrease in dispensing and accuracy station times is observed. The dispensing station had an approximate 10 second decrease with accuracy station times decreasing by 50 seconds. Below is a comparison of the total mean throughput times independent of the type of training. The first few PODs did not employ an accuracy station because, the need to increase accuracy did not occur until later review of the data.

Table 5.5 POD Comparison

	Algorithm	Total Time	Screening	Dispensing	Accuracy Station
POD 1	A	170 Seconds	66 Seconds	61 Seconds	N/A
POD 2	A	203 Seconds	50 Seconds	90 Seconds	75 Seconds
POD 3	B	155 Seconds	50 Seconds	77 Seconds	27 Seconds

5.5 Independent T-Test

In table 5.6 $p < .05$, meaning that equal variances are not assumed. Thus, the second line was used.

Table 5.6 Independent T-test

		Levene's Test for Equality of Variances		t-test for Unequal Variance						
		F	Sig.	*t*	*df*	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Retention	Equal variances assumed	5.00	.028	5.39	94	.000	3.45	.64	2.18	4.71
	Equal variances not assumed			5.67	93.74	.000	3.45	.61	2.24	4.65

On average, those who were given the test one month after the initial training (*M* = 8.98; *SD* = 3.49), scored higher on the test than those who were given the test two months after the initial training (*M* = 5.54; *SD* = 2.46). This difference was significant t (93.74) = 5.67.; $p < .01$ and shows a medium to large effect size, Pearson’s r = .51.

Table 5.7 Group Statistics

	Month	*N*	Mean	Std. Deviation	Std. Error Mean
Retention	1.00	55	8.98	3.49	.47
	2.00	41	5.54	2.46	.38

CHAPTER 6. DISCUSSION

6.1 Retention

As the data shows, retention falls significantly within the first 2 months. The just-in-time method of training should be used just prior to needing it. Much like fire drills that are done every month in most schools, just-in-time training could be used to train every other month. If asynchronous training were to be used every other month with fire drills, it is likely an improvement in response time could be seen during such an event, because it would be easier to track retention of the students. This can be seen in the three figures below. These figures show the extinction curve of the just-in-time training that was observed during the POD exercises.

The exercise did not examine more than two months after training was received, but it can be assumed that retention will be unsatisfactory by 6 months. Becker's scenario noted a significant increase in the time it took volunteers to perform their first shock. The same year, Northington's study concluded that only 14.3% of the subjects were able to complete the task without any critical errors. Regardless of the levels of retention required, it would seem that 6 months is too long for subjects to successfully perform the tasks they were trained on. This becomes more apparent when looking how far retention dropped during the first two months. Having programs that incorporate just-in-time training would help to alleviate the low retention that can be seen in these studies. Furthermore, such programs would have the ability to train right before or during an event. This would make sure that all trainees are at 100% retention before they need to complete their trained tasks.

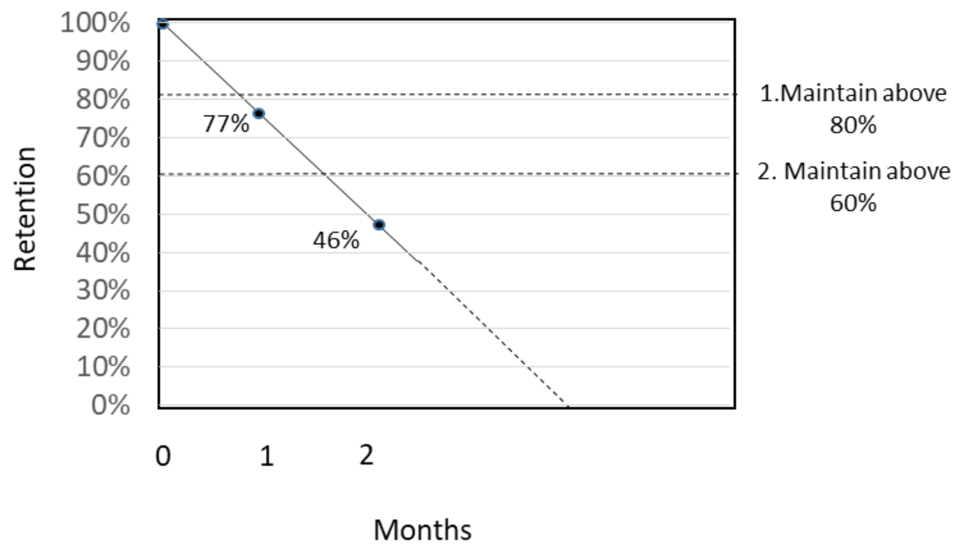


Figure 6.1 Retention (2 Month Update)

Figure 6.1 shows the retention if it were to be trained every 2 months. It is assumed that the students start out at one hundred percent retention. On January 1st the students receive just-in-time training. The following month of February 1st the students receive training again, which will see a 77 % retention rate. The next month on March 1st the students will once again receive just-in-time training, but at this time before the training they will have a 46 % retention rate for the material. In order to maintain above an 80% retention rate, more than monthly training would be required. During the first month, volunteers lose an average of .77% retention per day. If they start at 100% retention, the volunteers would need to be given the material every 25 days to stay above the 80% threshold. Knowing the estimated retention loss per day makes it possible to develop programs that help ensure acceptable retention. Examining the second month, there is a retention loss of 1.03% per day. Assuming this loss, it would be recommended that training be given at month and a half intervals. This would ensure that retention rate stays above 60%. Though 60%

retention wouldn't be acceptable when dispensing medication, other programs would have different levels of acceptance depending on what they are training. For this reason it is important to know how often training is needed for the effectiveness required. Seeing how quickly retention drops during the first 2 months alone, it is suggested that training be introduced often. This "training as you go" recommendation would help to ensure higher retention rates. This would also help to reduce the amount of time and money required to keep retention up to the standards laid out by those putting together such programs.

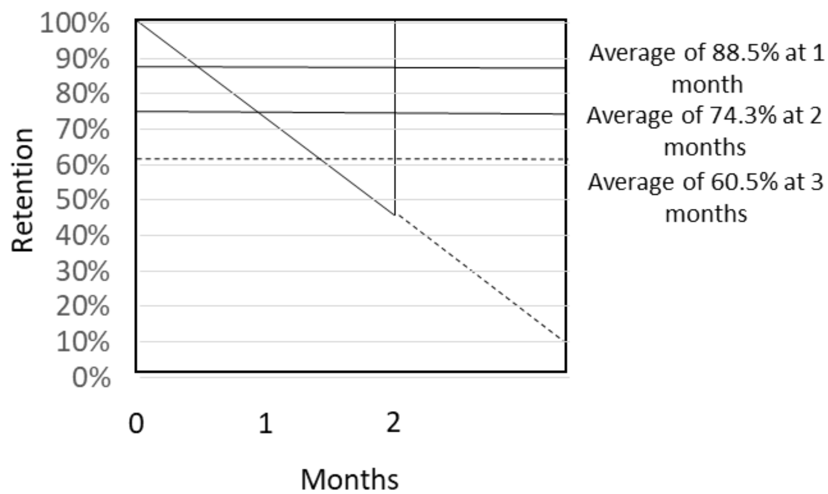


Figure 6.2 Averaged Retention Rates

Figure 6.2 shows the average retention rate observed during the first 2 months after an event. The third average was developed by using the retention drops from the first 2 months, which gave an average drop of 27%. This is given be subtracting the base 100% that is observed starting out from the 77% from month one. This gives a retention loss of 23%. The retention loss from month 1 with 77% was subtracted from month 2 which was 46%. This gives a retention loss of 31%. The average of the 23% and 31% loss gives the average drop assumed in month 3, which is 27% as stated above. Subtracting the assumed 27% decline in month 3 from the 46% retention in month two gives month three an estimated 19% retention. Averaging these four values (100%, 77%, 46%, 19%), gives a month three average of 60.5% retention. Depending on restrictions, it could be viable to base one's training on averages. For instance, would every student in a POD need to be above 80% retention? Would it be enough to have an average retention of 80%, where some students are above and below the average retention? The students who have the higher retention help students with lower retention learn the materials.

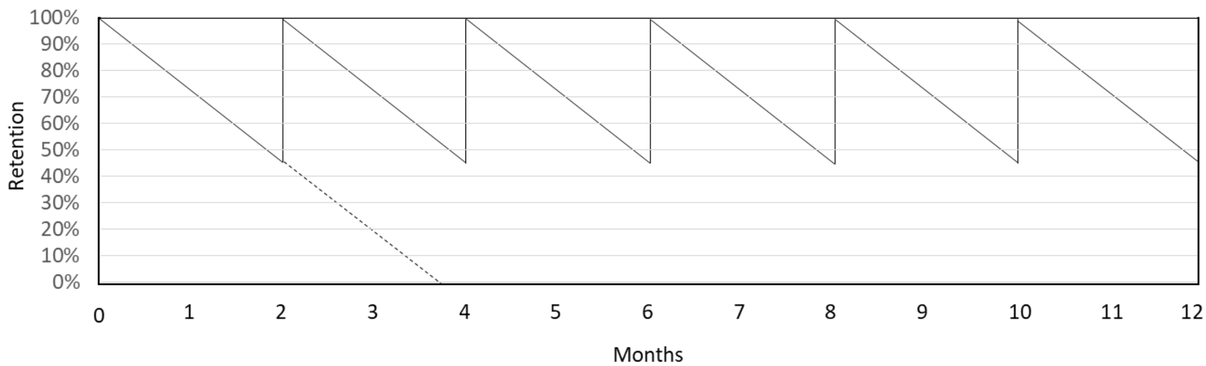


Figure 6.3 Projected Retention (Bi-Monthly Over 12 Months)

Figure 6.3 shows how just-in-time training can continually provide updates over the year, which would be very important to keep retention at acceptable levels. This type of training also could be delivered at home on any device that has internet access. Depending on acceptable averages and. These volunteers where nursing and pharmacy students, which would be more advanced than most volunteers participating in a POD exercise. Modules that can address these retention losses, also would help to reduce the cost and amount of staff required for such an event.

In table 6.1 24% of the variation of month 2 can be accounted for using month 1. An important note is how testing retention with a greater amount of time between surveys would help to provide homogeneity. Since the only variables that this exercise used for retention were months and scores, it could be in the studies best interest to add another independent variable. Having all twelve months of retention surveys could help to do this.

Table 6.1 Retention Regression

R	R Square	Adjusted R Square	Std. Error of the Estimate
.49	.24	.23	3.10

Note: Predictors: (Constant), Month 1. Dependent Variable: Month 2.

Figure 6.3 helps to show the retention regression one would see over the course of two months. As the figure shows, retention plummets over the course of the two months making the error rates of distributing medication ever higher. These graphs help to show how important the constant update and review of material can be in high skill fields. Material that isn’t used consistently is easily forgotten within the first two months. It is the job of those putting together such exercises and emergency units, to make sure that the volunteers being used are adequately trained to hand the situation. A failure to do so would result in the lowered retention and accuracy of those volunteers responding to the emergency event. This could have catastrophic results, especially when considering the distribution of medication.

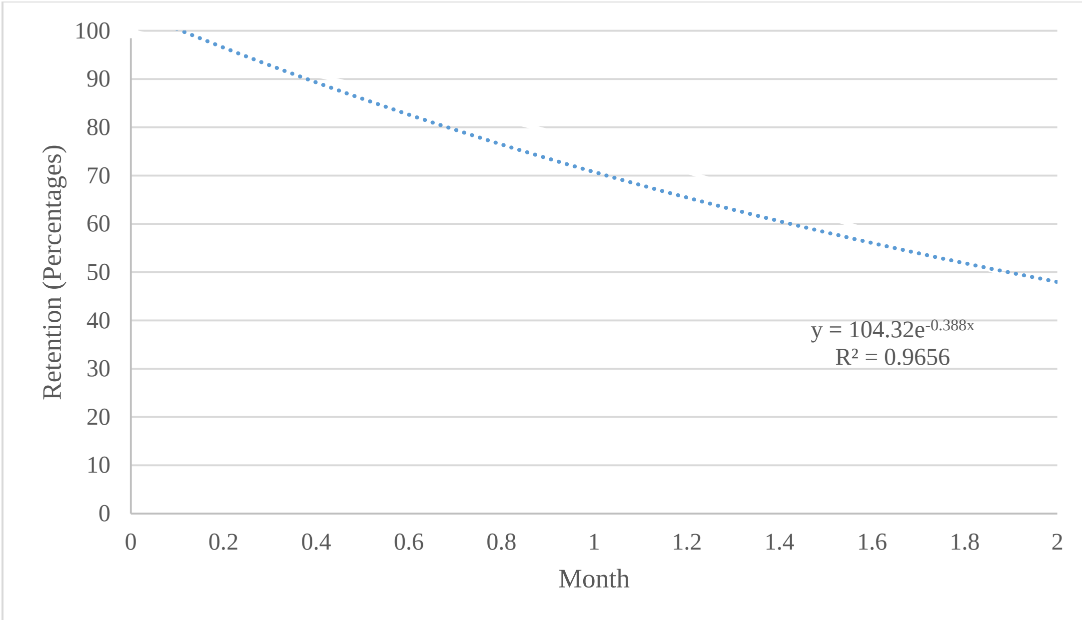


Figure 6.3 Retention Regression (2 Month Update)

Being able to identify the goals, outcomes, and criteria for a POD is important. Additionally, testing the PODs on the specific criterion (retention or population) helps develop the material in line with objectives. This research helps design the training modules to produce adequate skill development and task mastery. This design process should reference the criteria within the instructional design process, a multimedia guide to self-learning.

6.2 Cost

Figure 6.3 shows how many individuals would need to be trained from a one to ten-minute training video cost to equal benefit. This graph portrays one of the most expensive routes for developing a just-in-time training program.

However, a company could potentially lower costs if they were to incorporate their own videos or PowerPoint slides into a video platform like YouTube (Ryan, 2018). This could drastically affect how long it would take to be cost effective. According to census data as of April 2019 the average hour wage is around $23/hour, so paying an employee for 125 hours would be half the cost of hiring professionals. There is no significance in the 125 hours other than showing how someone would have over three weeks to put together the training require, assuming an average 40-hour work week. When completing the videos for the POD exercises it required only 2 days of recording and about a week to render and develop the videos to cut out any mistakes. Developing the script that was required took the most time, and still fell short of a week. For those companies looking to cut cost, there should be more than an ample amount of time to develop their own training at a portion of the cost.

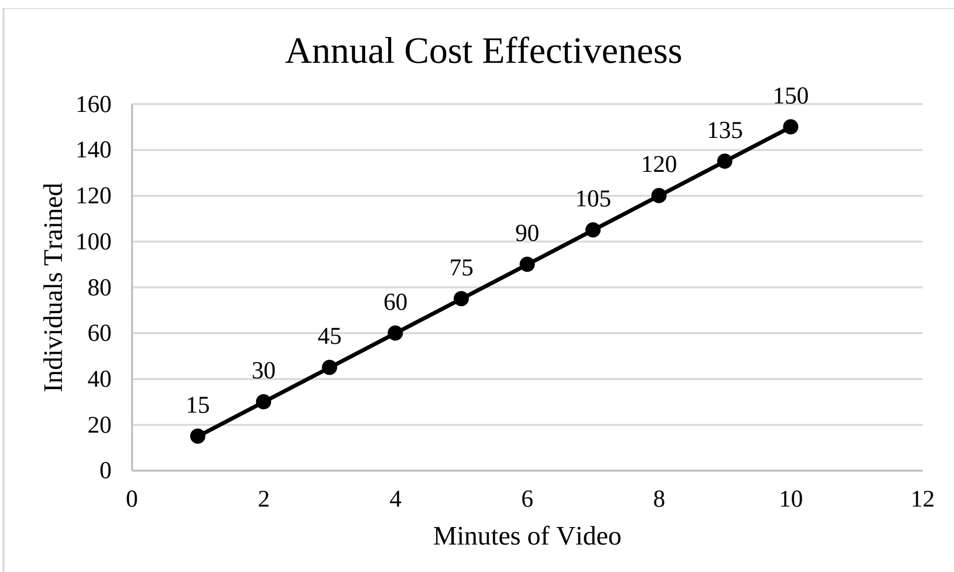


Figure 6.2 Calculated Cost Effectiveness

6.3 Implications of Just-In-Time Training on Retention

The need for gust-in-time training becomes apparent when looking at memory retention when training individuals. Simply sending employees to a training function once a year is insufficient. Incorporating gust-in-time training into current training practices is crucial to maintain acceptable retention. The concept of training is very different from that of education. Education differs from training as training seminars can only last a few days or hours as opposed to months of education. Education allows individuals to incorporate and test information through multiple outlets (quizzes, exams, and papers). Like FEMA training, given once every so many years to obtain a certificate, incremental updates should be more useful (fema.gov).

The cost for just-in-time training can be offset for any level of budget, regardless of the material. With the amount of technology available to employers, it is not enough to send employees to training without incorporating just-in-time training for an employee's convenience. As the goal of training is for the employee to learn and retain the material given, new training methods need to be incorporated with more traditional methods. This approach allows employers to handle both approaches to training cost-effectively without sacrificing retention. Ultimately, incorporating just-in-time training allows employers and employees the opportunity to train often for emergencies.

6.4 Staffing Training Distribution

It was the recommended that the data gathered should provide insight about the number of volunteers needed. With Purdue Homeland Security Institute assistance, the data helped show just how many volunteers would be needed to distribute medication to different population sizes of groups in a 48-hour period. Below is a graph that is a representation of the capacity and volunteer levels one would see in a real-world event. This 48-hour window is based upon the recommendations of the SNS (Strategic National Stockpile), which would oversee medication distribution around the US (2019).

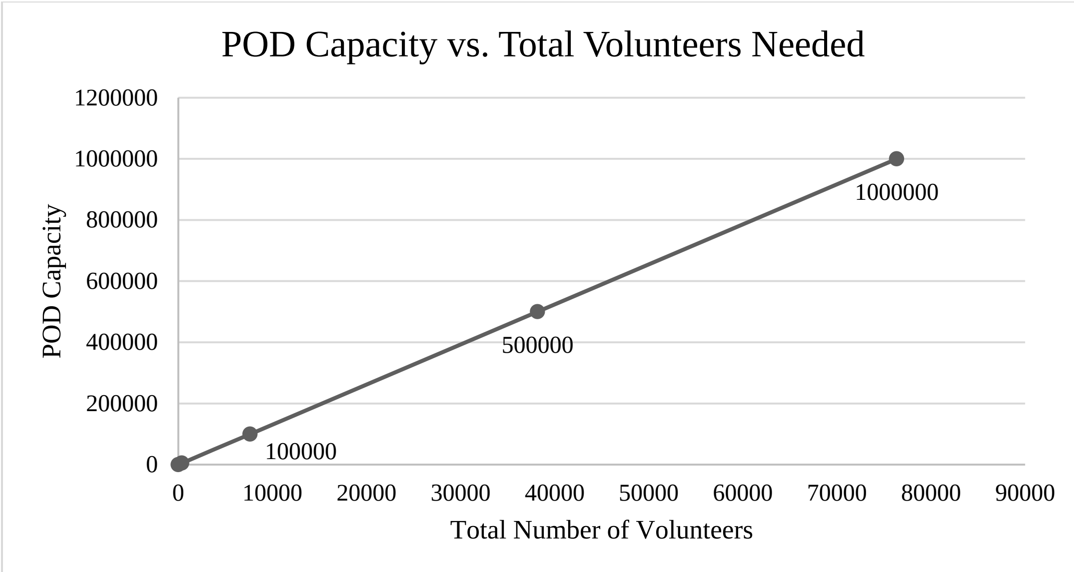


Figure 6.3 Chart Comparing Calculated POD Capacity vs. Needed Volunteers

The number of volunteers assumes that each volunteer works two 8-hour shifts in a 48-hour period. This would also be three shifts/day. If the volunteers are assumed to work one 8-hour shift and are not recycled, then the total number of volunteers needed would be roughly double the proposed amount. The proposed times are based on the mean completion times observed during live exercises of the POD. The average throughput time with 24 volunteers was 155 seconds. If one looks at the 500-POD in figure 5.2, the number shows 38 volunteers are needed to complete the POD in a 48-hour period. A population of 500 can be multiplied by the 155 seconds. Then divide that sum by 60 twice. This equates to a minimum of 21 hours of operation for a population of 500 individuals. There are 172,800 seconds in 48 hours. When divided by the 155 seconds, this is 1,115 people. However this is assuming that these 24 volunteers each work 48 hours non-stop.

Therefore, the three 8-hour shifts were added. This was a rough estimate to analyze the number of volunteers needed. Using the 28 volunteers used in the model, 28 was multiplied by the estimated three shifts. Thus, 84 volunteers are necessary to run the modelled POD for 48-hours.

This result is equitable to the 76 volunteers needed based on a POD capacity of 1100 (Appendix E). To simplify calculations, the number of volunteers that would be needed for a 48/ho period was divided by the number of volunteers used in the POD exercise. Thus, an average of 40 citizens can be served per volunteer in a 48-hour period. Using the population that may need to be served and then dividing by the average number of people served per volunteer (40) equates to an approximate number of the volunteers needed. This number would then be multiplied by three (for the three shifts needed/day). For this example, three shifts are assumed per day, with the volunteers having two shifts in the 48-hours.

Below is a table of the set increments of POD capacity to help show the difference in the number of volunteers needed based on the population. The numbers accurately reflect the calculations that can be seen above, and reviewed in Appendix E.

Table 6.2 POD Capacity vs. Total Volunteers Needed per POD.

POD Capacity	Total Volunteers Needed
50	4
100	8
500	38
1,000	76
5,000	382
10,000	764
50,000	3,818
100,000	7,636
500,000	38,182
1,000,000	76,364

CHAPTER 7. CONCLUSIONS AND RECCOMENDATIONS

Overall, it is believed that the continued exercises and data can be gathered from conducting POD practices and benefit everyone. As data is further examined and the processes of running a POD are refined, the planning time is reduced while training becomes more effective.

If the above suggestions are implemented, it would help estimate the number of volunteers needed per station. Reducing the amount of one type of station can have a drastic effect on total throughput times. Fifty seconds may a lot, but it becomes very significant when that amount of time is extrapolated to a given population. Fifty times 46,000 (population of West Lafayette) equals 638 hours in which volunteers are needed. In a real-world event, there would be multiple PODs and the 638 hours would be split between them. Additionally, training retention goes from 77% at 1 month to 46% at 2months. This is an initial retention loss of 23%, followed by an additional 31%. Continually training volunteers prior to an event or right before an event becomes increasingly important because having higher retention rates improves effectiveness during the POD exercise or if the event actually occurred.

For example, the population of West Lafayette would require 3,450 volunteers for two, 8-hour shifts. Even if it was assumed that a volunteer could work the full 48 hours, the POD would require 1,150 volunteers. If looking at a more populated city like Los Angeles, CA, It would require 289,618 volunteers to distribute medication to its 3,792,621 inhabitants who completed the 2010 census. It doubtful that this area would have enough trained professionals to operate a POD. Therefore, just-in-time training is crucial to train citizens as volunteers in case of an emergency of this magnitude. If the goal remains to dispense the medications in a 48-hour period, training would need to occur as quickly and efficiently as possible. All emergency training should be readily available and easy to access. It is unclear whether any establishment has enough personnel to help train all the volunteers needed without some type of pre-made software. Just-in-time training could be one method to train this number of volunteers in the amount of time of a real-world event.

The data representing retention rates will help impact how government agencies choose to train their employees and volunteers in case an event was to happen that would require training of many individuals. The number of individuals that would be needed to train volunteers in a traditional way would only increase the already staggering amount of volunteers a POD would need, in order to distribute medication in a 48-hour period. The only feasible chance to train the volunteers would be to have the material readily available ahead of time. The “training as you go” method becomes more viable when looking at the number of volunteers that would need to be trained during these events. The amount of resources and manpower it would take to continually update and train potential volunteers so that they are always above a certain retention threshold would be astronomical. It would be nearly impossible to keep everyone above the acceptable retention levels. Even if it was possible for such a program to be made, the costs would greatly outweigh the benefit considering that certain emergency events may never happen. Just-in-time training helps to quickly distribute the material to the masses and show viable candidates that could man the stations of the POD. The “Viable” candidates could be anyone that scores high enough on the pre-tests to be considered adequate for exercises.

The goal of the research is to help government agencies and non-profit-organizations (NPOs) better prepare for an event that requires a point-of-dispensing (POD) unit. For example, the research team developed a Navy funded course that simulated this concept. By outlining how to successfully reuse a point-of-dispensing (POD) unit during emergencies, the researcher compared Qualtrics surveys that were distributed at the beginning and end of this course. Thus, data showed the success of asynchronous training in education. Additional benefits to this project were expanding student knowledge and appreciation to areas outside their fields, in addition to showing the opportunities for the Navy.

Future work examine would how to maximize the accuracy of the volunteers who may have never reviewed a dispensing algorithm. Being prepared for different events and having a full proof plan that provide individuals with a template for o traversing such an algorithm would be essential. Only those potential volunteers with high enough scores would be viable candidates to participate. Incorporating an accuracy check station with professionals also could help to reduce errors and liability and protect health. Preparing for emergency training would be proactive response to emergencies as opposed to reactive. The nature of PODs requires preparation to accurately dispense the medications. Therefore, the best and possibly only way to adequately train the volunteers would be asynchronous training. The just-in-time training is the only foreseeable way to effectively train volunteers for the multitude of possible events that could arise.

APPENDIX A. EXPLAN (NEW ALGORITHM)

Purdue POD Full – Scale Exercise Spring 2018

Exercise Plan

29 March 2018

The Exercise Plan (ExPlan) gives elected and appointed officials, observers, media personnel, and players from participating organizations information they need to observe or participate in the exercise. Some exercise material is intended for the exclusive use of exercise planners, controllers, and evaluators, but players may view other materials that are necessary to their performance. All exercise participants may view the ExPlan.

• EXERCISE OVERVIEW

Exercise Name	Purdue POD Full – Scale Exercise Spring 2018
Exercise Dates	29 March 2018
Scope	This exercise is a Full – Scale Exercise, planned for 1 hour and 15 minutes at Purdue University in West Lafayette, Indiana
Mission Area(s)	Response
Core Capabilities	Medical Countermeasure Dispensing Communications Emergency Operations Coordination Volunteer Management
Objectives	1. Provide all NUR 415 and Pharmacy students the opportunity to simulate the process of distributing appropriate antibiotics to a large number of patients in a short period of time at a POD. 2. Implement and test a revised Dispensing Algorithm. 3. Evaluate the accuracy of the medical countermeasure dispensing, and decrease the previous 5 – 7% error rate. 4. Implement Incident Command System (ISC). 5. Test communications methods at a POD. 6. Test Purdue University Closed POD Site/Open POD Site. 7. Analyze the extinction curve for the POD Just-In-Time Training at 3 – 4 days after, 1 month after and 2 months after. 8. Increase awareness of the Medical Reserve Corps and how to join.
Threat or Hazard	Bioterrorism (Anthrax)

Scenario	A known domestic terrorist has claimed to have distributed anthrax widely throughout Tippecanoe County, and local hospitals are reporting an unusual increase in patients presenting with flu - like symptoms for this time of year. The local hospitals administer rapid influenza diagnostic tests to the patients and test results are largely returning negative. Further laboratory testing is ordered and blood samples are collected from the patients and sent for rapid testing through Polymerase Chain Reaction (PCR) at the Indiana State Department of Health Laboratory. Initial test results from PCR testing at the Indiana State Department of Health Laboratory confirm widespread anthrax infection. The Indiana State Department of Health and the Tippecanoe County Health Department have determined that it is appropriate to initiate dispensing of medical countermeasures against anthrax infection: Amoxicillin, Ciprofloxacin, and Doxycycline. Medical countermeasures are requested from Strategic National Stockpile and are distributed to local Points of Dispensing (PODs) throughout Tippecanoe County. As a part of the area's response, Purdue conducts its Closed Point of Dispensing operations, distributing one of the three antibiotics to the entire Purdue community. After completing dispensing to the Purdue community, Purdue has decided to open their Closed POD to the West Lafayette community in an attempt to take pressure off other POD locations. Today, you are taking over for the nurses who have been working diligently over the last 36 hours to dispense these medications appropriately.
Sponsor	Tippecanoe County Health Department
Participating Organizations	Tippecanoe County Health Department, Purdue Homeland Security Institute, Purdue Polytechnic Institute, Purdue University School of Nursing, Purdue University College of Pharmacy and Tippecanoe County Medical Reserve Corps.
Point of Contact	Ryan Tennessen Tippecanoe County Health Department Emergency Preparedness Coordinator rtennessen@tippecanoe.in.gov Office: (765) 423-9221 Mobile: (765) 491-3892

• General Information

• Exercise Objectives and Core Capabilities

The following exercise objectives in Table 1 describe the expected outcomes for the exercise. The objectives are linked to core capabilities, which are distinct critical elements necessary to achieve the specific mission area(s).

Exercise Objective	Core Capability
Evaluate the accuracy of the medical countermeasure dispensing, and decrease the previous 15% error rate.	Medical Countermeasure Dispensing
Effectively communicate and disseminate information within POD Operations, during a public health incident.	Communications
Use ICS to coordinate and manage multiple adverse situations during a large scale event by demonstrating the ability to properly delegate roles and responsibilities.	Emergency Operations Coordination
Use volunteers to examine if an improved Just In Time Training video, along with a "real time" checking component, is sufficient to reduce the previous 15% error rate.	Volunteer Management

Table 1. Exercise Objectives and Associated Core Capabilities

• Participant Roles and Responsibilities

The term *participant* encompasses many groups of people, not just those playing in the exercise. Groups of participants involved in the exercise, and their respective roles and responsibilities, are as follows:

Players. Players are personnel who have an active role in discussing or performing their regular roles and responsibilities during the exercise. Players discuss or initiate actions in response to the simulated emergency.

Controllers. Controllers plan and manage exercise play. They direct the pace of the exercise, provide key data to players, and may prompt or initiate certain player actions to ensure exercise continuity. In addition, they monitor the exercise timeline and supervise the safety of all exercise participants.

Data Collectors. Data Collectors evaluate and provide feedback. They observe and document performance.

Actors. Actors simulate specific roles during exercise play. Roles are typically that of patients, victims, media or other bystanders.

include elected officials, colleagues from another county/district or others who may benefit from seeing preparedness planning in action.

Support Staff. The exercise support staff includes individuals who perform administrative and logistical support tasks during the exercise. For example, registration functions, media escorts, observer escorts or the provision of snacks, meals & drinks.

Exercise Assumptions and Artificialities

In any exercise, assumptions and artificialities may be necessary to complete play in the time allotted and/or account for logistical limitations. Exercise participants should accept that assumptions and artificialities are inherent in any exercise, and should not allow these considerations to negatively impact their participation.

Assumptions

The following assumptions apply to the exercise:

The exercise is conducted in a no-fault learning environment wherein capabilities, plans, systems, and processes will be evaluated.

The exercise scenario is plausible, and events occur as they are presented.

Exercise simulation contains sufficient detail to allow players to react to information and situations as they are presented as if the simulated incident were real.

Participating agencies may need to balance exercise play with real-world emergencies. Real-world emergencies take priority.

Artificialities

During this exercise, the following artificialities apply:

Only communication methods listed in the Communication Plan are available for players to use during the exercise.

• Exercise Logistics

• Safety

Exercise participant safety takes priority over exercise events. The following general requirements apply to the exercise:

The Safety Officer is responsible for participant safety; any safety concerns must be immediately reported to the Safety Officer. The Safety Officer and Incident Commander will determine if a real-world emergency warrants a pause in exercise play and when exercise play can be resumed.

For an emergency that requires assistance, use the phrase **"real-world emergency."** The following procedures should be used in case of a real emergency during the exercise:

Anyone who observes a participant who is seriously ill or injured will immediately notify emergency services and the closest controller, and, within reason and training, render aid.

The controller aware of a real emergency will initiate the "real-world emergency" broadcast and provide the Safety Controller, Senior Controller, and Exercise Director with the location of the emergency and resources needed, if any.

• Fire Safety

Standard fire and safety regulations relevant to Purdue University will be followed during the exercise.

• Emergency Medical Services

The Tippecanoe County Health Department and Purdue University will coordinate with local emergency medical services in the event of a real-world emergency.

• Weapons Policy

All participants will follow Purdue University's weapons policy.

• Site Access

• Security

If entry control is required for the POD, Purdue University is responsible for arranging appropriate security measures. To prevent interruption of the exercise, access to the exercise site is limited to exercise participants. Players should advise their venue's controller or evaluator of any unauthorized persons.

designated areas and accompanied by an exercise controller at all times. Tippecanoe County Health Department representatives and/or the observer controller may be present to explain exercise conduct and answer questions. Exercise participants should be advised of media and/or observer presence.

- **Exercise Identification**

Exercise staff may be identified by badges, hats, and/or vests to clearly display exercise roles; additionally, uniform clothing may be worn to show agency affiliation. Table 2 describes these identification items.

Group	Color
Exercise Director	White Vest "Controller"
Nursing students	Red vests "Dispensers"
Screener and triage	Orange vests
Exit Screeners	Yellow vests
Registration	Green vests "Registration"
Civilian volunteers	Plain Clothes
Observers/VIPs	Plain Clothes/Uniforms
Media Personnel	Media Credentials
Players, Uniformed	Badges and vests
Players, Civilian	Plain Clothes

Table 2. Exercise Identification

• Post-exercise and Evaluation Activities

• Debriefings

Post-exercise debriefings aim to collect sufficient relevant data to support effective evaluation and improvement planning.

• Hot Wash

At the conclusion of exercise play, controllers facilitate a Hot Wash to allow players to discuss strengths and areas for improvement, and evaluators to seek clarification regarding player actions and decision-making processes. All participants may attend; however, observers are not encouraged to attend the meeting. The Hot Wash should not exceed 5 – 10 minutes.

• Controller and Evaluator Debriefing

Controllers and evaluators attend a facilitated C/E Debriefing immediately following the exercise. During this debriefing, controllers and evaluators provide an overview of their observed functional areas and discuss strengths and areas for improvement.

• Participant Feedback Forms

Participant Feedback Forms provide players with the opportunity to comment candidly on exercise activities and exercise design. Participant Feedback Forms should be collected at the conclusion of the Hot Wash.

• Evaluation

• Exercise Evaluation Guides

EEGs assist evaluators in collecting relevant exercise observations. EEGs document exercise objectives and aligned core capabilities, capability targets, and critical tasks. Each EEG provides evaluators with information on what they should expect to see demonstrated in their functional area. The EEGs, coupled with Participant Feedback Forms and Hot Wash notes, are used to evaluate the exercise and compile the After-Action Report (AAR).

• After-Action Report

The AAR summarizes key information related to evaluation. The AAR primarily focuses on the analysis of core capabilities, including capability performance, strengths, and areas for improvement. AARs also include basic exercise information, including the exercise name, type of exercise, dates, location, participating organizations, mission area(s), specific threat or hazard, a brief scenario description, and the name of the exercise sponsor and POC.

- ## Improvement Planning

Improvement planning is the process by which the observations recorded in the AAR are resolved through development of concrete corrective actions, which are prioritized and tracked as a part of a continuous corrective action program.

- ### After-Action Meeting

The After-Action Meeting is a meeting held among decision- and policy-makers from the exercising organizations, as well as the Lead Evaluator and members of the Exercise Planning Team, to debrief the exercise and to review and refine the draft AAR and Improvement Plan (IP). The AAM should be an interactive session, providing attendees the opportunity to discuss and validate the observations and corrective actions in the draft AAR/IP.

- ### Improvement Plan

The IP identifies specific corrective actions, assigns them to responsible parties, and establishes target dates for their completion.

• Participant Information and Guidance

• Exercise Rules

The following general rules govern exercise play:

Real-world emergency actions take priority over exercise actions.

Exercise players will comply with real-world emergency procedures, unless otherwise directed by the control staff.

All communications (including written, radio, telephone, and e-mail) during the exercise will begin and end with the statement **"Exercise. Exercise. Exercise."**

• Player Instructions

Players should follow certain guidelines before, during, and after the exercise to ensure a safe and effective exercise.

• Before the Exercise

Review appropriate organizational plans, procedures, and exercise support documents.

Be at the appropriate site at when the exercise starts. Wear the appropriate uniform and/or identification item(s).

Sign in when you arrive.

Review the exercise materials that have been provided on Blackboard Learn.

• During the Exercise

Respond to exercise events and information as if the emergency were real.

Controllers will give you only information they are specifically directed to disseminate.

Do not engage in personal conversations with controllers, evaluators, observers, or media personnel. If you are asked an exercise-related question, give a short, concise answer. If you are busy and cannot immediately respond, indicate that, but report back with an answer as soon as possible.

If you do not understand the scope of the exercise, ask a controller.

Parts of the scenario may seem implausible. Recognize that the exercise has objectives to satisfy and may require incorporation of unrealistic aspects. Every effort has been made by the exercise's trusted agents to balance realism with safety and to create an effective learning and evaluation environment.

All exercise communications will begin and end with the statement **"Exercise. Exercise. Exercise."** This precaution is taken so that anyone who overhears the conversation will not mistake exercise activities for a real-world emergency.

- ### After the Exercise

Participate in the Hot Wash at your venue with controllers and evaluators.

Complete the Participant Feedback Form. This form allows you to comment candidly on emergency response activities and exercise effectiveness. Provide the completed form to your professor.

Provide any notes or materials generated from the exercise to your controller or evaluator for review and inclusion in the AAR.

- ## Simulation Guidelines

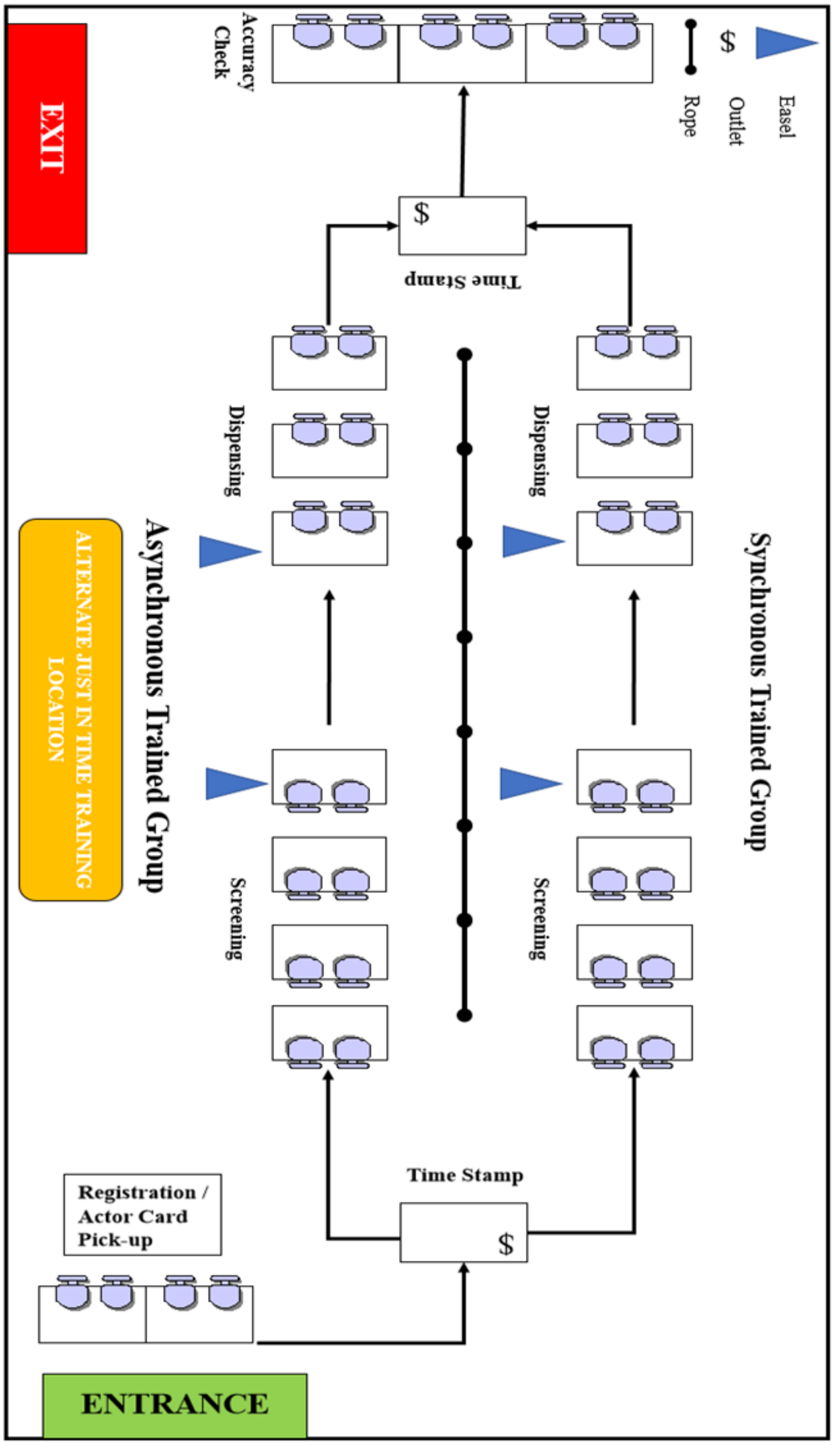
Because the exercise is of limited duration and scope, certain details will be simulated. The physical description of what would fully occur at the incident sites and surrounding areas will be relayed to players by simulators or controllers.

- ## Appendix A: Exercise Schedule

	Time	Personnel	Activity	Location
			9/9/2017	
	1:30 pm	All	POD Set-Up Starts	Purdue University
	2:30 pm	All	POD Set-Up Ends	Purdue University
	3:00 pm	All	Welcome / Introduction	Purdue University
Group A	3:15 pm	All	Dispensing 1 Starts	Purdue University
	3:40 pm	All	Dispensing 1 Ends	Purdue University
	3:40 pm – 3:42 pm	All	Switch Groups / Transition	Purdue University
Group B	3:43 pm	All	Dispensing 2 Starts	Purdue University
	4:08 pm	All	Dispensing 2 Ends	Purdue University
	4:12 pm	All	Exercise Ends & Hot Wash	Purdue University
	4:15 pm – 5:00 pm	All	Demobilization	Purdue University

• Appendix B: Exercise Participants

Participating Organizations
Tippecanoe County Health Department
Purdue Homeland Security Institute
Purdue Polytechnic Institute
Purdue University School of Nursing
Purdue University College of Pharmacy
Tippecanoe County Medical Reserve Corps
Observing Organizations
Tippecanoe County Emergency Management Agency
IU Health Arnett
Franciscan Health Lafayette
Purdue University Fire Department
Purdue University Police Department
Purdue University Campus Safety
Purdue University Student Health Center
Dean for Nursing
Dean for Pharmacy
Advisor for Maters in Public Health Students
Advisor for Undergraduate Public Health Students
Indiana District 4 County Health Departments



Population	Antimicrobials for 60-day PEP: Give balance of 60-day course at follow-up visit in 7–10 days.

<table>
<tr>
<td>Non-pregnant Adults ≥19 years of age

_____1st choice____>

_____2nd choice____>

_____3rd choice____></td>
<td>Preferred Choices <u>IF</u>:
NO ALLERGIES TO
DOXYCYCLINE (VIBRAMYCIN)
TETRACYCLINES (ACHROMYCIN)
MINOCYCLINE (MINOCIN)
Doxycycline 100 mg orally twice daily for 10 days (Provide crushing instructions with medication)

OR (if Doxycycline unavailable or contraindicated);
NO ALLERGIES TO
CIPROFLOXACIN (CIPRO)
GEMIFLOXACIN (FACTIVE)
LEVOFLOXACIN (LEVAQUIN)
MOXIFLOXACIN (AVELOX)
NORFLOXACIN (NOROXIN)
OFLOXACIN (FLOXIN)
NOT TAKING
TIZANIDINE (ZANAFLEX)
THEOPHYLLINE
NO MEDICAL HISTORY OF
MYASTHENIA GRAVIS
CENTRAL NERVOUS SYSTEM OR SEIZURE DISORDERS
DECREASED KIDNEY FUNCTION
Ciprofloxacin 500 mg orally twice daily for 10 days

(Doxycycline and Ciprofloxacin are equally recommended for PEP in non-pregnant adults)
Second-line options (if preferred choices unavailable or contraindicated)

Second-line options <u>IF</u>:
NO ALLERGIES TO
PENICILLIN
AMOXICILLIN (AMOXIL)
AUGMENTIN
AMPICILLIN (UNASYN)
PIPERACILLIN (ZOSYN)
Amoxicillin 1000 mg every 8 hours for 10 days

Final option (if preferred choices AND second-line option unavailable or contraindicated)

Final option: MEDICAL CONSULTATION</td>
</tr>
</table>

Children (≤18 years of age)	**Preferred Choices IF:** • NO ALLERGIES TO ○ DOXYCYCLINE (VIBRAMYCIN) ○ TETRACYCLINES (ACHROMYCIN) ○ MINOCYCLINE (MINOCIN)
_____1st choice____>	**Doxycycline (not to exceed 100 mg/dose) (Provide crushing instructions with medication)** >8 years and >99 pounds in weight: 100 mg every 12 hours for 10 days >8 years and ≤ 99 pounds in weight: 1 mg per pound every 12 hours for 10 days ≤8 years: 1 mg per pound every 12 hours for 10 days *(Use at age <8 years may affect tooth development)* **OR** *(if Doxycycline unavailable or contraindicated);* • NO ALLERGIES TO ○ CIPROFLOXACIN (CIPRO) ○ GEMIFLOXACIN (FACTIVE) ○ LEVOFLOXACIN (LEVAQUIN) ○ MOXIFLOXACIN (AVELOX) ○ NORFLOXACIN (NOROXIN) ○ OFLOXACIN (FLOXIN) • NOT TAKING ○ TIZANIDINE (ZANAFLEX) ○ THEOPHYLLINE • NO MEDICAL HISTORY OF ○ MYASTHENIA GRAVIS ○ CENTRAL NERVOUS SYSTEM OR SEIZURE DISORDERS ○ DECREASED KIDNEY FUNCTION
_____2nd choice____>	**Ciprofloxacin 15 mg/kg orally every 12 hours for 10 days (not to exceed 500 mg/dose)** (Doxycycline and Ciprofloxacin are equally recommended for PEP in children.) Second-line options *(if preferred choices unavailable or contraindicated)* -- **Second-line options IF:** • NO ALLERGIES TO ○ PENICILLIN ○ AMOXICILLIN (AMOXIL) ○ AUGMENTIN ○ AMPICILLIN (UNASYN) ○ PIPERACILLIN (ZOSYN)
_____3rd choice____>	**Amoxicillin:** ≥ 88 pounds in weight: 1000 mg every 8 hours for 10 days < 88 pounds in weight: 25 mg/kg every 8 hours for 10 days, not to exceed 1000 mg per dose

	Final option (*if preferred choices AND second-line option unavailable or contraindicated)* --- **Final option: MEDICAL CONSULTATION**

Instructions for Using Algorithm

1) First determine if the client is symptomatic for anthrax exposure. If they are, direct them to seek off site medical attention immediately.

2) Doxycycline is the first drug of choice. If the client is **NOT** allergic, pregnant, or breastfeeding, they may receive Doxycycline. If the client is less than 90 lbs or cannot swallow pills you will need to provide crushing instructions with their medication.

3) If the client **IS** breastfeeding send them to your on-site medical consultant for further screening.

4) If the client **IS** allergic to Doxycycline or pregnant the next drug of choice is Ciprofloxacin. If a client is **NOT** allergic to Ciprofloxacin, does **NOT** have seizures, and does **NOT** take Theophylline for asthma, then the client should receive Ciprofloxacin. If the client is less than 90 lbs then they should be referred to their family or other primary care physician.

5) If a client **IS** allergic to Ciprofloxacin, **DOES** have seizures, or **IS** either taking Theophylline for asthma or is taking medication for asthma but **DOES NOT KNOW** what it is, the client should be seen by the on-site medical consultant.

Notes:

Ciprofloxacin is currently not approved for crushing by the Food and Drug Administration (FDA). If clients are to receive Ciprofloxacin, and are either under 90 lbs. or cannot swallow pills, direct them to their family or other primary care physician for dosing instructions.

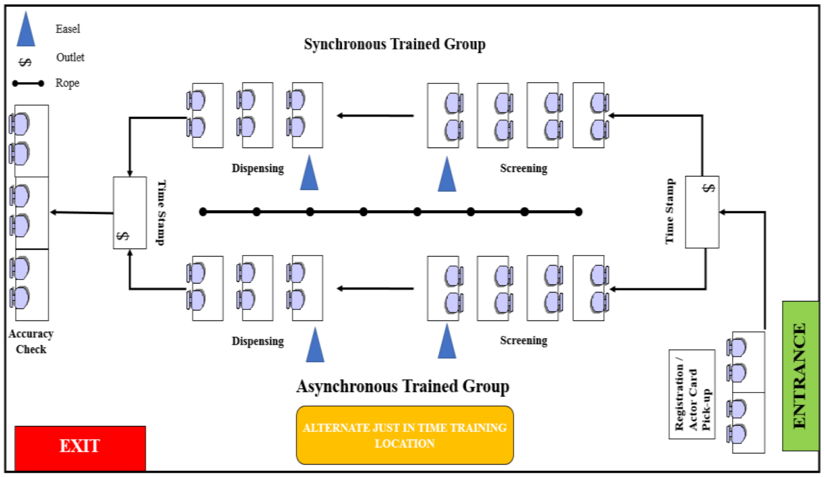
An algorithm cannot account for every potential condition or adverse reaction that may be caused by medication. If a client has concerns regarding an adverse reaction due to a medical condition or medications they are taking that are not covered in this algorithm, have them speak with the on-site medical consultant or their personal physician.

The information provided in this document is current as of November 2017, and is based on the best information available. The information provided herein is subject to change based on new or revised guidance from the Centers for Disease Control & Prevention (CDC) and/or changes in best practices suggested by the medical or pharmaceutical community. Updates to this information will be provided as needed.

POD Research Methods

Coding/ Accuracy

POD Map



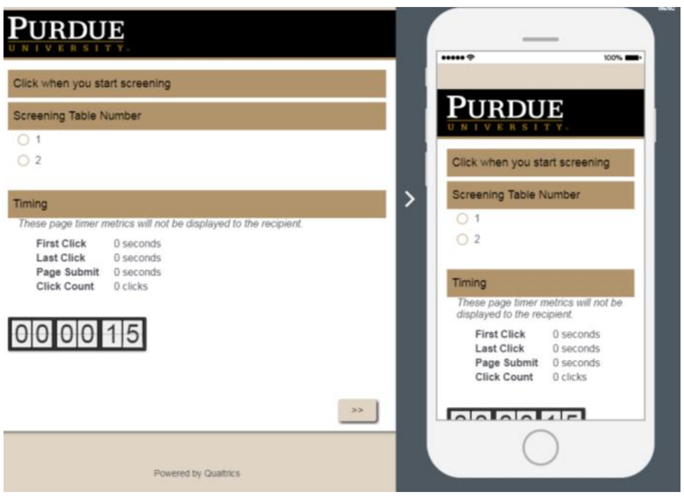
In order to preserve the student's identity a code was developed. This code helps us to check the accuracy of each set and training style. This new code system also allows the research to show if certain students drastically skew the overall accuracy rate. The reason this coding became necessary is due to the number of times the data was either not properly collected or filled out. Synchronous tables are always to be labeled 1/A with the presenters name (Ryan). Asynchronous tables are always to be labeled 2/B. When looking at the POD unit from the entrance, the synchronous is on the left and the asynchronous is on the right. It is this way in order to keep the data simple, since the first POD was done with this setup. The code itself has three identifiers. The first refers to the set of the exercise, the second refers to the type of training the student was administered, and the third refers to the seat that the student will take. These codes are solely to help with the accuracy. A sample of the code would look something like this. "1S14". This would mean that it is the first set, the student had synchronous training, and will be in seat fourteen. The codes could be anywhere between 1S1 and 2S28. For a certain set, 1S1-1S14 would all be synchronous, while everything between 1S15-1S28 would all be asynchronous. This would be replicated for set 2. Each set has a total of twenty-eight seats, with fourteen seat being in each training group. To simplify the code so that the same numbers in a row are correlated with a type of training, the left/ Synchronous side will be seats 1-14, and the right/Asynchronous will be seats 15-28. . The Qualtrics portion of the data will be how each type of training is measured regarding time of completion.

Qualtrics

The qualtrics portion of the exercise will be completed on any smart device the student might bring with them. The assessment has timers built within each of the pages, that records the time for each station that the student visits. The directions help to navigate the students through the POD, in addition to keeping track of the time they spend at each station. A sample of what the assessment looks like can be seen below. The reason table one is always synchronous, and table two asynchronous is because every assessment leading up to this point has been so. This makes the data easy to understand when comparing the past exercises to the most current. Even if the sides of the training types change, the table numbers should always refer to the same type of training for easy comparison. The different parts of the assessment are below. Each part of the assessment helps in a different way. The main reason for this assessment is to gauge the time the students spend at each station. The question referring to the screening table number helps tell the researcher what type of training the student has taken. (1 = Synchronous, 2 = Asynchronous) The only other question refers to whether or not there was an accuracy check during the round. Previously, there was an accuracy check for only one of the rounds. As the exercises have continued we have found a need to incorporate an accuracy check for every round. The assessment also records the date that the survey was taken, which is useful when comparing past and current POD exercises.

Survey parts:

1. Click when you are ready for: Line Start
    a. This starts the timer for the POD
2. Click when you start screening/ Indicate screening table number
    a. This helps record the time spent at the screening table and indicate which type of training the student received
3. Click next when you start dispensing
    a. This records the time spent at the dispensing table
4. Click next when you start accuracy check/ Was there accuracy check this round
    a. This helps record the time spent at the accuracy check if there was one
5. Click next when you have finished the POD
    a. This helps record the end time of the POD duration



Recently there was also an assessment implemented in order to introduce the students to the algorithm they will be using. This assessment also tests their ability to navigate the algorithm by required them to get each question correct before being able to click the submit button on the survey. Each student is required to complete this assessment before they leave the training session. The questions can be seen below with an image of what the assessment looks like.

A 23-year-old male who weighs approximately 180 pounds comes to the POD. He isn't feeling well, has a sore throat, shortness of breath and mild fever. He has no known allergies. Which medication do you give him?

- ○ Doxycycline
- ○ Amoxicillin
- ○ Ciprofloxacin
- ○ Refer for medical care

A 32 year old female who weighs approximately 120 pounds comes to the POD, and has no known allergies. She is picking up medication for her two children in addition to herself. Her infant son, who is still breastfeeding, has no known allergies. Her 4 year old son, who weighs 35 pounds is allergic to Amoxicillin. Which medications to you give her?

- ○ Mother receives Doxycycline, infant receives Doxycycline with crushing instructions, 4 year old son receives Ciprofloxacin
- ○ Mother and infant receive a referral consult for medical screening, 4 year old son receive Doxycycline with crushing instructions.
- ○ Mother receives Amoxicillin, infant receives a referral consult for medical screening, 4 year old son receives Doxycycline with crushing instructions.
- ○ Mother receives a referral consult for medical screening, infant receives Doxycycline with crushing instructions, 4 year old son receives Ciprofloxacin.

A 32 year old female who weighs approximately 145 pounds, isn't pregnant or breastfeeding arrives at the POD. She is allergic to Doxycycline. She has no history of seizures. She has asthma, but doesn't know which medication she takes for it. Which medication to you give her?

- ○ Doxycycline
- ○ Amoxicilin
- ○ Ciprofloxacin
- ○ Refer for medical consultant for screening

A 55 year old man who weighs approximately 250 pounds cones to the POD, and is allergic to Doxycycline, but has no history of seizures. He is picking up medication for his family in addition to himself. His 52 year old wife who weighs 180 pounds has no known allergies, and is neither pregnant nor breastfeeding. His 17 year old son who weighs 180 pounds has no known allergies, but is taking Theophylline for asthma. His 10 year old daughter who weighs 75 pounds has no known allergies. Which medications do you give him?

- Father receives Ciprofloxacin. Mother receives Doxycycline. 17 year old son receives Doxycycline. 10 year old daughter receives Doxycycline with crushing instructions.
- Father receives Amoxicillin. Mother receives a referral consult for medical screening, 17 year old son receives Ciprofloxacin. 10 year old daughter receives Doxycycline.
- Father receives Amoxicillin. Mother receives Doxycycline. 17 year old son receives Ciprofloxacin. 10 year old daughter receives Doxycyline with crushing instructions.
- Father receives Ciprofloxacin. Mother receives Doxycyline, 17 year old son receives Ciprofloxacin. 10 year old daughter receives Doxycyline.

A 23 year old female who weighs approximately 85 pounds, isn't pregnant or breastfeeding. She is allergic to Doxycycline, and Ciprofloxacin. Which medication do you give her?

- Doxycycline with crushing instructions
- Amoxicillin
- Ciprofloxacin and refer to a physician
- Refer to medical consultant for screening

A 33 year old male who weighs approximately 190 pounds arrives at the POD. He has no known allergies, but has a history of seizures, and is taking Theophylline for asthma. Which medication to you give him?

- Doxycycline
- Amoxicillin
- Ciprofloxacin
- Refer to medical consultant for screening

A 19 year old female who weighs approximately 85 pounds, isn't pregnant or breastfeeding arrives at the POD. She is allergic to Ciprofloxacin. Which medication to you give her?

- Doxycyline
- Amoxicillin
- Doxycycline with crushing instructions
- Amoxicillin and refer to a physician

A 25year old female who weighs approximately 130 pounds and is 3 months pregnant arrives at the POD. She is allergic to Amoxicillin. She has no history of seizures, and is not asthmatic. Which medication to you give her?

- Ciprofloxacin
- Amoxicillin
- Doxycycline with crushing instructions
- Amoxicillin and refer to a physician

A 45 year old male who weighs approximately 210 pounds arrives at the POD. He is picking up medication for his 10 year old son who weighs 75 pounds.

- Father receives Doxycycline. Son receives Amoxicillin
- Father receives Ciprofloxacin, Son receives Ciprofloxacin and a referral to a physician
- Both receive Doxycycline
- Father receives Doxycycline. Son receives Doxycycline with crushing instructions

A 20 year old female who weighs approximately 160 pounds comes to the POD. She has no known allergies, isn't pregnant or breastfeeding. Which medication do you give her?

- ○ Amoxicillin
- ○ Ciprofloxacin
- ○ Doxycycline
- ○ Refer for medical care

A 26 year old female who weighs approximately 145 pounds, isn't pregnant or breastfeeding arrives at the POD. She is allergic to Doxycycline, and Amoxicillin. She has no history of seizures. She has asthma, but doesn't know which medication she takes for it. Which medication to you give her?

- ○ Ciprofloxacin
- ○ Amoxicillin
- ○ Doxycycline
- ○ Refer for medical consultant for screening

A 19 year old male who weighs approximately 155 pounds comes to the POD. He has no known allergies, no history of seizures, and is not asthmatic. Which medication do you give him?\

PURDUE
UNIVERSITY

A 23 year old male who weighs approximately 180 pounds comes to the POD. He isn't feeling well, has a sore throat, shortness of breath and mild fever. He has no known allergies. Which medication do you give him?

- ◯ Doxycycline
- ◯ Amoxicillin
- ◯ Ciprofloxacin
- ◯ Refer for medical care

A 32 year old female who weighs approximately 120 pounds comes to the POD, and has no known allergies. She is picking up medication for her two children in addition to herself. Her infant son, who is still breastfeeding, has no known allergies. Her 4 year old son, who weighs 35 pounds is allergic to Amoxicillin. Which medications to you give her?

- ◯ Mother receives Doxycycline, infant receives Doxycycline with crushing instructions, 4 year old son receives Ciprofloxacin
- ◯ Mother and infant receive a referral consult for medical screening, 4 year old son receive Doxycycline with crushing instructions.
- ◯ Mother receives Amoxicillin, infant receives a referral consult for medical screening, 4 year old son receives Doxycycline with crushing instructions.
- ◯ Mother receives a referral consult for medical screening, infant receives Doxycycline with crushing instructions, 4 year old son receives Ciprofloxacin.

A 32 year old female who weighs approximately 145 pounds, isn't pregnant or breastfeeding arrives at the POD. She is allergic to Doxycycline. She has no history of seizures. She has asthma, but doesn't know which medication she takes for it. Which medication to you give her?

- ◯ Doxycycline
- ◯ Amoxicilin
- ◯ Ciprofloxacin
- ◯ Refer for medical consultant for screening

A 55 year old man who weighs approximately 250 pounds cones to the POD, and is allergic to Doxycycline, but has no history of seizures. He is picking up medication for his family in addition to himself. His 52 year old wife who weighs 180 pounds has no known allergies, and is neither pregnant nor breastfeeding. His 17 year old son who weighs 180 pounds has no known allergies, but is taking Theophylline for asthma. His 10 year old daughter who weighs 75 pounds has no known allergies. Which medications do you give him?

- ◯ Father receives Ciprofloxacin. Mother receives Doxycycline. 17 year old son receives Doxycycline. 10 year old daughter receives Doxycycline with crushing instructions.
- ◯ Father receives Amoxicillin. Mother receives a referral consult for medical screening, 17 year old son receives Ciprofloxacin. 10 year old daughter receives Doxycycline.
- ◯ Father receives Amoxicillin. Mother receives Doxycycline. 17 year old son receives Ciprofloxacin. 10 year old daughter receives Doxycyline with crushing instructions.
- ◯ Father receives Ciprofloxacin. Mother receives Doxycyline, 17 year old son receives Ciprofloxacin. 10 year old daughter receives Doxycyline.

A 23 year old female who weighs approximately 85 pounds, isn't pregnant or breastfeeding. She is allergic to Doxycycline, and Ciprofloxacin. Which medication do you give her?

- ◯ Doxycycline with crushing instructions
- ◯ Amoxicillin
- ◯ Ciprofloxacin and refer to a physician
- ◯ Refer to medical consultant for screening

A 33 year old male who weighs approximately 190 pounds arrives at the POD. He has no

100%

PURDUE
UNIVERSITY

A 23 year old male who weighs approximately 180 pounds comes to the POD. He isn't feeling well, has a sore throat, shortness of breath and mild fever. He has no known allergies. Which medication do you give him?

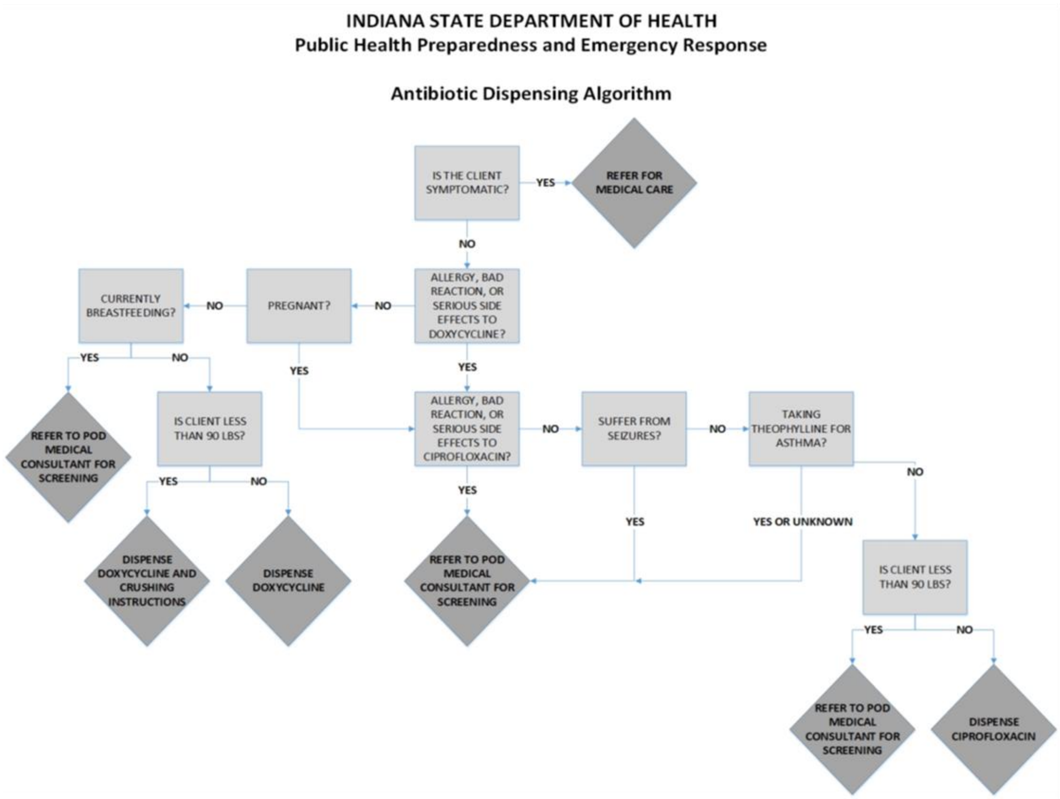
Doxycycline
Amoxicillin
Ciprofloxacin
Refer for medical care

A 32 year old female who weighs approximately 120 pounds comes to the POD, and has no known allergies. She is picking up medication for her two children in addition to

• APPENDIX F: ACRONYMS

DHS	U.S. Department of Homeland Security
ExPlan	Exercise Plan
HSEEP	Homeland Security Exercise and Evaluation Program
SME	Subject Matter Expert
ICS	Incident Command System
TCHD	Tippecanoe County Health Department
POD	Point of Distribution
FSE	Full Scale Exercise
AAR/IP	After-Action Review/ Improvement Plan

APPENDIX B. OLD ALGORITHM



APPENDIX C. RETENTION NOVEMBER 9, 2017

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Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	11
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Amoxicilli	Doxycylin	11
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	11
Amoxicilli	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	9
Amoxicilli	Amoxicillin an	Amoxicilli	Father rec	Doxycyclir	Refer for r	Doxycylin	4
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Amoxicilli	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	9
Ciprofloxa	Doxycycline wi	Amoxicilli	Father rec	Amoxicilli	Doxycyclir	Ciprofloxa	4
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Ciprofloxa	Amoxicillin	Ciprofloxa	Father rec	Ciprofloxa	Amoxicilli	Ciprofloxa	4
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Doxycyclir	Doxycyline	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	10
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
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Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Amoxicilli	Doxycyline	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	8
Amoxicilli	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	10
Doxycyclir	Amoxicillin	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	10
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	11
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Ciprofloxa	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	10
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Amoxicilli	Amoxicillin	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	10
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Amoxicilli	Amoxicillin	Amoxicilli	Father rec	Ciprofloxa	Amoxicilli	Ciprofloxacin	
Doxycyclir	Doxycyline	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	11
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Amoxicilli	Doxycylin	11
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Amoxicilli	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Amoxicilli	Doxycylin	10
Amoxicilli	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	11
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Ciprofloxa	Doxycylin	11
Doxycyclir	Doxycycline wi	Ciprofloxa	Father rec	Doxycyclir	Refer for r	Doxycylin	12
Doxycyclir	Doxycyline	Ciprofloxa	Father rec	Amoxicilli	Refer for r	Amoxicilli	4
	One Month After						
	Average Score		9.222222				
	9.2/12						
	Average Percent						
	77%						
	Date						
	12/7/2017						

APPENDIX D. RETENTION MARCH 29, 2018

Default Report			
Last Modified: 2018-05-07 05:53:26 MDT			
Q1 - A 23 year old male who weighs approximately 180 pounds comes to the POD. He isnâ€™t feeling well, has a s			
#	Answer	%	Count
1	Doxycycli	63.41%	26
2	Amoxicilli	7.32%	3
3	Ciprofloxa	9.76%	4
4	Refer for	19.51%	8
	Total	100%	41
Q2 - A 32 year old female who weighs approximately 120 pounds comes to the POD, and has no known allergies. S			
#	Answer	%	Count
1	Mother re	47.50%	19
2	Mother ar	40.00%	16
3	Mother re	12.50%	5
4	Mother re	0.00%	0
	Total	100%	40
Q3 - A 32 year old female who weighs approximately 145 pounds, isnâ€™t pregnant or breastfeeding arrives at the			
#	Answer	%	Count
1	Doxycycli	17.07%	7
2	Amoxicili	21.95%	9
3	Ciprofloxa	41.46%	17
4	Refer for	19.51%	8
	Total	100%	41
Q4 - A 55 year old man who weighs approximately 250 pounds cones to the POD, and is allergic to Doxycycline, but			
#	Answer	%	Count
1	Father rec	42.50%	17
2	Father rec	15.00%	6
3	Father rec	20.00%	8
4	Father rec	22.50%	9
	Total	100%	40
Q5 - A 23 year old female who weighs approximately 85 pounds, isnâ€™t pregnant or breastfeeding. She is allergic			
#	Answer	%	Count
1	Doxycycli	9.76%	4
2	Amoxicilli	58.54%	24
3	Ciprofloxa	9.76%	4
4	Refer to n	21.95%	9
	Total	100%	41
Q6 - A 33 year old male who weighs approximately 190 pounds arrives at the POD. He has no known allergies, but			
#	Answer	%	Count
1	Doxycycli	41.46%	17
2	Amoxicilli	9.76%	4
3	Ciprofloxa	29.27%	12
4	Refer to n	19.51%	8
	Total	100%	41

Q7 - A 19 year old female who weighs approximately 85 pounds, isnâ€™t pregnant or breastfeeding arrives at the P

#	Answer	%	Count
1	Doxycylin	65.85%	27
2	Amoxicilli	14.63%	6
3	Doxycycli	19.51%	8
4	Amoxicilli	0.00%	0
	Total	100%	41

Q8 - A 25year old female who weighs approximately 130 pounds and is 3 months pregnant arrives at the POD. She

#	Answer	%	Count
1	Ciproflox	56.10%	23
2	Amoxicilli	9.76%	4
3	Doxycycli	26.83%	11
4	Amoxicilli	7.32%	3
	Total	100%	41

Q9 - A 45 year old male who weighs approximately 210 pounds arrives at the POD. He is picking up medication for

#	Answer	%	Count
1	Father rec	14.63%	6
2	Father rec	9.76%	4
3	Both recei	26.83%	11
4	Father rec	48.78%	20
	Total	100%	41

Q10 - A 20 year old female who weighs approximately 160 pounds comes to the POD. She has no known allergies,

#	Answer	%	Count
1	Amoxicilli	14.63%	6
2	Ciproflox	4.88%	2
3	Doxycycli	80.49%	33
4	Refer for	0.00%	0
	Total	100%	41

Q11 - A 26 year old female who weighs approximately 145 pounds, isnâ€™t pregnant or breastfeeding arrives at th

#	Answer	%	Count
1	Ciproflox	31.71%	13
2	Amoxicilli	4.88%	2
3	Doxycycli	12.20%	5
4	Refer for	51.22%	21
	Total	100%	41

Q12 - A 19 year old male who weighs approximately 155 pounds comes to the POD. He has no known allergies, no

#	Answer	%	Count
1	Amoxicilli	9.76%	4
2	Ciproflox	14.63%	6
3	Doxycylin	75.61%	31
4	Refer for	0.00%	0
	Total	100%	41

SC0 - Score

#	Field	Minimum	Maximum	Mean	Std Deviat	Variance	Count
1	Score	1	12	5.54	2.43	5.91	41

Average Score 2 Months After

46.25%

APPENDIX E. POD VOLUNTEERS PER CAPACITY

pod_operation_total_in_hours	pod_operation_total_in_min	pod_operation_total_in_sec	pod_capacity	number_of_pod	number_of_table	volunteer_
48	2880	172800	1100	1	14	
			50	0.045454545	0.636363636	
			100	0.090909091	1.272727273	
			500	0.454545455	6.363636364	
			1000	0.909090909	12.72727273	
			5000	4.545454545	63.63636364	
			10000	9.090909091	127.2727273	
			50000	45.45454545	636.3636364	
			100000	90.90909091	1272.727273	
			500000	454.5454545	6363.636364	
			1000000	909.0909091	12727.27273	
				0	0	
				0	0	
				0	0	
				0	0	
				0	0	
				0	0	
				0	0	
				0	0	
				0	0	

Pod Capacity	Total Volunteers Needed
50	4
100	8
500	38
1000	76
5000	382
10000	764
50000	3818
100000	7636
500000	38182
1000000	76364

	volunteer_per_table	total_number_of_volunteers_per_shift	per_capacity_ratio_to_volunteers	number_of_shifts	total_number_of_volunteers
2	2	28	39.28571429	3	84
3	2	1	39.28571429	3	4
4	2	3	39.28571429	3	8
5	2	13	39.28571429	3	38
6	2	25	39.28571429	3	76
7	2	127	39.28571429	3	382
8	2	255	39.28571429	3	764
9	2	1273	39.28571429	3	3818
10	2	2545	39.28571429	3	7636
11	2	12727	39.28571429	3	38182
12	2	25455	39.28571429	3	76364
13	2	0	39.28571429	3	0
14	2	0	39.28571429	3	0
15	2	0	39.28571429	3	0
16	2	0	39.28571429	3	0
17	2	0	39.28571429	3	0
18	2	0	39.28571429	3	0
19	2	0	39.28571429	3	0
20	2	0	39.28571429	3	0
21	2	0	39.28571429	3	0
22					

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