Implementing Lean Solutions at the Front Desk of Hahnemann Family Health Center

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Abstract

Transitioning from one Electronic Health Record (EHR) system to another can initially hinder performance for even the most efficient clinics. This project explored potential effects on front desk workflow with the implementation of a new EHR system at Hahnemann Family Health Center. The team shadowed employees and collected data to examine options to support the EHR transition and improve efficiency at the front desk. Countermeasures included standardizing the front desk tasks, creating a template to determine staffing levels, and redesigning the current checkout process.

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Table of Contents

Table of Tables

Table of Figures

Chapter 1: Introduction

Ambulatory care, or outpatient care, refers to a unit where patients are treated, but are not admitted to a hospital or other facility. Examples of ambulatory care are ambulatory surgery centers, walk-in clinics, dialysis clinics, and physician offices. Ambulatory care is quickly growing due to more advanced medical technology allowing for more streamlined procedures that do not require patients to stay overnight. Hahnemann Family Health Center (HFHC), an ambulatory unit that is part of UMass Medical Center, is a residency clinic that focuses on many areas within family medicine.

Healthcare costs in the U.S. account for nearly one-fifth of economic output (Gamlin, 2016). In response, the U.S. healthcare market has placed an increased focus on higher patient quality and more efficient systems. In order to improve clinics effectiveness, many healthcare organizations are utilizing lean thinking to decrease defects, waste, and waiting, while maximizing value. Lean design promotes standardization and streamlined processes (Miller, 2005). Within UMass, HFHC is a model cell, which is a unit used to pilot new lean ideas before they are implemented within UMass' other units. Most recently, HFHC has been a pilot test site for employee training for a new Electronic Health Record system.

The Electronic Health Record system, or EHR system, was developed as a computerized way for hospital staff to increase efficiency when documenting patient information ("Benefits of Electronic"). The EHR provides up-to-date, real-time information on patients and contains the patient's past medical history. While the functionality of previous EHR systems addressed only certain areas of healthcare organizations, a new Electronic Medical Record software, a leader in the EHR market, is able to encompass most, if not all, areas in the organization. The new software provides the information for the patient, but can also be used for administrative tasks like registration, patient scheduling, and billing.

As HFHC prepares for their new Electronic Medical Record software launch, their current operations encounter obstacles with their computer systems and their daily processes within the clinic. For example, HFHC uses three computer systems, Allscripts, Medaptus and IDX, which do not communicate well. Issues with tasks appearing in the

systems and also appearing in all applicable systems has been a common occurrence. Another concern at HFHC is to determine how the implementation of a new Electronic Medical Record software will impact staffing levels within the clinic. For the clinic to implement a new Electronic Medical Record software effectively, the impact on existing processes must be understood and redesigned.

The goal of this project was to support Hahnemann prior to the implementation of a new Electronic Medical Record software by evaluating the check-in process and identifying opportunities to improve the checkout process at HFHC. To do this, we used an A3 planning approach, first evaluating the current state process flow at HFHC by shadowing six different roles and performing time studies on the check-in and checkout processes. Next, we examined root causes related to current workflow as well as the new EMR software system. Finally, we developed countermeasures and solutions that addressed the root causes. In particular, we created a universal template for UMass to determine the number of check-in employees necessary when a new Electronic Medical Record software is launched. We also analyzed more efficient and effective checkout methods to use at HFHC.

The report is organized as follows. The benefits and disadvantages of EHRs and lean implications are described Chapter 2. Chapter 3 describes the clinic of focus, Hahnemann Family Health Center. Chapter 4 provides an overview of the methods we used to accomplish the project goals. Chapter 5 evaluates the current state of clinic staffing roles. Chapters 6, 7, and 8 discuss the process, findings, and recommendations for the staffing template, front desk standard work, and checkout redesign, respectively. Conclusions, recommendations, and reflections are found in Chapter 9.

Chapter 2: Literature Review

Ambulatory care, or outpatient care, is medical care in which patients arrive and depart from the healthcare provider within the same day. Examples of ambulatory care are outpatient surgery, walk-in clinics, and physician offices. Ambulatory care is the fastest growing sector of care because advancements in medical technology have decreased the need for patients to stay in the hospital overnight.

One example of this increased technology is an Electronic Health Record, or EHR. An EHR is an electronic record of a patient's health information that provides up-to-date information and "allows a patient's medical information to move with them" (Weiss, 2016). It is important to note that while EHR and electronic medical records (EMR) seem similar, an EMR is just an electronic version of a specific chart and is not meant to be moved from practice to practice. The main purpose of the EMR is to help with diagnosis and treatment by a specific practice (Weiss, 2016).

This chapter discusses the literature we researched to become more familiar with the project theme. This includes: ambulatory care, implementing Electronic Health Record systems and their benefits, value added work, Lean principles and its applications in healthcare, and primary care time and task studies. We used the information to gain awareness of common issues in ambulatory care and to analyze different Lean methods that could be applied to mitigate these issues.

2.1 Issues in Implementing an Ambulatory Care Electronic Health Record

Many issues have arisen with the implementation of EHR systems within ambulatory care, most notably, not taking full advantage of all of the components, features, and benefits of the system. EHR systems have numerous functions and record important information such as patient history and demographics, problem lists, physician clinical notes, comprehensive medications and allergy lists, computerized prescription orders, and laboratory and imaging results electronically. However, in 2012, studies showed that only 40% of U.S. ambulatory care providers used a fully functional EHR system. This suggests that many of the reported users of EHR systems are not utilizing them to their full potential

(McAlearney et al., 2015). Many organizations are concerned that the implementation of an EHR system is expensive and decreases productivity among the physicians. A study has shown that there are six major issues pose barriers to physicians' adoption and use of EHR including "a need to change practice style; threat to professionalism; shift of expertise; required changes to interactions with patients; concern about the impact on medical education and training; and concern about the potential impact on clinical practice itself" (McAlearney et al., 2015).

One issue stems from a physician making changes from their normal practice styles. Many physicians feel as though a majority of their time is now consumed with inputting data into the EHR system as opposed to performing their normal tasks. An American Journal of Emergency Medicine study stated that Emergency Department physicians spent 44 percent of their time entering data into an EHR and clicking up to 4,000 times during a 10-hour shift. This meant they spent less than one-third of their time directly working with patients. It has also been a difficult transition for some older physicians to adapt to the new computer systems (Butler, 2016). Specialized physicians encounter issues when they encounter complex cases which are hard to document in the system.

The threat to the professionalism of physicians has been growing with the implementation of EHR systems. Physicians feel micromanaged because EHR systems have requirements that need to be met which differ from their normal mindset. Some physicians, who are less comfortable with technology, worry about typing in front of patients and being seen as incompetent at their job. This concern is supported by a study done by Mysen, which found that patients are more likely to trust an EHR system if the physician and nurses using it are comfortable doing so (Mysen, Penprase, & Piscotty, 2016). As a result, there has been a shift in which expertise is seen as most important for physicians. This is occurring because younger physicians are more comfortable with computers and becoming EHR "experts" in comparison to their colleagues who have more clinical experience, but less experience with EHR.

Another issue involves a change in physician-patient interactions. The interactions are less face-to-face with the addition of EHR systems because physicians are now interacting more with computers in order to update the patient's chart. It becomes difficult

for the physician to document a patient's complaints, symptoms, and questions in real-time while also showing compassionate care and listening to the patient. Patients, however, do not see this as an issue because it is perceived that the physician is recording in-depth information about the patient. The study by Mysen also found that 87.3% of patients reported that they trusted the EHR system used by their primary care physicians suggesting that lack of eye contact is not a deterrent for the majority of patients (Mysen et al., 2016).

The increased use of EHR systems has had an impact on both medical education and training. Medical schools need to start teaching students how to use EHR systems with a specific emphasis on the interaction with a patient and using the EHR simultaneously. One concern with this approach is that doctors may stop thinking for themselves and become dependent on information provided by the computer. Teaching physicians how to use their computers effectively without becoming dependent on them can mitigate this issue (Essin, 2012).

The last major issue is the impact that implementing EHR could have on a clinical practice itself. Changing requirements for documentation may threaten the completeness of medical records causing quality within health care to decline. A doctor said that "if [he] senses that a patient needs to have face-to-face time, then [he] will not document as much when in the room because [he] knows they need personal interaction." This creates a "fear that what is documented doesn't tell the whole story" (McAlearney et al., 2015). EHR systems are supposed to allow for more documentation and easier tracking of a patient's health history, however, as shown in the case above, it may actually end up having the opposite effect.

2.2 Benefits of EHR use in Ambulatory Settings

Electronic Health Records allow for multiple care providers to have access to a patient's record. The electronic record provides up-to-date patient information. This allows for a more in-depth evaluation and enables physicians to more accurately and quickly determine a diagnosis. Sandhya Pruthi, M.D., of Mayo Clinic in Minnesota states "I can quickly and easily pull up test results in the exam room to review with my patients [and]

also verify when they had past exams or procedures. I can even show them results of their imaging tests on the screen" with the help of the EHR system ("Benefits of Electronic health Records"). The system can also save time during a doctor's office visit. EHR systems can be extremely helpful in emergency situations because the doctors are able to gather information on the patients they are treating faster which can save patient lives.

Within healthcare, administrative and secretarial work represents a significant amount of effort in terms of both time and cost on a daily basis (Gamlin, 2016). Physicians and nurses spend a large amount of their time during the day filling out and processing forms. EHR is paperless and removes multiple routine tasks that were needed when paper files were used. EHR systems also take up much less physical space than paper files which can help organize offices, decrease clutter, and improve efficiency.

An EHR system eliminates the problem of lost and misplaced patient files while eliminating data errors that occur during physician and nurse transcription. Having records digitized saves time in comparison to looking for paper charts and entering changes manually. This time can now be used for value-added activities, which in turn reduces staff overtime charges. Through EHR systems, costs decrease and productivity increases because of office efficiency. This benefit is important because it eliminates lost prescriptions and improves patient safety because electronic prescribing automatically checks for potentially dangerous drug interactions. In fact, a study by Singer and Fernandez (2015) shows that "the number and percentage of clarification requests, interaction notifications, and incorrect dose notifications were lower after the implementation of the EHR system." A patient's chart can be accessed anywhere by both the patient and ambulatory staff. By using an EHR system, it can improve the quality of care for the patient which is beneficial for the hospital or clinic (Singer et al., 2015).

An EHR can increase the quality of care and strengthen the relationship between physicians and patients because up-to-date and accurate data is readily accessible. This allows physicians, clinicians, and nurses to communicate more clearly and quickly to patients over the phone, in the office, or at remote locations. Not only do patients have access to their personal information, including notes from their appointment and prescriptions, but they also have access to national databases which can be used to look up

further information or compare their condition to national information in between patient visits (Lorenzi et al., 2009). This gives the patients the ability to further educate themselves between appointments, giving them more power.

2.3 The New Electronic Medical Record Software as an EHR

The new Electronic Medical Record software selected is a fast-growing EHR system in both market share and functionality. This selected software is able to encompass all areas of a healthcare organization, whereas previous EHR systems could not. The new software provides the information for the patient, but also can be used for administrative tasks like registration, patient scheduling, and billing. In part because of its functionality, it encompasses most healthcare areas, this selected Electronic Medical Record software is used in more than 250 healthcare organizations nationwide. The new Electronic Medical Record software covers the medical records of 45% of the US population in the system. Furthermore, the new EMR software is a useful system for the patient as well. Patients are able to obtain their information on the computer or using a smartphone application. They can also message their doctors and make appointments using the system. The newly selected Electronic Medical Record software has a subsection specifically for ambulatory care.

2.4 Value Added and Lean in Healthcare

Value added work is focused on work that the customer is willing to pay for, which adds value directly to the product or service (Capuano et al., 2004). Non-value added work is work that does not add to the final product or service. In some cases, there is required non-value added work, and other times, it is waste, which can be eliminated.

Value added work includes priorities like diagnosing the patient, treatment of the patient, and giving a solid care plan (Bond et al., 2013). Required non-value added time includes administrative tasks like billing and regulatory (Bond et al., 2013).

Waste can be broken up into different categories such as defects, overproduction, and waiting in healthcare. The first is defects which includes issues such as medication errors, wrong procedures, wrong patient, and missing information. The second,

overproduction, includes, for example, giving out pills early, duplicating tests, and performing tasks in the wrong order. The third, waiting, is experienced both by the staff and the patient. These issues involve bed assignments, discharge, testing results, approvals, and equipment (Lockwood, 2013).

2.5 Applying Lean Principles to EHRs

Electronic Health Records can be a way to save money, improve healthcare quality, make processes safe, and optimize operational processes by making patient information more easily accessible throughout a healthcare system ("Benefits of Electronic"). Healthcare costs in the Unites States are much higher than those in other industrial countries with similar healthcare systems. Wasteful spending has many consequences that can be improved through waste reduction (Bentley et al., 2008).

Waste in healthcare includes waste regarding information, processes, and the physical environment. Information waste includes redundant input and output information such as patients filling out the same information multiple times and nurses asking the same questions to patients. Another example of information waste that is specific to HFHC is when the ASRs have to enter the same information in multiple computer systems because of the poor communication of their current EHR systems. Information problems occur due to physician's handwriting. These issues from poor handwriting can lead to mortality in patients, additional time costs for providers to clarify orders, and costs to payers for additional procedures. "The Institute of Medicine has estimated that preventable medical errors claim between 44,000 and 98,000 lives in hospitals each year" (Bentley et al., 2008).

One way to reduce information waste is to work from a single source of information. However, until EHRs are universal, the collection of redundant and excessive data presents a problem. Differing EHRs may use the same process, but cannot share data. This leads to errors and wasted resources because some systems require manual checking. Common data issues include re-entering data, converting formats, data error, and data safety issues (Campbell, 2009, pg. 40-43).

Lean in healthcare refers to a systematic method to maximizing value to patients by reducing waste and waits (Lawal et al., 2014). It can be used to alleviate inconsistencies in

a process by eliminating redundancies, wastes, and unnecessary tasks (Miller, 2005). Lean is a useful tool because it simplifies overly-complicated processes and is ideal for large complex healthcare organizations. Lean is a way to simplify and standardize operations across many different units. Lean thinking is a technique for creating change.

There are several lean techniques that can effectively mitigate waste regarding EHR systems. One lean technique that can be utilized is standard work (Bicheno, 2008). Standard work is defined as the most effective way to perform a process or task. Standard works breaks down a large, complex process into small work steps. By using standard work, the variability of the system decreases making it easier to train new employees when needed. Standard work decreases process time which in turn will increase patient satisfaction and also increase the number of patients that can be admitted into the healthcare clinic.

Another lean technique that can be used during EHR systems is a root case analysis (Bicheno, 2008). This allows the organization to pinpoint why issues and problems may occur before the system is launched, and why problems are occurring after the system has been launched. Common EHR issues can result from duplicate documentation, inadequate or missing information flow, or even a lack of standard work. Once the root cause issues are identified, a healthcare organization can move forward in creating solutions.

2.6 Primary Care Time and Task Studies

Primary care is an important sector of healthcare because it serves as a first line of defense against many illnesses. The EHR system has become an increasingly prevalent tool used in primary care. The effects of these EHRs on time usage in primary care clinics have been a source of debate in the medical community and has prompted further studies and analysis on the issue. Most studies show that the average patient time spent in the clinic decreases after implementation of EHR systems. This convenience factor for patients and staff is an added benefit to an organization that implements an EHR system. Another factor that affects the efficiency of primary care clinics is the task allocation and perception of roles of staff members in primary care clinics. A survey done by Edward (2015) shows that there are discrepancies in perceived roles in primary care clinics depending on who is

asked. These factors must be carefully examined in order to determine the best method of caring for as many patients as possible while also giving each patient sufficient attention.

The change to new technology can be a concern for primary care clinics if there is an adjustment period for their employees. Usage rates of EHR systems for office based physicians has nearly doubled from 2008 to 2014 from 42% to 83%, according to the Office of the National Coordinator for Health Information Technology (Office of the National Coordinator for Health Information Technology). These statistics are encouraging, but because the numbers are rising so quickly, many EHR users are inexperienced with these systems. Less than a decade ago, less than half of office based physicians used EHRs, so many physicians who used paper records have had to learn a new software due to the increase of EHR usage. Ensuring that all staff members are trained to use an Electronic Health Record system is vital to successful implementation and needs to be a priority when deciding to adopt a new system (Clarke et al., 2016).

Opposition to EHR systems usually comes from the perception that it takes longer than traditional methods of record keeping. However, studies show that EHRs take the same or less time than older methods. According to a time study done by Pizziferri (2005) which analyzed time usage before and after implementation of an EHR system, average time spent on each patient was nearly identical before and after implementation of the EHR system. In fact, the average time spent with each patient decreased by 0.5 minutes per patient. In this study, even a newly implemented system did not slow clinics, suggesting such systems can be quickly and effectively put into use if done correctly. This study also included a survey that asked physicians to rate the EHR system and the paper record method on a scale of 1 to 5 in various categories. The categories included communication, access, efficiency, impact on workload and quality of care. The only category that the EHR scored worse in was the impact on workload. The physicians noticed improvements in four out of the five categories, but it also shows that they see EHRs as an increase to their workload even though time spent with each patient did not increase. This is an interesting contradiction, and it also illustrates that some physicians are resistant to these new methods even though they see the benefits.

Chapter 3: Background

To gain a better understanding of the environment at Hahnemann Family Health Center, our group researched the literature and talked with different employees to learn about various aspects, ideals, and procedures at the clinic. This gave us insight into the clinic, specifically the process flow, current Lean practices, and issues with the current processes, which are discussed in the following sections.

3.1 Process Flow in Hahnemann Family Health Center

Hahnemann Family Health Center (HFHC) is an ambulatory care center within the UMass Memorial Healthcare system that serves about 100 people each day. The staff consists of 10 Licensed Practice Nurse (LPN), 2 floor nurses, 6 Medical Assistants (MA), 12 residents, as well as other supporting staff. These staff include Ambulatory Service Representatives (ASRs), who are responsible for checking patients in and out, sending prescriptions to pharmacies, creating appointments, and clarifying information in patient records.

Before patients arrive at HFHC, the ASRs make reminder calls the day before an appointment to minimize the 18% no-show rate. The patient's insurance is verified the night before his or her appointment. Each morning, the clinic team has a "Ruddle," or registry huddle, that discusses the patients with scheduled appointments that day, special treatments that will occur, staffing availability, and the provider's schedule.

When patients arrive at the ambulatory care center, they wait in line to check-in for their appointment at the registration desk. The patient presents his or her patient blue card and fills out a check-in checklist and then proceeds to the waiting room. The ASR verifies the patient's insurance, prints a medical list, stamps the patient's paperwork, and marks the patient as "Arrived" in both Electronic Health Record (EHR) systems, IDX and Allscripts. The patient is then called into the clinic by the MA and has his or her vitals taken such as height, weight, and blood pressure. The MA asks the patient about the reason for his or her visit and if the patient is experiencing any pain. This information is recorded in Allscripts.

After vitals are checked, the MA brings the patient to an exam room and the patient

waits for the provider. Following the appointment, the provider creates a task, such as scheduling another appointment, in the EHR system. The patient either proceeds to checkout or is picked up by a nurse for additional work. The nurse picks up the patient after receiving an Allscripts order or a verbal request from the provider. After the patient receives vaccinations, blood work, or other treatment, he or she uses the same queue to checkout as he or she did to check-in. The ASR schedules follow up appointments and prints a clinical summary. In 2015, HFHC created a current state patient flow process diagram, as shown in Appendix A. The current state diagram shows the major stages, inputs and outputs of each stage, the tasks associated with each stage, and undesirable effects (UDE) that Hahnemann is looking to mitigate. The process flow summarizes the appointment process from the clinic's point of view, starting with the pre-visit work and ending with the patient checkout.

3.2 Current Lean Practices at HFHC

Hahnemann Family Health Center strives to incorporate Lean concepts into their daily routines in order to continuously make improvements and offer the best care possible to their patients. . Lean can help clinics increase patient inflow while maintaining a high level of patient satisfaction. The current process at HFHC creates an environment that allows all team members to practice Lean principles. Two Lean tools HFHC utilizes are an Idea Board and a Scoreboard.

The Idea Board at HFHC is in a central location where staff members are able to post and organize their ideas for clinical improvements. It allows for more ideas to be shared and considered, and it also ensures that all staff members' ideas are heard. It lists the idea description or problem, the task that would need to be done to improve the process and the owner of the idea. The cards that the staff members fill out to share their ideas are then organized in several different categories. The ideas are reviewed at a weekly meeting in order to transition these ideas into actions. When thinking of new ideas and deciding how to turn ideas into actions, UMass uses a Plan-Do-Study-Act (PDSA) technique. This is an iterative process to strive for continuous improvement.

Changes are evaluated through the use of clinical Scoreboards. UMass leaders set

organizational priorities and ask that all departments and individual units (like Hahnemann Family Health Center) align with those priorities by setting specific goals they can measure and monitor. This is to ensure that all units within UMass are working towards a common goal, but each clinic has the flexibility to create more specific goals based on their needs. These clinic goals are discussed during the Daily Huddle. The Scoreboard not only allows for the team to track goals, but it also improves communication in the office as well.

HFHC developed four different metrics that are counted and tracked each day:

1. Less than 10 abandoned calls per day
2. Daily survey for staff to rate their satisfaction from 1-5
3. Implement at least 1 idea from the idea board per employee each year
4. Less than 20 bills that are more than 7 days overdue

These metrics are used to ensure patient accessibility, employee satisfaction, and continuous improvement. The clinic is piloting this scoreboard, thus these goals have been initially defined and can be altered if necessary.

3.3 Issues within HFHC Current Process

HFHC has identified several areas of possible improvement within their organization. First, the three computer systems that are used, Allscripts, Medaptus and IDX, do not communicate well. For example, physicians make tasks in Allscripts to schedule appointments, but these tasks do not always show up for ASRs. Additionally, some information that is input into one system should automatically be in the other, but does not appear. These errors can result in important patient information being lost or patients missing appointments.

Another concern at HFHC is ensuring that all employees work to their license. This allows the most expensive resource to focus on tasks that only they can perform. More specifically, they want to make sure that any documentation that can be done by nurses are not done by physicians. This will allow physicians to spend more time diagnosing and helping patients. If there is a more standardized process of task allocation, tasks and documentation would not be repeated.

Chapter 4: Methodology

Our methods were developed to support Hahnemann prior to the implementation of a new Electronic Medical Record software by evaluating the check-in process and identifying opportunities to improve the checkout process at HFHC. Our team utilized an A3 problem solving approach which is built around Plan-Do-Study-Act. The A3 is a tool to summarize the problem and solutions using structured thinking. The A3 thinking process includes steps such as determining the goal and problem, understanding the current condition, identifying root causes, and determining countermeasures (Pelletier, 2011). Through the A3 problem solving approach, we verified and analyzed the current state at HFHC to deduce its shortcomings and propose feasible solutions to these findings. Following this, our team explored the root causes that were contributing to the problems, and finally, developed countermeasures to address the root causes. A timeline of our methods and tasks can be seen in Figure 1.

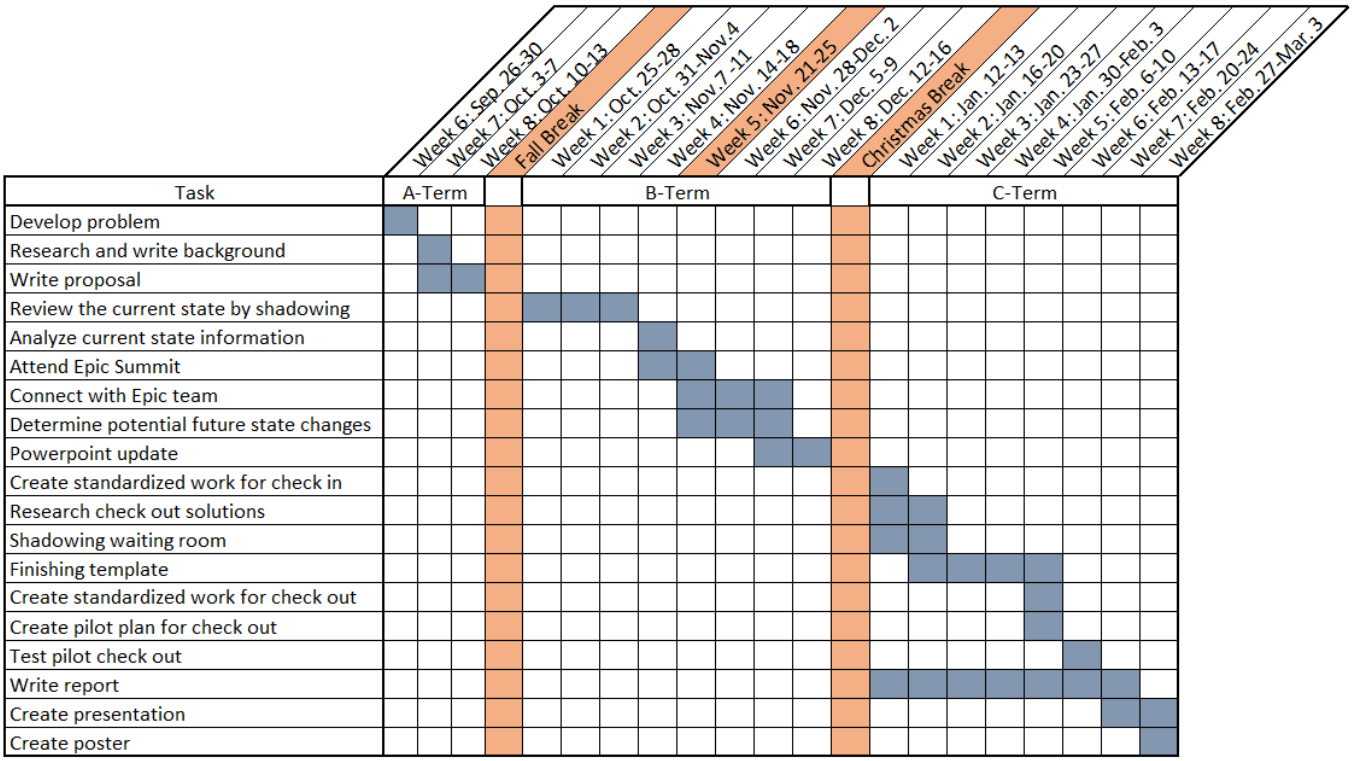

Figure 1. Timeline of methods and analysis

4.1 Current State Analysis

First, our team analyzed the current condition of Hahnemann Family Health Center. We shadowed six different roles at HFHC for a cumulative 20 hours. The six roles we shadowed were the Ambulatory Service Representative (ASR), Medical Assistant (MA), Licensed Practice Purse (LPN), Triage Nurse, Lead ASR, and the call center employees. While shadowing each employee, we recorded the following information: tasks performed, what information was collected, what system was used to record this given information, frequency that the task was performed (i.e. every visit, every patient), number of occurrences, and number of patients served. The results of this analysis are found in Chapter 5.

4.2 Root Cause Analysis

The next step in the A3 planning process was to develop a root cause analysis for our project, as seen in Figure 2. First, we identified the problem that we were focusing on, which was the effect a new Electronic Medical Record software would have on the front desk process. Then, we analyzed which factors would have an impact on that problem. The categories that we developed included: People, Technology, External Environment, Process, and Unexpected Events. The process of carrying out the root cause analysis gave our group a better perspective of the scope of the problem, which allowed us to develop more effective countermeasures.

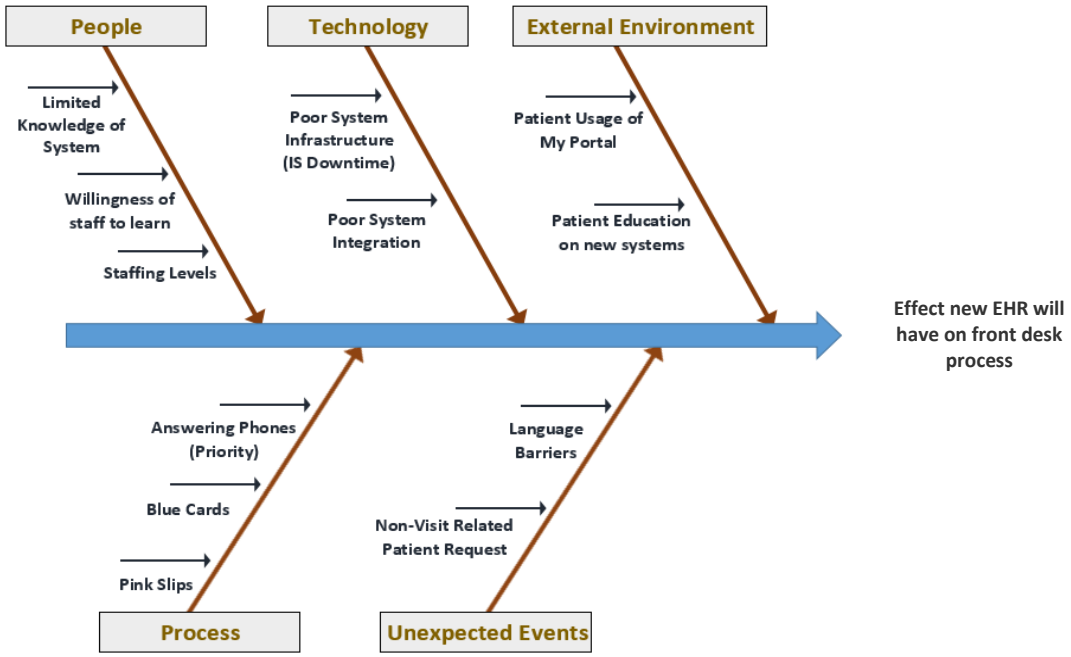

Figure 2. Root cause analysis at HFHC

4.3 Countermeasures

Using the current state and root cause analyses, our team developed three deliverables or countermeasures for HFHC to support the transition from the current IT systems to a new Electronic Medical Record software was smooth and utilized lean principles:

1. An excel template to allow UMass to determine accurate front desk staffing levels
2. Standard work for both the check-in and checkout processes for the new Electronic Medical Record software
3. An analysis of three new checkout processes to reduce patient wait time and increase efficiency within the clinic

The excel template used queuing theory, which takes into account arrival rates and service times, to provide guidelines for staffing levels for ASRs at check-in. Based on our shadowing calculations or other data, the user can input the service rate per server into the template, and as well as a target time for the patients to be involved the check-in system. Lastly, the number of patients per day per block is entered. The template then calculates and recommends the number of ASRs needed for the check-in process. This

countermeasure is described in more detail in Chapter 6.

To develop standard work for the check-in process once the new Electronic Medical Record software is implemented, the group first obtained the current standard work that is used for check-in at Hahnemann. We then modified this standard work to match the process that is likely to be followed once the new Electronic Medical Record software is being used by the clinic. We were also given a form that UMass employees use when creating standard work for processes in hospitals and clinics. We contacted members of the new Electronic Medical Record software rollout team at UMass to ensure that the steps that we created were accurate and also that we did not miss any steps in the check-in process for the new EMR software. A more in depth analysis of the standard work is provided in Chapter 7.

The analysis for the new checkout design process began with our group researching different designs used by other clinics. We then looked into the benefits and shortfalls of each design and which would be the easiest for Hahnemann to implement. Currently, HFHC uses a pink slip system. The pink slip shows the patient and visit information as well as informs the ASR what checkout tasks they need to perform. We collected checkout pink slips from Hahnemann to estimate the percentage of patients who check out, the percentage who need follow-up appointments, and the percentage of patients who only needed their clinical summary. We then created process flowcharts for each of the three options and piloted the MA in-room checkout option. After piloting the option, we held discussions with employees who were involved and made a recommendation on which option we think would be most beneficial for the clinic. A more detailed description and the results of this analysis is provided in Chapter 8.

Chapter 5: Current State Analysis

Our group analyzed the current state at Hahnemann Family Health Center to understand where there were inefficiencies within the system and where we could suggest improvements. This chapter summarizes the current state of Hahnemann Family Health Center. This includes shadowing procedure, current workflows, and areas for improvement.

5.1 Verify the Current State by Shadowing

In order to understand, review, and verify the current state process workflow provided by Hahnemann Family Health Center (Appendix A), we shadowed the various roles in the clinic. This allowed us to verify that the tasks HFHC thought were occurring were actually being performed at each stage in the workflow. We shadowed 3 MAs, 2 LPNs, 2 call center representatives, 5 ASRs, 1 triage nurse, and spoke with providers.

Throughout our shadowing, we recorded the following information: tasks performed, what information was collected, what system was used to record this information, frequency that the task was performed (i.e. every visit, every patient), number of occurrences, and number of patients served. The Shadowing Documentation Form we used when collecting data can be seen in Appendix B. We collected data on the current state for 4 weeks. We shadowed twice a week and had at least two team members attend the clinic at the same time.

5.2 Analysis of the Current State Data

After we collected the current state data, we analyzed the information to determine which areas of the clinic to focus on specifically. We did this by identifying which areas utilized the computer software systems and performed the most tasks. After focusing on a specific area of the clinic, we compiled the areas within the process which were identified as problematic by the employees. We looked at the undesirable effects identified on the process flow chart created by UMass (see Appendix A) and determined which might be removed with the implementation of the new Electronic Medical Record software.

Following this, we brainstormed solutions for the employee problems and undesirable effects that would not be resolved after a new Electronic Medical Record software implementation.

Lastly, to complete our analysis, we spoke with the current employees about areas they thought could use improvements. This was invaluable when determining what waste was hiding in the system. The current employees use the software and processes every day and were able to tell us where inefficiencies lie in the system and the effects of system downtime.

5.2.1 Current Tasks Performed Observations

Our team observed Hahnemann Family Health Center for 5 hours a week for 4 weeks. We shadowed six different roles at Hahnemann Family Health Center: front desk ASRs, call center, LPN, MA, Lead ASR, and triage nurse. Through our observations, we recorded the tasks of each role, the systems the information was recorded in, frequency of the tasks, and issues employees faced.

<u>Ambulatory Service Representative</u>

The ambulatory service representative (ASR) at Hahnemann Family Health Center is responsible for the check-in process, checkout process, and answering phones. Either two or three are designated employees for check-in, and two for checkout, but they can share roles and responsibilities. The ASR workflow can be seen in Figure 3 below.

During check-in, the ASR receives the patient blue card (UMass Identification) and a government issued identification and verifies the patient's information within the system. The employee then gives the patient any paperwork that he or she needs to fill out. Following this, the ASR finishes the documentation and puts a pink slip into a bin for the MA to pick up. The checkout ASR assists the patient after the appointment to set up follow-up appointments. The patient hands the pink slip to the ASR at the end of the appointment, which tells the ASR to schedule an appointment or print out a clinical summary sheet. All ASRs answer the phones. Phone calls are primarily for patients requesting an appointment or a prescription refill.

We observed multiple issues that the ASRs face during their daily routine. The first is the aforementioned task of answering the phone. This takes the employees away from the check-in process and causes the queues to grow. Another issue is language barriers. When the patient forgets to change his or her language preference, it slows down the check-in process because the ASR has to get an interpreter. Another issue is that there are not enough clipboards available, which causes the ASRs to walk around the clinic looking for them. Other inefficiencies involve having the blue card and pink slip process because patient identification and notes about follow-up appointments can be done faster without these systems.

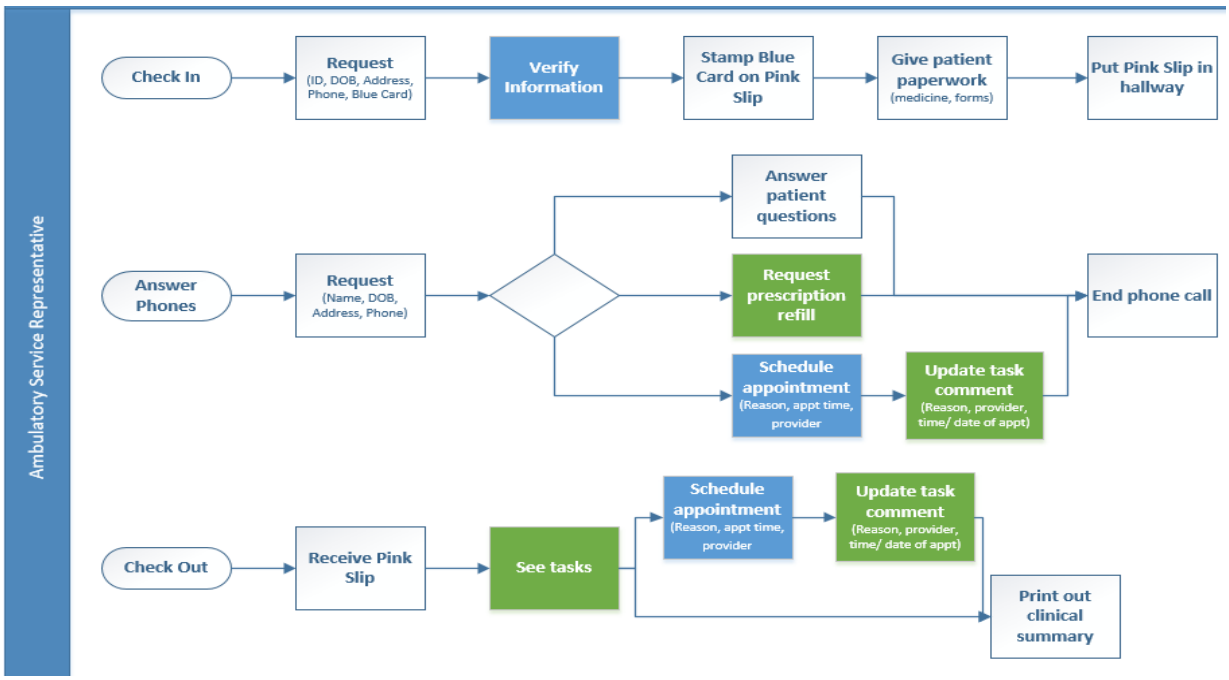

Figure 3. Current workflow of ASR

Lead ASR

The Lead ASR at Hahnemann Family Health Center is the leader of the team that schedules patient visits to the clinic. The workflow for the Lead ASR can be seen in Figure 4. The Lead ASR creates the templates for the provider schedules in Excel and then inputs them into IDX. When appointments are scheduled incorrectly, causing double booking, the Lead ASR is one of the only employees who can fix the template. The Lead ASR helps when ASRs need assistance completing their tasks. However, most of the tasks within this task list are to call patients and schedule appointments, which uses the IDX system.

During shadowing, several issues were identified. The first issue was that the Lead ASR is one of the only employees that has access to change the scheduling templates and is solely responsible for recognizing and changing the template. Another issue occurs when a task is complete, but not closed within the system. When it is not closed, another employee must verify the task was done correctly and then close it. Lastly, patients sometimes incorrectly choose English as their preferred language, which causes a delay when the scheduler has to call an interpreter to have a three-way call.

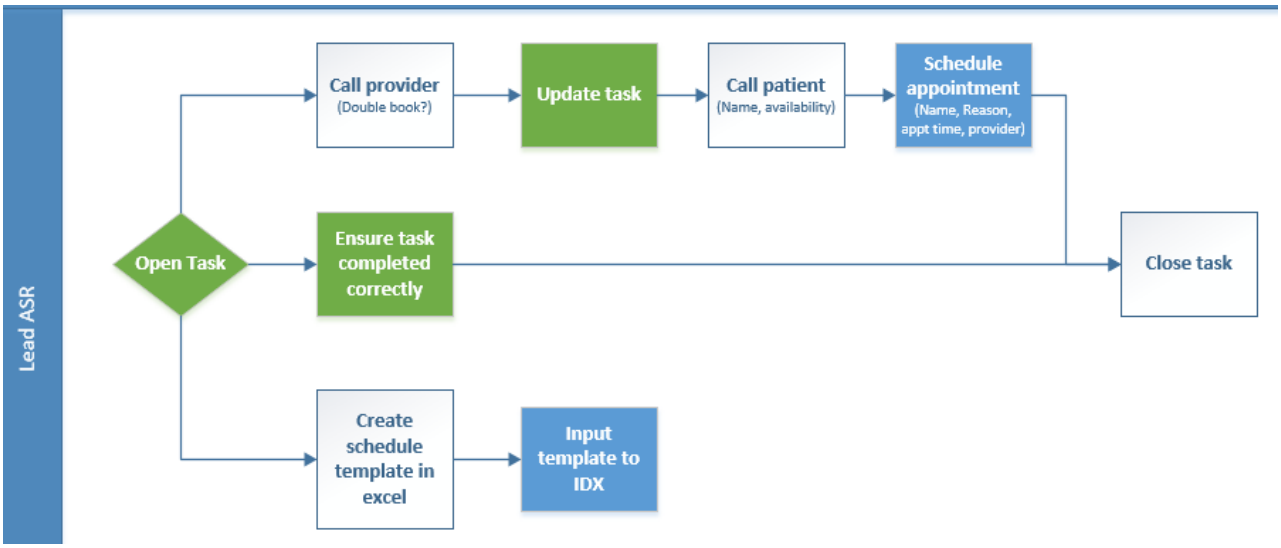

Figure 4. Current workflow of lead ASR

Medical Assistant

The medical assistant (MA) at Hahnemann Family Health Center is a vital part of the patient flow through the clinic. Some of their main roles include rooming patients, tracking the daily schedule of their assigned providers, checking vitals of patients, and inputting the vital information into Allscripts. The workflow of the MA can be seen in Figure 5. The MA calls the patient into the clinic, after Allscripts has identified the patient as arrived, to take his or her vitals and other patient-specific initial information. The MA then rooms the patient, and the MA enters which room the patient is in into Allscripts. In between patients, the MA inputs the patient's vitals into Allscripts and enters billing information regarding the visit into Medaptus.

One issue an MA faces is that a significant number of patients arrive late and others do not show up at all. These no-shows and late patients are disruptive to the schedule, can

cause delays for other patients, and require additional work from the MAs to fit all patients into the schedule. Alternatively, when providers are behind and do not want their patients to be roomed too early, it causes downtime for the MAs.

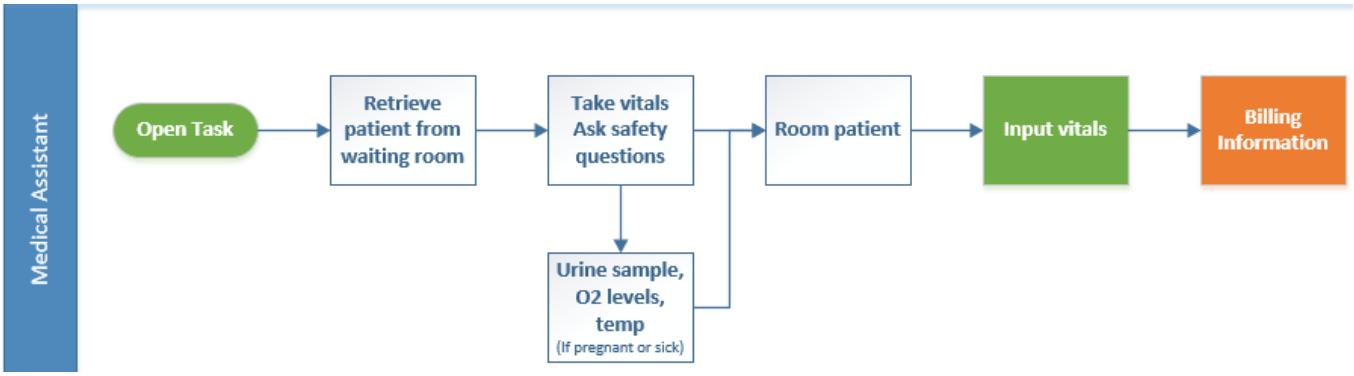

Figure 5. Current workflow of MA

Call Center

The call center has multiple roles within Hahnemann Family Health Center including: billing, setting up specialist appointments, setting up follow-up appointments, receiving calls, delivering medical forms, and helping refill prescriptions for patients. These responsibilities and tasks can be seen in Figure 6. According to a call center employee, each employee within the call center answers around 70 calls per day from patients. When setting up specialist appointments, the call center calls the patient up to 3 times before ending the task. The call center sends billing reminder emails to providers if they have not completed this within 24 hours of an appointment. They send around 900 reminder emails to providers asking them to submit encounters in a month, and it takes approximately 1.5 hours to complete each day.

The call center employees face multiple problems throughout their daily work. The first major problem they face is that Medaptus and Allscripts do not communicate well together which causes the call center employees to look up the patient and input the same information in both systems. With phone calls coming into the call center regularly, these delays can make it difficult for the employees to finish other tasks they are working on. These frequent interruptions cause task errors. They have attempted to combat this problem by having certain employees only work on tasks and others answer the phone, but this can cause longer queues and dropped calls.

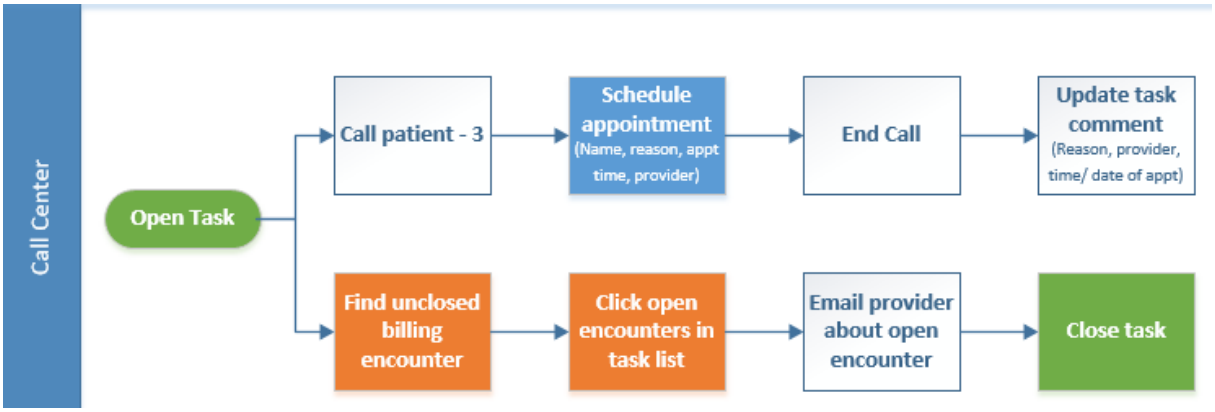

Figure 6. Current workflow of call center employee

Triage Nurse

The triage nurse in the call center is responsible for calling patients to schedule appointments and suggesting ways to manage symptoms such as pain until the appointment, as seen in Figure 6. The triage nurse reviews the lists of tasks in Allscripts. When the task requires a phone call, she calls the patient to find a time for the patient to come in. She does a quick analysis of the patient's pain, asks the patient how he or she has attempted to mitigate the pain, and suggests other pain alleviation methods. After this, she looks at provider schedules to book an appointment in IDX. Then, the triage nurse goes into Allscripts and updates the task comment. She is also responsible for faxing patient-requested information.

One setback for the triage nurse was that she spent most of her time leaving voicemails and not speaking directly to patients. This causes redundancies because the information in the voicemail is repeated when the triage nurse is able to speak to the patient. Another issue regarding phone calls is that many patient files do not have the correct phone number, which makes it difficult to contact the patient.

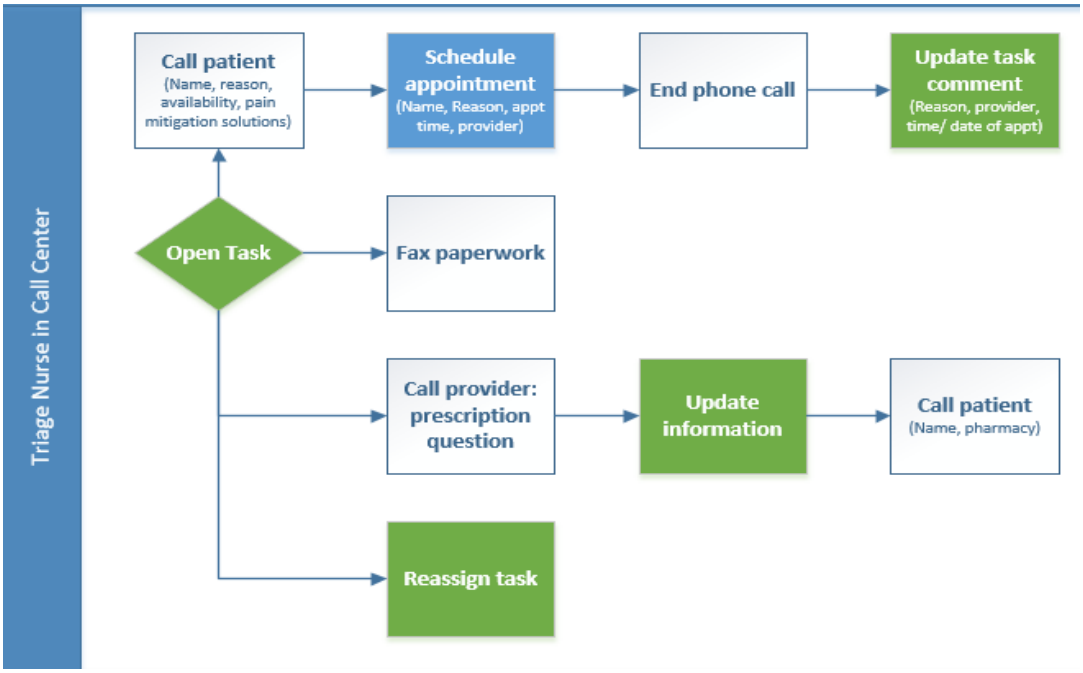

Figure 7. Current workflow of triage nurse

Licensed Practical Nurse

The licensed practical nurse, or LPN, at Hahnemann focuses on administering vaccines, flu shots, and TB tests. As shown in Figure 7, The LPN uses Allscripts to receive tasks and document that the procedure was completed. Paper forms are utilized to record shot information such as manufacturer and lot number in addition to the patient's information, prior to being inputted into Allscripts. Other tasks performed by LPNs include retrieving the medicine from the Pyxis Medstation, administering the medicine to the patient, filing the paper forms, checking health forms, requesting immunization records for patients, and correcting billing errors.

The nurses do not always have time to chart right away which creates issues in Allscripts because completed tasks remain as "in progress." This causes the LPN to ask other nurses and check rooms to find the patient when he or she is no longer at the clinic. Another issue is that HFHC must keep records for the state. While Allscripts is supposed to keep track of this information and forward it on, the LPNs must keep a hard copy of records to send in case the system fails. Lastly, when families come into the clinic and have similar procedures done (i.e. flu shot), clerical errors can occur which causes one family member to be charged in Medaptus for more than just his or her procedure, while another family

member is not charged at all. When the LPN is notified via email of this extra charge, the LPN has to search through Medaptus and Allscripts records to fix the issue.

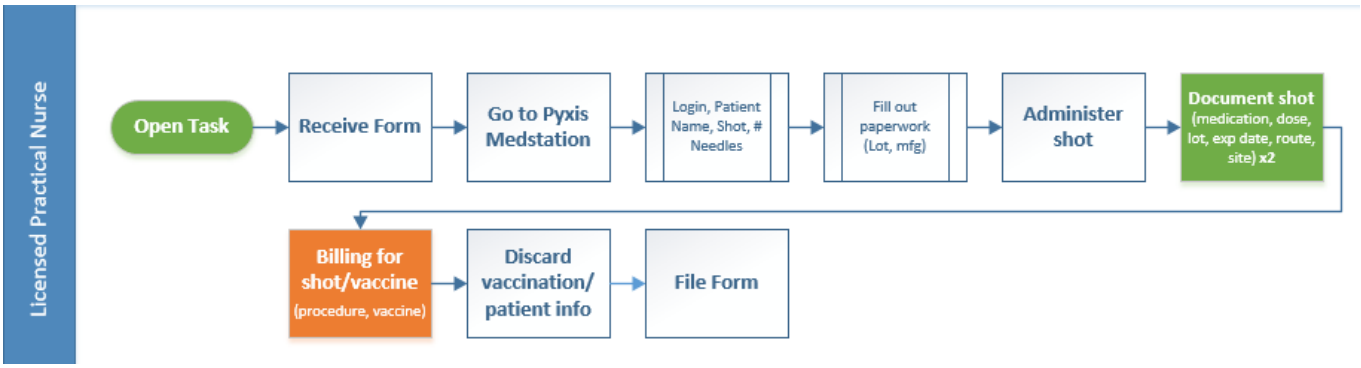

Figure 8. Current workflow of LPN

5.3 Results of Workflows

Through our shadowing, we were able to fully understand the tasks of each employee and the undesirable effects the employees saw within their roles. We compiled a list of undesirable effects noted both in the current state map for Hahnemann (Appendix A) and those identified by the staff. These undesirable effects are analyzed below. We focused on the front desk processes because they used all three EHR systems, Medaptus, Allscripts, and IDX and would face the biggest change going from three systems to one. We also saw many inefficiencies within their day-to-day processes.

We identified three issues with the current process that a new Electronic Medical Record software and other technology will mitigate after its launch. Currently, there are many non-visit related patient requests. These can include, but are not limited to, patients calling or coming to the clinic for prescription information, questions about appointment times, and medical history requests. With the new Electronic Medical Record software, this documentation will be easily accessible through the patient portal. Although not all patients will utilize the portal, the overall number of requests will decrease if more patients use the portal. Secondly, if a patient incorrectly indicates their language preference, the ASR needs to find a translator which can take the ASR away from the front desk and lead to a backup in the queue. With the introduction of kiosks, patients have the opportunity to choose their preferred language. We also identified issues with the paper trail involving the blue card system, pink slip system, and lack of clipboards. With the new Electronic Medical

Record software, paper will become obsolete and, thus, these systems will be removed.

Not all root causes identified were addressed within our project. Based on our results and the staff's feedback, the main area of focus for our project was the check-in and checkout processes. Through feedback from UMass employees including the clinic manager, the UMass the new Electronic Medical Record software team, the Vice President of Ambulatory Care at UMass, and process improvement engineers, we paid particular attention to three areas of the check-in and checkout processes. The UMass staff wanted to better understand the potential change in staffing after the new software is implemented. They also wanted to ensure all ASR staff would have a standardized way to check patients in and out and guarantee the staff knew the steps involved with both processes. Finally, we observed patients did not always need to checkout, and when they did, they entered the wrong line to do so. Alternatively, some patients that did need to checkout skipped the checkout. This created rework and added non-value added tasks to the call center due to the need to call patients to schedule follow-up appointments. Because of this, our team focused on different queuing methods for the checkout process to determine if a redesign would be more efficient and effective.

Chapter 6: Staffing Template

Our team built an excel template to help determine staffing levels for check-in ASRs. Through our observations, it was evident that the front desk was understaffed which caused long queues or overstaffed causing periods of downtime. The template was created to mitigate these staffing issues.

In order to create the template, our group shadowed the reception area of Hahnemann Family Health Center (HFHC) to collect patient arrival rates, how long a patient spent in queue, and how long the checkout and check-in processes took. This data was used to assist in the development of an excel template our team built to determine staffing levels for ASRs. Our team also created an Arena simulation model to validate the Excel template. The Arena model tested different arrival time and service rate distributions to verify the assumptions made in the template.

6.1 Check-in Time Studies Observations

Our team shadowed on two consecutive Wednesdays in two hour blocks to collect arrival rates, average time spent in the check-in and checkout queues. Three group members observed and recorded how long patients waited in queue and how long they were assisted by ASRs for check-in. The fourth group member was responsible for recording when patients arrived at the clinic to determine the arrival rate and recorded checkout queue times. The majority of this information was useful in the creation and verification of our staffing level template. More specifically, the arrival rates and check-in times were used in an Arena model that we created to simulate the check-in process. The time spent checking out was simply used to get a better idea of the effectiveness of the current checkout process.

We also made other general observations because it was the first time we spent an extended period of time in the waiting room. For example, during the first day we were in the clinic for observation, the queue grew very long and a few patients seemed to be concerned that they would miss their appointment. Additionally, we observed that the main queue that is intended for patients waiting to check-in would also sometimes contain

patients waiting to checkout. We also noticed that some patients waiting to checkout in this queue would leave after waiting for several minutes. This information is important because it verifies the importance of our research into alternative checkout processes for the clinic.

6.2 Creating a Template for Check-in Staffing Levels

We created a template to recommend the correct staffing level for ASRs at check-in. We used the M/M/s queuing theory model, which assumes an exponential distribution for arrivals and service rate (Al-Nowibet). The template takes into account the number of arrivals, service rate, and target time for a patient to be in the check-in system, number of kiosks, and the percentage of patients that will use a kiosk. These inputs, which are circled in green and highlighted in yellow, can be seen below in Figure 8. The staffing level results, circled in red, are also shown in Figure 9

Number of Kiosks	0
Percentage to use kiosk	20%
Percentage kiosk will help	0%
Percentage to use ASR	100.00%

Service Rate per server in minutes	4.2
Mean Time Target Minutes	6

Copy & Paste Number of Patients from Block Schedule in Yellow

Actual Visits per Time Slot	6-8am	8-10am	10am-12	12-2pm	2-4pm	4-6pm	6-8pm
Saturday	0						
Sunday	0						
Monday	0	29	25	6	21	5	0
Tuesday	0	16	22	8	24	8	0
Wednesday	0						
Thursday	0						
Friday	0						

Number of ASRs Needed

Actual Visits per Time Slot	6-8am	8-10am	10am-12	12-2pm	2-4pm	4-6pm	6-8pm
Saturday	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0
Monday	0	1.7	1.6	0.9	1.4	0.9	0
Tuesday	0	1.3	1.5	1.0	1.5	1.0	0
Wednesday	0	0	0	0	0	0	0
Thursday	0	0	0	0	0	0	0
Friday	0	0	0	0	0	0	0

Figure 9. Screenshot of Excel Template for Check-in Staffing Levels with Highlights/Circles

Since Hahnemann plans on implementing kiosks to aid with check-in, we first included the number of kiosks that will be in the clinic as an input as well as the percentage of patients that will use the kiosk. These parameters determine how many patients utilize the ASRs. Based on our shadowing calculations, we inputted the service rate per server into the template. We used the 80th percentile from our service times because the exponential or average service rate was considered too perfect to accurately reflect the information. To

minimize the time that the patients spend waiting and being checked-in, we included a target time for the patient in the check-in system.

After these initial steps, the model only requires that the number of patients per day per block be copied and pasted from the weekly report into the top yellow section. The results are available in the bottom portion labeled "Number of ASRs Needed." The staffing levels are presented by block and calculate the number needed based on patients and service rate to meet the target time. The results are formatted to be dark red if a high number of ASRs are needed and are toned down through shades of red, ending with white being zero ASRs needed.

To verify that the information we collected was an accurate representation of the check-in process, we created a simulation in Arena. We used Input Analyzer to find the best fit, worst fit, and exponential distribution for the interarrival rate data for both January 18th and January 25th. We also found these fits for the ASR service rates. We created six simple simulation models, one for each fit on each date which can be seen in Appendix D. This simple model only contains a create module, process module, and exit module. The model assumes three ASR's are working, and they are busy with their respective patient until the patient exits to the waiting room.

6.3 Results: Arena Simulation and Template for Check-in Staffing Levels

Our team used best, worst, and exponential fits for the Arena simulation models. The best fit most closely fits the given data which represents a perfect scenario. The worst fit uses the distributions that least match the given data. This is the worst case scenario as it has large variations and stress on the system. The exponential case, which was a medium fit, is similar to the Excel template and uses averages for distributions. We examined these different fits to see the variation between perfect, worst, and exponential in comparison to the Excel template to test validity.

For January 18, the best fit simulation model used a lognormal distribution for the process module and a Weibull distribution for the arrival module. The worst case simulation model used a uniform distribution for both the arrival and process modules.

For January 25, the best fit simulation model used a lognormal distribution for both

the arrival and process modules. The worst case simulation model used a Poisson distribution for the arrival module and a uniform distribution for the process module. The exponential case for both dates used the exponential distribution for the create and process modules. Each model was setup to run for nine hours, since Hahnemann has a ten hour day, but does not typically schedule appointments during the lunch hour. We chose to ignore the gap for lunch to simplify the model. We also assumed that three ASRs were available to be utilized at all times.

The results of the six models as well as the observed results are shown in Table 1. The observed data summarizes the information we collected from the time study on the check-in system, including the average wait time in the line for patients. We used the best fit cases to capture what a perfect system would look like in comparison to the exponential cases. As expected, the results for both January 18 and 25 show a smaller average wait time, maximum wait time, average total time in system, and maximum total time in system for the best case. Similarly, the worst fit case has larger values for these criteria in the January 25 simulation. However, the January 18 worst case had lower numbers due to the poorly fit arrival rate.

It is also important to note that the number of patients arrived in the simulations for January 25 were far from the observed. This is due to the closeness of the interarrival times on this day. The number of patients arrived in the January 18 simulations were much closer to the observed because there were occasionally large gaps between interarrival times, which happens in the real clinic.

Table 1. Comparison of observed data and simulated data for check-in

Date	Data	Number Arrived	Average Wait Time (min)	Maximum Wait Time	Average Total Time in System	Maximum Total Time in System	Utilization
1/18/17	Observed	86	3.25	13.4833	6.4667	15.3667	--
	Expo	90	0.037	2.1155	3.5128	15.5980	0.1931
	Best Case	95	0.0029	0.2769	3.3001	11.5879	0.1934
	Worst Case	50	0	0	7.5257	13.6372	0.2337
1/25/17	Observed	78	0.9667	3.5333	3.6833	13.8000	--
	Expo	172	0.2353	3.8277	3.6163	15.5980	0.3590
	Best Case	151	0.1270	2.0215	3.3316	11.5879	0.2987
	Worst Case	175	1.2258	8.5784	8.3168	21.4558	0.7726

Based on the overall results, the model for January 18 is more accurate than January 25. The exponential case for January 18 was the closest to the observed number of patients arrived. The results suggest that the use of the exponential assumptions in the Excel template is acceptable. While the wait time is much less in the simulation models than observed, we believe this is because the simulation model does not allow the ASRs to remain idle if someone needs to be helped in the queue. At Hahnemann, the ASRs often carry out other tasks between helping patients, such as answering calls or finding clipboards. Fortunately, the average total time in the system is fairly accurate if it's taken into consideration that the wait time should be larger. Also, the maximum total time in the system for the exponential January 18 model is nearly the same as the observed time. Based on this analysis, we believe that using the exponential assumption for interarrival and service rates in the Excel template is reasonable.

The Excel template in Figure 9 shows the recommended number of ASRs, based on assuming service and arrival rates consistent with the January 18 and January 25 data. The example template shows that during lunch and after 4pm, only one ASR is needed to check-

in patients. During the rest of the day, two ASRs are advised. This recommendation is different from their current number of three ASRs. However, many times the three ASRs are doing both check-in and checkout. In a perfect situation, it is easy to understand why fewer ASRs are recommended for check-in specifically when the ASRs are separated by tasks.

6.4 Conclusions and Recommendations

Overall, the template is simple to use and quickly recommends staffing levels by block. The model is beneficial to UMass because it can be adjusted for use with any clinic in the UMass system. While the model is certainly helpful and useful, there are limitations to its accuracy.

As mentioned in the results, we saw a discrepancy in the number of ASRs needed based on the template and current staffing levels. Based on our observations, we think that the ASRs are only with patients approximately 65% of the time and spend 35% of their time doing various other tasks or remaining idle. In our template model, we used the 80th percentile of the data for our service rate to help combat this issue, but does not account for all variance. Moving forward, the template could be adjusted to include a formula that would increase the service rate based on a statistically found ratio to account for this check-in downtime. Furthermore, the template could be improved by inputting hourly patient arrivals rather than by block.

While the current system requires the ASRs to utilize many systems which adds time to the check-in process service time, with the implementation of the new Electronic Medical Record software, the service rates could decrease. With the new EMR, the staffing levels need to be reevaluated. We recommend that after the new Electronic Medical Record software has been launched, the clinic should allow for three months of training and standardization for employees before performing a time study on the check-in process. This time study will provide a new service rate for check-in with the new Electronic Medical Record software which can be entered into the Excel template and produce the new staffing levels. We also suggest that this method be used at other clinics within UMass after using Hahnemann as a pilot.

With the implementation of a new Electronic Medical Record software, UMass will have the ability to use kiosks to aid with check-in. We propose that Hahnemann purchase one kiosk to test the capability and usability of this system. There are many advantages to using a self-serve kiosk system. The kiosk will reduce patient wait time as fewer patients will be waiting for an ASR to check them in. The kiosk system will also increase patient privacy since the patient is not saying information aloud, but rather typing it into the tablet themselves. Lastly, since the patient can select a language, the kiosk can help with language barriers.

Chapter 7: Check-in and Checkout Standard Work for a New Electronic Medical Record Software

As another countermeasure, the MQP group created standard work for both the check-in and checkout processes to represent these processes after the implementation of a new Electronic Medical Record software. To understand the new EMR software workflows for these processes, our team attended a two-day preliminary a new Electronic Medical Record software Summit held by the UMass EMR software team. This summit gave our group the opportunity to learn and view the new Electronic Medical Record software and also understand the concerns of the HFHC employees regarding the new processes. Following the summit, we created standard work with the help of Hahnemann and UMass' EMR software employees. This standard work is specific to the clinic and is used to assist the ASRs.

7.1 A New Electronic Medical Record Software Summit

We attended a new EMR software Summit on November 18th and 21st at Hahnemann Family Health Center (HFHC) which was hosted by the new EMR software implementation group for UMass Memorial Hospital. The purpose of the event was to educate current employees on the new Electronic Medical Record software in the workflow areas of check-in, rooming, and registration. The new Electronic Medical Record software implementation group planned to use HFHC to determine the best teaching model for introducing the new Electronic Medical Record software to employees. The EMR software team tested three different teaching models. A PowerPoint was tested on the telephone encounters workflow, which presented the information as screenshots. A video that introduced a new Electronic Medical Record software as a continuous process was tested on the check-in and checkout workflow. Lastly, a live demonstration was trialed on the rooming workflow employees. Our role in the summit was to observe and record when employees noticed differences and gaps between the new Electronic Medical Record software and the current systems.

We attended two, one and a half hour summits to show Hahnemann employees a

new Electronic Medical Record software. The goal of each session was to show the new software flow, demonstrate how to perform processes, highlight significant changes, and receive feedback from the staff. The first day focused on the rooming process. The second day focused on telephone encounters and the check-in and checkout process.

7.2 Observations from the New Electronic Medical Record Software Summit

On the first day, the new Electronic Medical Record software team demonstrated how the new Electronic Medical Record software flow would work by using a Hahnemann employee as a volunteer to click through the necessary steps involved with rooming a patient. The second day, the new Electronic Medical Record software team played a video of someone inputting information into a new Electronic Medical Record software and the new Electronic Medical Record software representative explained the process.

Not only did the new Electronic Medical Record software team want to introduce the software system to the HFHC employees, but they also wanted to gauge concerns. There were many concerns voiced from the employees to which the software team further explained or said they would further investigate. Staff was concerned about the tracking system and how the staff would know when a patient was ready for the next process step. The new Electronic Medical Record software uses a visual management system denoted by colored dots to indicate where the patient is within the system. In the current system, employees use pink slips to track patients and the employees worried the new process would increase wait times.

With the new Electronic Medical Record software, there will be no paper trail associated with a patient. Currently, the infrastructure at HFHC is poor, and it takes a long time to login to the computers. This prompts many employees to write notes on paper and input these notes into the system later. The employees worried that it would take too long to login to their computers. Another concern was regarding the removal of the pink slip system. Currently, the check-in ASR creates a pink slip with a patient's blue card information on it and it follows the patient throughout their visit. Employees worried that by removing the pink slips, they would not know how to identify a patient in the waiting

room and that patients would skip checkout without the visual pink slip reminder.

7.3 Develop Standard Work for Check-in and Checkout Process

Our team developed and created new standard work for the check-in and checkout processes at HFHC to more accurately represent the processes with the introduction of a new Electronic Medical Record software. The goal of this standard work is to reduce variability and ease training for the ASRs from the current EHR systems to a new Electronic Medical Record software. Our team used flow charts from the UMass Implementation team to determine broad process steps. We also used the current check-in and checkout standard work at Hahnemann to specialize our new standard work to the clinic. After creating our preliminary standard work design, we reviewed the design with the software team and with Hahnemann Family Health Center staff and created our final version.

7.4 Standard Work

The final standard work provides the baseline for the ASR for both the check-in and checkout process, starting with the patient arriving at the front desk and ending after the patient has been fully checked-in or out. The standard work consists of the step, the time to complete the respective step, and the cumulative time. To represent sub-steps, we indicated this as step as "5a, 5b, 5c, etc." The cumulative time to complete the check-in process is 2:06 minutes. The cumulative time to complete the checkout process is undetermined because some of the additional process workflows are still being created by the UMass EMR software team. These workflows include: appointment entry, recall, order scheduling, and enterprise payment. The standard work for check-in and checkout are shown in Figure 10 and Figure 11 respectively below.

Standardized Work - Check-In

Date:		Job: ASR		Supervisor:
Area:				Written by:
#	Step	Step Time (Sec)	Total Time(Sec)	Other Comments
1	Greet patient	0:02	0:02	
2	Request Patient Identification-Document	0:10	0:12	
3	Locate appointment on Department Appointments Report (DAR)	0:02	0:14	
4	Click Check In	0:01	0:15	
5	If no picture, write description in Epic. Ask if patient wants photo taken to avoid having to show ID for future appointments.	0:07	0:22	
5a	If photo is taken, remove any photo FYIs click "demographics" to take photo and load into Epic.	0:07	0:29	
6	Check demographic, race, ethnicity	0:05	0:34	
7	Check MyChart Status; introduce MyChart, ask if patient is interested. If yes, send access code to email/print. If no, enter patient's email	0:20	0:54	If patient's MyChart status is "Declined" ask the patient if they want to reconsider starting a MyChart account. If they patient says yes, give the patient a access request form.
8	Check Care Everywhere to see if authorization is required before downloading data. Complete the receipt of Care Everywhere data	0:07	1:01	
9	Verify insurance and PCP	0:06	1:07	
9a	information	0:15	1:22	
9b	If a patient does not have insurance (self-pay), note "self pay" in comments	0:05	1:27	Provide self-payment information
10	Verify emergency contacts, update if needed	0:07	1:34	
11	Collect payment - cash, check, credit card, debit card	0:20	1:54	
12	Hand patient paperwork	0:10	2:04	Paperwork includes:
13	Complete check in and presss Accept	0:02	2:06	Appointment status is now Arrived
		TOTAL TIME	2:06	

Figure 10. New Standard Work for Check-in

Standardized Work- Checkout

Date:		Job:		Supervisor:
Area:				Written by:
#	Step	Step Time (Sec)	Total Time(Sec)	Other Comments
1	Greet patient	0:02	0:02	
2	Select patient in Department Appointments Report (DAR)	0:02	0:04	
3	Click Check Out	0:01	0:05	
4	If missing information, use checklist to complete missing Reg items	0:15	0:20	
4a	Resolve warnings and document tables	0:10	0:30	
5	Schedule follow-up appointment using *Appointment Entry workflow*		0:30	
6	Set up Recall Reminder using *Recall workflow*		0:30	
7	If orders need to be scheduled, use *Order Scheduling workflow*		0:30	
8	Collect copay using *Enterprise Payment workflow*		0:30	
9	Print receipt, clinical summary and ABN waiver form (if applicable)	0:13	0:43	
10	Thank patient for visit	0:01	0:44	
		TOTAL TIME	0:44	

Figure 11. New Standard Work for Checkout

7.5 Recommendations

In order to fully utilize the lean principle, improve consistency, and ensure sustainability, Hahnemann Family Health Center should have full agreement from both

managerial staff and ASRs. Before implementing the standard work, HFHC managerial staff should have a meeting on the importance of standard work and also outline each of the steps. This workshop should go through the steps in the new software to ensure that the ASRs know how to complete them.

We recommend that HFHC continues to work with the UMass software team when the new Electronic Medical Record software workflows are complete. In the current standardized work for the new EMR software checkout, it references "Appointment Entry workflow," "Recall workflow," "Order Scheduling workflow," and "Enterprise Payment workflow." Once these workflows have been completed, HFHC should update the standard work to better represent the steps required for said workflows and the time associated with each. It will be beneficial to have all of the required steps for each workflow on the checkout standard work so it may be easily accessible and in one place. After the new Electronic Medical Record software is launched, Hahnemann should review the standard work for both check-in and checkout after the first three months after the new Electronic Medical Record software launch and update the standard work. It would be advised the HFHC staff solicits advice and information from the ASRs to see if the steps sequentially make sense and the respective time frames. Following this, we recommend that HFHC reviews the standard work every six months or if there are new software system updates.

We recommend that HFHC print out the standard work and place a copy at each work station in the front desk. This visual management will not only act as a reminder of the steps associated with the check-in and checkout during the transition to the new Electronic Medical Record software, but it will also allow ASRs to remember how long it should take for each respective step. This will reduce variability and increase patient throughput.

Chapter 8: Redesign of Current Checkout Process

One of the main areas of concern for the clinic was the inefficiencies within the checkout process. This chapter describes the current checkout process and its limitations. Following this, there is a summary of three new and different checkout design solutions. Based on these, there is an analysis of the advantages and disadvantages of each potential solution and a final recommendation selected for Hahnemann.

8.1 Redesign Checkout Process

The current checkout process at Hahnemann Family Health Center is physically located in the reception area of the clinic. There are two checkouts windows on either side of the check-in windows, with one for the A side of the clinic and one for the B side. Although there are designated windows for check-in and checkout, the ASRs are able to do both processes.

Through previous shadowing, our team observed multiple issues with the current checkout process. The first major issue observed was the long queue times associated with the checkout line. In many occurrences, patients who need to checkout re-enter the original queue with patients who are checking in, which caused additional and unnecessary wait time. This waste occurs because there are not any signs or indicators directing the patients to specific checkout lines.

The second major problem is that patients miss or skip checkout, which is usually due to the long queues. This creates additional work for the clinic because the call center needs to call those patient to make their follow-up appointments. In many cases, this takes multiple calls or the appointment is never made because the phone number on file is incorrect or the patient does not answer the initial call. As a group, we realized that many patients do not actually need to checkout, they only need to receive their clinical summary. Through data collection, we found that around 40% of patients only need a clinical summary printed out, not a follow-up appointment scheduled. These patients are wasting time standing in line when it is not needed, which decreases patient satisfaction and increases wait time for patients checking in. This can cause a backup in scheduled

appointments, causing the clinic to run late.

The last issue with the current checkout process is the privacy that is given to the patient checking out. In many circumstances, the ASR has to double check with the patient to ensure they are interpreting the pink checkout slip correctly. Additionally, many times, the diagnosis, follow-up appointments or referrals to other specialists are discussed aloud. With the checkout desk being located outside of the clinic near the waiting room, many of these discussions can be heard by other waiting patients. This can cause patients to be unhappy or feel uncomfortable. Many of these issues can be mitigated by a different design of the system.

8.2 Collecting Patient Pink Slips

When a patient checks out at HFHC, they give the pink slip they received at check-in to the checkout ASR. This pink slip acts as a patient identifier to the HFHC employees and also serves as a visual reminder to the patient to checkout. At the end of the appointment, the provider marks one of two boxes required for checkout: “See Tasks” or “Clinical Summary.” The “See Tasks” box requires the checkout ASR to go into Allscripts to review and perform the task(s) the provider has requested. These tasks vary, but tend to involve requesting follow up appointments or referrals. The “Clinical Summary” box requires the checkout ASR to print a clinical summary and give it to the patient. These patients do not need any further assistance.

In order to fully understand how many of the patients required the ASR to “See Task” and “Clinical Summary,” our team collected the pink slips for four days: February 2nd, February 3rd, February 6th, and February 7th. This also allowed us to understand how many patients skipped checkout. After totaling and tallying the number of “See Task” and “Clinical Summary” check marks, we compared the total number of pink slips received for each day with the actual data of how many patients were seen that day. This allowed us to understand the difference between how many patients went through the checkout process and how many people left without being unaccounted for or did not checkout.

8.3 Checkout Options

To combat and mitigate these issues we observed, we explored and researched three new checkout alternatives. The first option we analyzed removed the checkout from the reception area and brought it to the patient's exam room. The second option was to do a physical redesign and put the checkout window within the clinic, as opposed to in the reception area. The third option was the simplest change. It explored having the MA escort the patient to the reception following an appointment to ensure they check out. All of the following workflow processes indicate the steps that would be needed once a new Electronic Medical Record software is implemented, not the current system.

8.3.1 In-Room Checkout (ASR or MA)

In-room checkout refers to when either an ASR or MA checks the patient out within the examination room after the physician has finished the appointment. This process is described in Figures 8 and 9 below. In this method, the ASR or MA is alerted by the physician in the new Electronic Medical Record software system when they are done with the appointment. The ASR or MA then returns to the room and performs the checkout process. Since the ASR or the MA will move from room to room, they will have a cart for their computer and a printer.

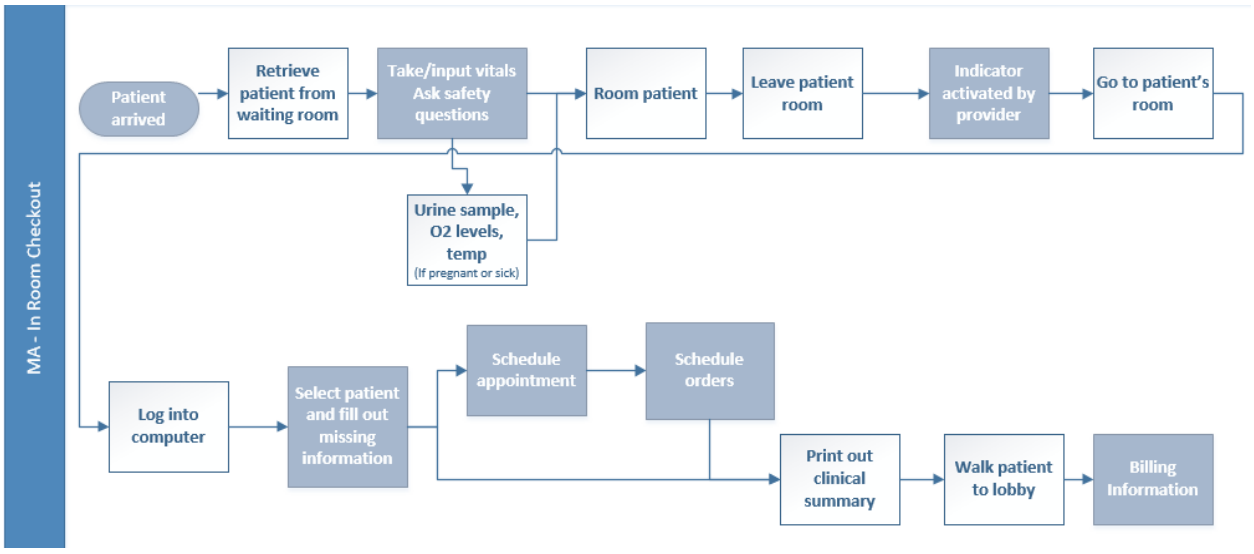

Figure 12 In-Room Checkout Process with MA

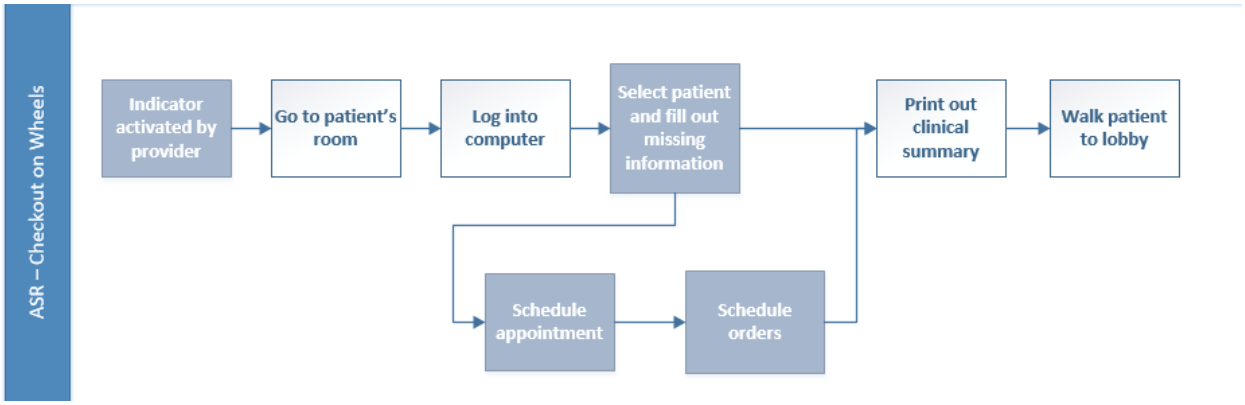

Figure 13. In Room Checkout Process with ASR

8.3.2 Loop (within Clinic Checkout)

Loop design is where checkout occurs within the clinic as opposed to in the reception area where check-in occurs. This is the most common design for checkout and was originally used by Hahnemann before their most recent redesign. This option does not change the workflow of the current process, but instead relocates the checkout desk.

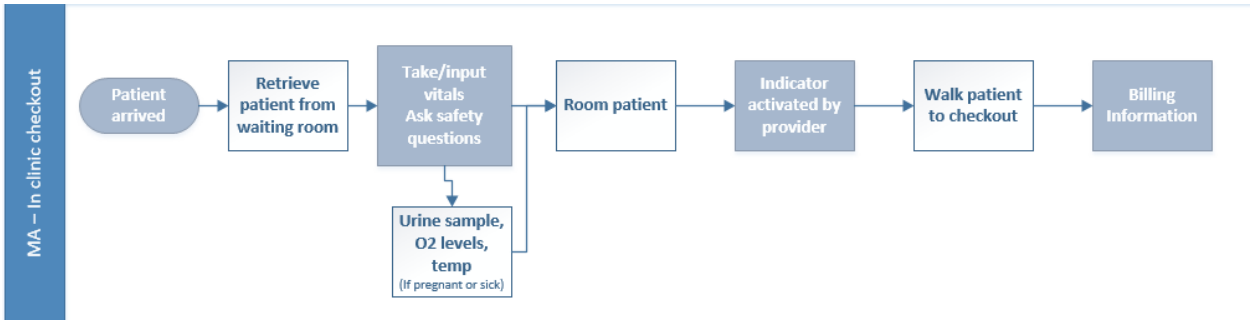

Figure 14. In Clinic Checkout Process with MA

8.3.3 Assisted Exit to the Checkout Window by the MA

The assisted exit design changes the process from patients walking out of the clinic by themselves to now having MAs usher them to the checkout window. Similar to the in-room checkout, this design will need the physician to alert the MA the appointment has finished and the patient is ready to be taken out of the clinic. This small change is to ensure the patient understands to checkout and also uses the checkout window instead of entering the queue for check-in.

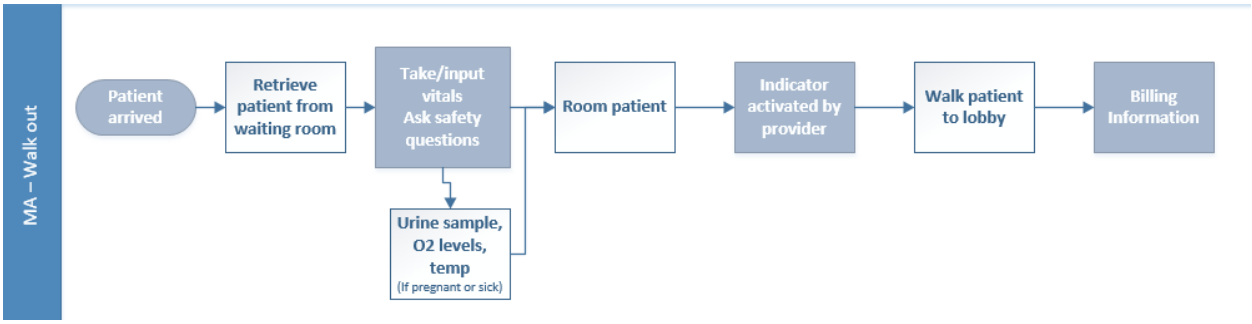

Figure 15. Medical Assistant Walks Patient out to Checkout in Reception

8.4 Results: Checkout Redesign

The knowledge we collected through the pink slips, research, and piloting have allowed for us to gain greater insight into the checkout process. Analyzing the pink slips showed us the number of patients that checked out and what tasks the ASRs needed to accomplish at checkout. Then, through researching the three options and piloting one of them, we were able to evaluate the advantages and disadvantages of each. This allowed us to make an informed decision on which checkout design we think will be most beneficial for Hahnemann to implement. In Table 2, the advantages and disadvantages for each of the checkout options is given based on the criteria of budget, privacy, rework, and satisfaction.

Table 2. Comparison between the Three Checkout Options

In Room Checkout		Loop		Assisted Exit by MA	
+	-	+	-	+	-
Increased Privacy	Tie up exam room	Different queues	Construction (possible clinic shutdown)	Reduce rework	Patients can still miss checkout
Increased patient convenience	Patients wait in room	Lower rework	Costly	Easiest Process change	Requires MA to go back to room
100% checkout-less rework	MA tasks increase	Increased privacy	Lack of physical space	Separate check-in and checkout queues	Privacy issues in reception
No reenter to queue	Budget for extra resources		Less help for check-in ASRs		
	Flagging system for patient ready to checkout		Possible checkout queues within clinic	Checkout ASRs can still assist on check-in	Flagging system for patient ready to checkout
	No help for check-in ASRs				
Based off of criteria of budget, privacy, rework, and patient satisfaction					

8.4.1 Pink Slip Analysis

From our pink slip collection, we assembled information regarding the number of

patients who checked out, number of patients who had a task, and the number of patients who only needed a clinical summary; the results are shown in Table 3. From these numbers, we noted that 56% of patients needed the ASR to perform a task for them whether that be in the form of a referral or follow-up appointment and 39% of patients only needed to have their clinical summary printed. This means that about one-third of the patients checking out do not need direct work done by the ASR after their appointment. Ideally, this group should be able to skip the checkout line and receive their clinical summary from another source such as a mobile portal or sent to the person's residence.

Table 3. Pink Slip Checkout Analysis

	See Task	Clinical Sum	None	Total	Actual Total	# Missing	% See Task	% Clinical Sum	% None	% No Checkout
2/2/2017	14	8	3	25	95	70	56%	32%	12%	74%
2/3/2017	45	21	4	70	109	39	64%	30%	6%	36%
2/6/2017	36	24	2	62	87	25	58%	39%	3%	29%
2/7/2017	26	31	2	59	84	25	44%	53%	3%	30%
Total	121	84	11	216	375	159	56%	39%	5%	42%

8.4.2 In Room Checkout (ASRs or MAs) - Benefits and Disadvantages

The major benefit of in-room checkout is the "exam room check-out aids convenience, privacy (Parekh)." By moving the checkout to within the exam room there is no fear of other patients in the waiting room being able to hear the conversation about diagnoses, follow-up appointments or payments. It ensures that every patient is checked out, which will involve less rework to schedule follow-up appointments. Failing to check out at the clinic can involve multiple phone calls and additional time than checkout. Lastly, with this system, the patient does not need to wait in line. If the line is long, patients have a tendency to skip the line or leave if they have waited for too long and skip the checkout process. Some repeat patients know that they will receive a call from HFHC to make follow-up appointment. This queue-less system will increase patient satisfaction because they will not have to wait and it will also improve checkout rates for Hahnemann as patients will not leave the line.

The concerns with this option are mostly related to time and resources. The first concern is that checking out the patient in the exam room will tie up an exam room for

more time when they could be used to see or treat another patient. The patients will no longer need to wait in queues to checkout, but will have to wait within their room. By having ASRs or MAs perform the in room checkout process, staffing levels also become a concern because it adds to their responsibilities at the clinic. The last concern is it is imperative to have a good infrastructure to be able to support quick use of computers within the exam room as well as having printers readily available to be able to print clinical summaries and follow-up appointment information. The clinic would need to budget for these additional resources not already available.

8.4.3 Loop- Advantages and Disadvantages

This option is called the "loop", which is when checkout occurs within the clinic at a designated checkout area. This is the most common design for checkout and was originally used at Hahnemann before their most recent redesign. The design's primary focus is on privacy which is enhanced because check-in and checkout are separated within the clinic. This design also mitigates the problem of rework because it guarantees that every patient stops at the checkout desk before leaving the clinic. The last benefit is that patients checking out are in a defined area, so there will not be any confusion as to which queue the patients should be waiting in.

The first concern with this design is that it will take a large redesign effort and require large initial capital to physically construct this design within Hahnemann Family Health Center. Construction may require Hahnemann to temporarily shut down the clinic, or even a part of the clinic. This limited space would not allow for all patients to be seen. If the clinic chose to continue to see patients, patients may be upset due to loud noises and a lack of cleanliness. Also, since the current layout at Hahnemann has an A side and a B side, it would require the clinic to either usher all individuals to one side or create checkout windows on both sides. This could cause inefficiencies due to escorting patients to the other side or having low utilization of the ASRs at the checkout windows because of low patient flow. Finally, Hahnemann has tried this method and moved away from it because they did not have enough room for patients to have their vitals taken.

8.4.4 MA Walk Out- Advantages and Disadvantages

This option has the MA walk the patient from the examination room directly to the checkout window or checkout line. The major benefit of this process is that like the others, it will reduce the need for rework because all of the patients will be checked out. This design change is also the easiest and will cause the least amount of changes to the current workflows. It will also hopefully create separate queues for both check-in and checkout which will result in shorter queue times.

The concern is that although patients will be assisted to the checkout window, if there is a queue, it is very possible that patients will still exit the clinic without checking out properly, adding to rework. This design will require communication between the physician and the MAs to let them know that the patient is ready to be checked out, similar to the in-room checkout option. There could also be privacy issues that arise with this option because of the current location of the checkout window.

8.5 Pilot New Checkout Process

In order to understand the feasibility, advantages, and downsides to the redesign that has the biggest impact on current processes, our team piloted the new in-room checkout. To do this, our team first created a process flow chart for the MA, which now includes the checkout process, as seen below in Figure 16. Prior to the pilot, our team sat down with the MA helping us with the pilot, the lead ASR (who would be there if the MA needed any assistance when piloting), and the clinic manager to explain the new process and address any concerns.

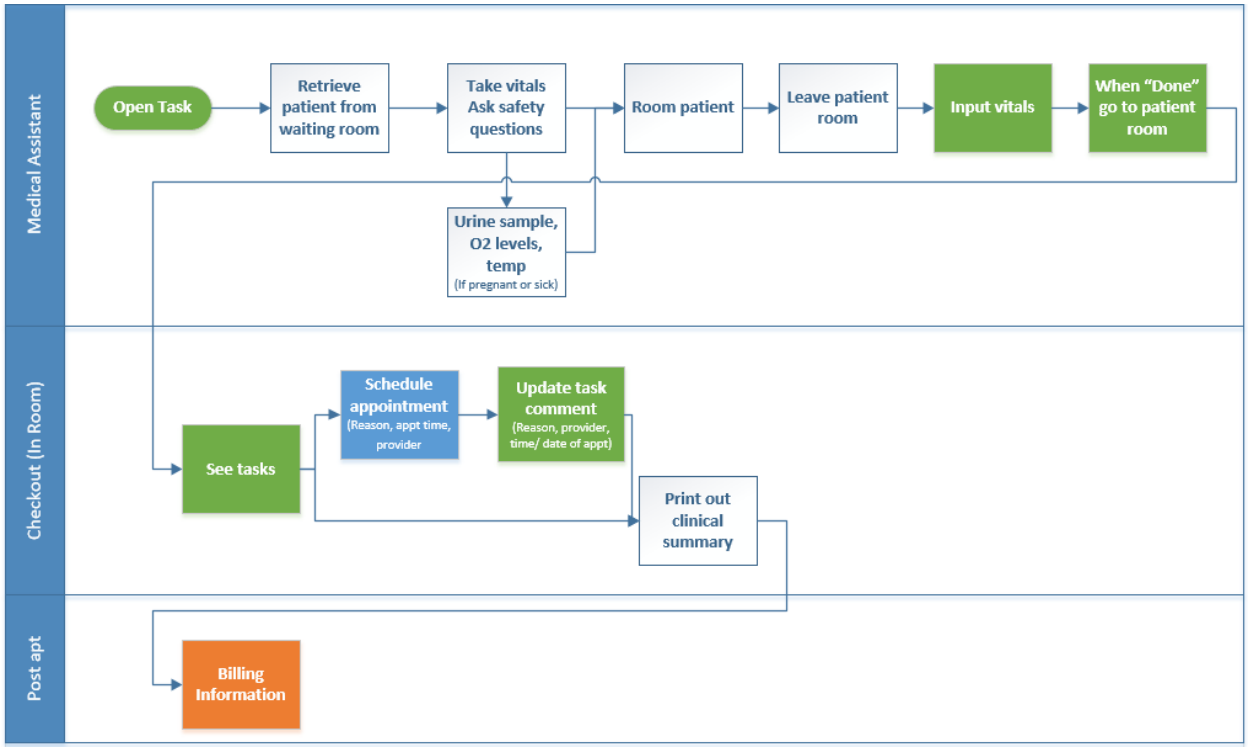

Figure 16. Pilot MA In-Room Checkout in Current System

We piloted on a day when the MA had low patient flow, was only working with one provider, and the lead ASR was available to help the MA if she came across any difficulties scheduling an appointment. This was to reduce a bottleneck within the clinic and to mitigate any negative effects the new process would have on patient care quality. We created a feedback survey, attached in Appendix C, for the MA to complete after piloting occurred to receive her initial feedback on the process change. After the pilot, our team sat down with the MA to understand issues with the pilot, things she liked, and resources needed if implemented at full scale.

8.6 Pilot New Checkout Process Results

We captured two times for the in-room checkout pilot which included the time it took the MA to walk to the exam room, check the patient out, and walk back to her station. The times were 4:53 and 3:41 (minutes). During both of these checkouts, the MA scheduled an appointment for the patient. During our time study analysis on the current front desk, we observed that checkout with a follow-up appointment took on average 2:46, which does not account for time in queue. The observed times are higher than the current checkout,

but reasonable. The difference in time results from the walking to and from the room, as well as needing to login to the computer in the exam room. To fix the login issue, laptop computers could be utilized so the MAs remain logged in to the system and mobile. New, faster infrastructure will allow the MA to log into the system more quickly. This change will be implemented before the new EMR software goes live.

There were also other obstacles within the pilot for the MA. Rather than using the task system in Allscripts, the provider told the MA what the patient needed (when to schedule the appointment, the purpose of the appointment). The MA also spent time waiting around for the provider to tell her that the appointment was over. We had previously discussed using the flag notification system on the outside of the exam room door. Since it was just one provider and one MA, we decided it would be easier to have the provider personally tell her. Lastly, the MA was unable to print the clinical summary for the patients since she did not know where it would print. While the patients did not request it in these cases, if they had, this could present a problem if printers are not easily accessible for the MAs.

From our feedback survey, the MA indicated that the process was easy. She felt prepared to perform the tasks and answer questions regarding checkout. Although she felt comfortable completing checkout, she did not want to check patients out in the future. The MA noted in order for the checkout to be successful, there would need to be a printer available for the clinical summaries.

8.7 Recommendations

After analyzing the current checkout process at Hahnemann we recommend that multiple changes be made to the current system. The hope is that the implementation of the new Electronic Medical Record software and the online patient portal will also support this process change. We are recommending changes that will make the checkout process more convenient and desirable for both the patient and staff. These changes will help mitigate waiting time for the patients and lessen the workload on both the checkout staff and the call center employees.

The first recommendation our group would like to make for the checkout process is to push for a change when patients checking out only need a clinical summary. First, we recommend that Hahnemann strives to increase patient utilization of the portal through education and marketing. This will allow for the physician to quickly send the patients their clinical summary through the system instead of wasting the time of other clinical staff and paper by printing it out. Patients who do not need a follow-up appointment would leave the clinic after their appointment without having to wait in line for checkout because they are going to receive their clinical summary online. If the patients do not sign up for the online portal we would still like to streamline this process by having a printer in every room so the clinical summary can be printed out in the room without having additional staff working with the patient.

Our group recommends that the current checkout system change to the in-room checkout. Although we piloted this checkout process with an MA, we believe the checkout process could be performed by an ASR or a MA. This option would be the most beneficial for Hahnemann. This checkout design would ensure a 100% checkout rate. This, in turn, would decrease the rework currently involved with the checkout process. The call center employees would not have to call patients multiple times to schedule follow-up appointments. These employees would then be able to answer the phones instead of the front desk ASRs. If ASRs do not need to answer the phone, they will be able to dedicate all of their time to checking patients in, which would reduce the queue length. Unlike the loop design, it would not require a physical redesign. Also, it will be beneficial to the patients as they will be able to skip the checkout lines in the reception area, increasing patient satisfaction. Based on the feedback from the pilot, the MA said the process was easy, indicating it would be feasible for staff to implement.

To make this redesign possible, we recommend a few suggestions and advancements to make this process run smoothly. First, we suggest implementing a signaling system to indicate to the ASR or MA that the physician has finished the appointment. The new Electronic Medical Record software has a colored circle feature. The color of the circle changes depending on where the patient is within the system. We recommend allocating a certain color for when the patient is ready for checkout. We

suggest creating a funding request in order for each checkout MA or ASR to have a laptop. Since there is not the capacity and infrastructure to place a printer in every room, we suggest purchasing carts and placing wireless printers on them. If this funding is unavailable, we suggest putting a centralized printer on both side A and B of the clinic. When the MA or ASR walks the patient out, they can pick up the clinical summary from the printer and give it to the patient.

Chapter 9: Conclusions, Recommendations and Reflections

9.1 Conclusions and Recommendations

This project aimed to aid Hahnemann prior to the implementation of a new Electronic Medical Record software by evaluating the check-in process and identifying opportunities to improve the checkout process at HFHC. In order to address these goals, we utilized an A3 problem-solving method in which we identified the problem and current state, developed a root cause analysis of the problem and determined proper countermeasures for these root causes.

We have created a staffing template, standard work for the check-in process, and identified other ways that HFHC can improve their checkout process by suggesting redesign options. The staffing template is intended to be a way that the clinic can determine the number of check-in ASRs needed based off of patient volume. The standard work can help to ensure that each ASR knows the proper steps to take to check a patient in, but only if there is agreement and understanding from the clinic managers and ASRs. We identified the checkout process as an area that can be improved within HFHC and explored different options through testing and research.

We have identified 6 recommendations for Hahnemann to consider to ensure a smooth transition to a new Electronic Medical Record software and to increase efficiency. These recommendations focus on check-in and checkout standard work, a staffing template, and opportunities for new technology.

Recommendation 1: Implement the check-in and checkout standard work after the new Electronic Medical Record software has been introduced

Explanation: In order for standard work to be successfully implemented, there needs to be a common understanding of the new processes before the new Electronic Medical Record software goes live. There should be a meeting with the ASRs to ensure they understand the purpose of the standard work and the steps required. Additionally, the standard work should be approved before the implementation of the new Electronic Medical Record

software so that it can be incorporated into the new software training. By introducing the standard work in the training, it allows the ASRs to learn the new process the same way instead of trying to change each ASR's process to fit the standard work. Standardization will decrease error. Once the UMass software team has completed the additional workflows involved with the checkout process, Hahnemann should update the standard work with additional steps and times to create a more accurate representation of the real state. Once the new EMR software is launched, Hahnemann should print out the standard work for both check-in and checkout and distribute them to each ASR. The standard work should be placed at each front desk work station as a visual reminder of the steps required in the new Electronic Medical Record software and how long each step should take. The standard work should be reviewed every six months or whenever there is a system update to ensure the standard work is accurate and up-to-date.

Recommendation 2: Implement an In-Room Checkout Process with MA or ASR
Explanation: To reduce rework needed and increase patient satisfaction, while realistic for Hahnemann, our group would like to recommend that the current checkout system be changed to the MA or ASR in-room checkout option. This will allow patients to be able to checkout within their room with more privacy and without having to wait in a queue. This new system will also reduce rework because all patients will go through checkout reducing the need for the call center to call patients to schedule follow up appointments. This redesign will be both beneficial to the patient and Hahnemann.

Recommendation 3: Distribute clinical summary to patient portals when applicable
Explanation: To remove extra work usually performed by the clinical staff and waiting time for the patient in checkout process, clinical summaries can be made available to patients through the new Electronic Medical Record software portal. For patients who only need their clinical summary upon checkout, the physician can let patients know it is available via the new software portal. This will allow patients to skip the checkout process, minimize the checkout queue, and reduce paper use. The physician can print the summary if the patient prefers a paper copy or has not registered for the portal.

Recommendation 4: Market the new Electronic Medical Record software patient portal to patients to increase utilization

Explanation: The providers and clinical staff should be taught about the new patient portal prior to its launch. Since patients take advice from and trust providers and clinical staff, these staff members should explain the advantages and features (update personal information, receive forms, and access health record data) of the portal to their patients if they are not enrolled during the appointment. Hahnemann should work with the UMass software team to create informational packets that walk patients through the steps of registering for the portal and instructions on how to use it once registered. Hahnemann can also create an education video that can be played within the reception explaining some of the benefits and features of the portal (Haugen, 2015).

Recommendation 5: Use Excel template for check-in staffing levels

Explanation: Because the new Electronic Medical Record software will likely reduce the time required for ASRs to check-in patients, we recommend that Hahnemann reevaluate the service times used in the template after the new Electronic Medical Record software has been launched. The clinic should allow for several months of training and standardization for employees before performing a time study on the check-in process. This time will allow staff to have a sufficient understanding of the new system and steps involved. The new service rate obtained from the study, which can be input into the template to generate recommended staffing levels post-implementation.

Recommendation 6: Install self-serve check-in kiosks

Explanation: We see the implementation of the new Electronic Medical Record software as an opportunity to upgrade technology. We recommend that HFHC purchase a self-serve kiosk for check-in. A kiosk will not only lessen the workload for ASRs, but it will reduce patient wait time, increase patient privacy, and help with language barriers. By allowing certain patients to check themselves in, it will reduce queue lengths and waiting times for patients while also allowing more time for ASRs to help with special cases that take longer

to check-in. Also, the patient will be able to choose from different languages which minimizes the issue of the ASR not speaking the patient's native language.

9.2 Reflections

Reflection on Design

The engineering design process involves identifying a problem, performing background research, compiling potential solutions, implementing a solution, and evaluating the results. We used the engineering design process and, more specifically, the A3 problem solving approach which focuses on the process of Plan, Do, Study, Act (PDSA). Our team identified the problem, analyzed the current state, considered alternatives, and implemented solutions. We analyzed the current condition of Hahnemann Family Health Center. From our observations and research of the current state, we identified inefficiencies at the front desk. To counter these, our team considered many alternatives. We chose to design an excel model using queuing theory, to develop standard work for the check-in and checkout processes, and to evaluate three new checkout options. We used an iterative process to develop each deliverable. For example, we created a preliminary standard work and sent it to the UMass software team for feedback. When we received their feedback, we made changes, and then showed it to a process improvement engineer. We sought the feedback from multiple experts and continued to edit our standard work. After our models were created, they were sent to our sponsor and critiqued and adjusted based on their suggestions.

An important consideration throughout any design process is understanding and accounting for constraints. We encountered a number of different types of constraints as we completed the project. First, models are approximations of reality, and so model recommendations must be understood in the context of real practice. For example, the staffing model and template we developed assumes that the front desk staff are working at 80% utilization and are spending time only checking patients in. The resulting model may underestimate staffing needs as it does not account for additional time spent answering phones and doing other miscellaneous tasks. This shows that the model represents a more

perfect state than reality since it is made on generalizations and assumptions. We also made a recommendation that might require purchasing computers and other devices, which could also be limited by financial constraints.

There was also a social constraint involved with our project in regards to the tasks employees performed because the workers unionized. When choosing a checkout process, one potential design required employees to take on the responsibilities of other employee roles. We accounted for this by ensuring workers performed tasks within the realm of their job description since these workers were unionized. Finally, there was a physical space constraint in our project. One suggestion our group has for the redesign of the checkout was to move the checkout within the clinic as opposed to in the reception area. This would require a physical redesign of the clinic and was not feasible for us to test within our project.

Reflection on Lifelong Learning

This project has given us the opportunity to put into practice the knowledge that we learned within the classroom at a healthcare organization. For example, the staffing template we made allowed us to utilize concepts such as queuing theory, Arena software and stochastic models. This experience has highlighted the relevance of our education at WPI, but has also shown that there will always be more to learn about the process improvement industry within different disciplines and environments.

The scope of our project also changed multiple times from the start to the end. Through this project, our team has learned the importance of adaptability. We learned the importance of soliciting advice from the multiple different professionals in the field to understand different perspectives. Throughout our project, we worked with process improvement engineers, the manager and staff of the clinic, the UMass software team, and the Vice President of Operations. Each had a different view and desired outcome for the project. Without understanding and balancing each stakeholder's ideas and input, the project would not have been successful.

Reflection on Interdisciplinary

Throughout this project, our team was able to work with professionals in a variety of roles within the healthcare industry. Working with these professionals effectively was key to our team's ability to gather the necessary knowledge and data to complete this project.

In order to communicate effectively with the clinic employees, who were trained differently and often had a different focus than us, we needed to understand and acknowledge their perspective before we began working with them. In this way, we were able to get the information we needed without contradicting the interests of the other employees. For example, we received the current state patient flow from the continuous improvement engineer that highlighted undesirable effects at Hahnemann. We also shadowed each role at Hahnemann and asked where they saw inefficiencies and problems within their tasks. We combined the two viewpoints to create recommendations that suited the interests and needs of both parties.

Working with UMass taught us the importance of both having the knowledge from the classroom as well as being able to communicate effectively to use that knowledge and add value to a real world project. In this project, we gained a better understanding of ambulatory care, which has allowed us to give more valuable input to UMass and Hahnemann Family Health Center. It has also given us a greater insight into the healthcare industry, which is extremely different from the normal manufacturing role that many industrial engineers are accustomed to. In many circumstances, industrial engineers work with systems or machines putting value into a product while in the healthcare industry it is more about the people working on the product, which in healthcare is a human being.

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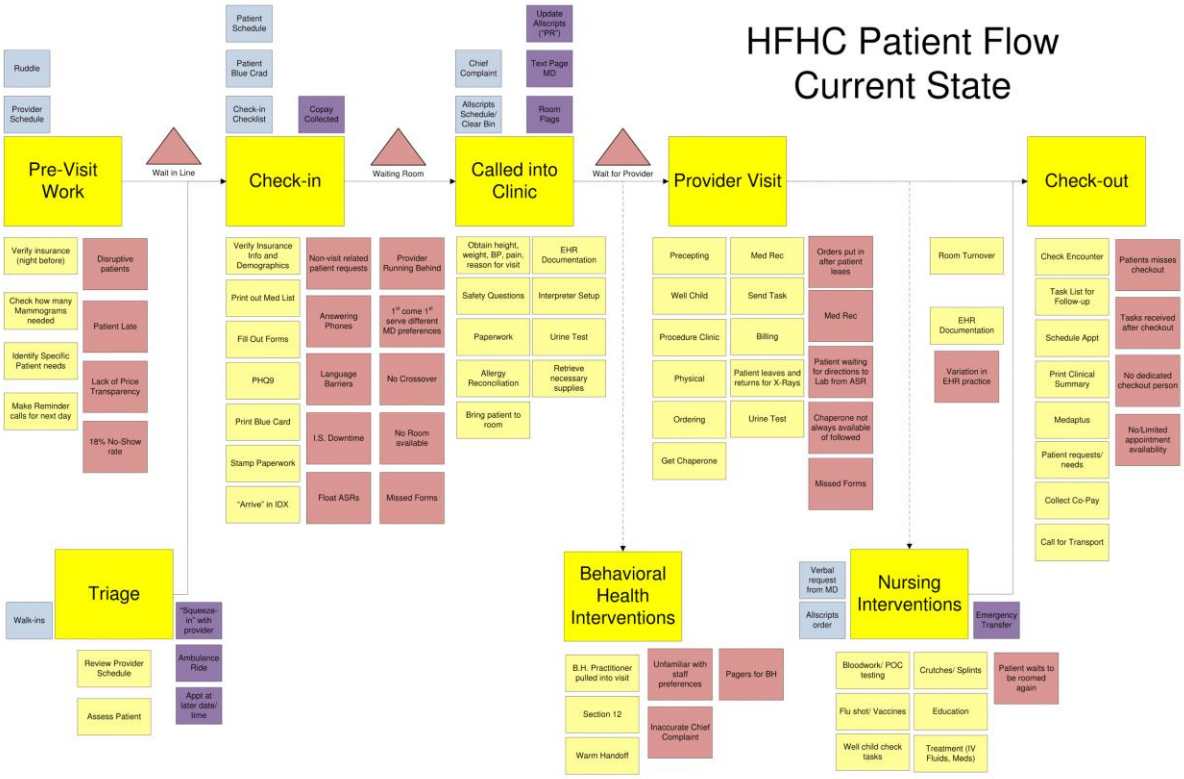
Appendices

Appendix A - Current State Patient Flow



Appendix B- Shadowing Documentation Form

Employee Performing Task	Task Description	Information Collected	System Used	Frequency	Number of Occurrences	Number of Patients Served	VA	NVA	Waste

Appendix C - PCA Feedback Survey

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Did you like the new checkout process?	1	2	3	4	5
How easy (1) or difficult (5) was it to get to the printer for the clinical summary?	1	2	3	4	5
Were you prepared for answering checkout questions?	1	2	3	4	5
Feasibility of MA performing this task long term?	1	2	3	4	5
Patient involvement and acceptance of new process?	1	2	3	4	5

What resources did you need that you didn't have? Computer? Printer?

_____

_____

What was difficult for you?

_____

_____

Where did you see inefficiencies?

_____

_____

How would you change the process?

_____

_____

What comments, if any, did the patient make about exam room checkout?

_____

_____

Did the flag system work well or should we have used a different indicator? Suggestions?

_____

_____

Appendix D - Sample Arena Simulation Model